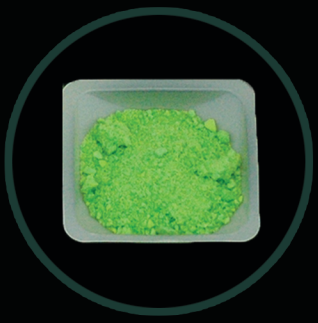
PhytoTechnology Laboratories®

"Helping to Build a Better Tomorrow Through Plant Science"™



Plant Tissue Culture Media



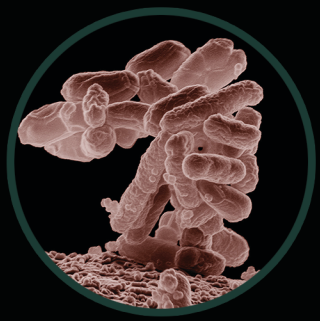
Biochemicals



Molecular Biology



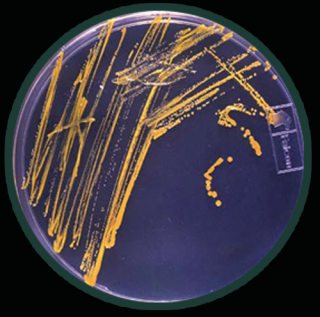
Equipment



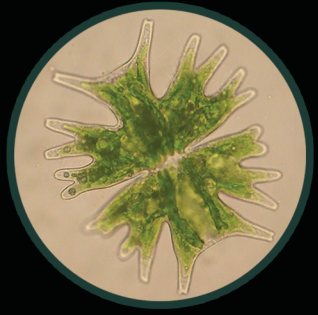
Microbiology



Seed Testing



Phytopathology



Phycology



Tissue Culture Kits



Technical Information

Contact Information

Contact Us By Mail

*Phyto*Technology Laboratories®
PO Box 12205
Shawnee Mission, KS
66282-2205
United States of America

Contact Us by Phone or Fax

Phone: 1.913.341.5343
1.888.749.8682*
Fax: 1.913.341.5442
1.888.449.8682*

*Toll free numbers are applicable for the United States, Canada, and some parts of the Caribbean.

Shipping Address

*Phyto*Technology Laboratories®
9245 Flint Street
Overland Park, KS
66214-1739
United States of America

Sales Information

Questions regarding pricing, product availability, or shipping and returns policies can be answered by contacting: **sales@phytotechlab.com**.

Technical Inquiries

Technical inquiries regarding our products (e.g., questions about product usage, custom media quotations, bulk pricing, or recommended concentrations) or requests for any technical documentation (e.g., MSDSs or Certificates of Analysis) can be directed to: **tech@phytotechlab.com**.

For Questions about Orders

For any questions about an order that has *already been placed,* please contact: **cs@phytotechlab.com**.

Placing an Order

Ordering Online

For your convenience *Phyto*Technology Laboratories® accepts orders online through **www.phytotechlab.com**. **Rush orders (i.e., requiring same day shipping) should be placed by phone to ensure availability.**

Ordering by Phone, Fax or E-mail

New and returning customers can place orders by phone, fax, or by e-mailing **sales@phytotechlab.com**.

When submitting an order, please make sure to provide the following information:

Shipping and Billing Information
- Shipping Address with Country
- Billing Address with Country
- Company Name (if applicable)
- Billing Contact Name
- Phone Number
- E-mail Address
- Customer VAT Number (EU Only)

Product Information
- Product Catalogue (ID) Number
- Product Description
- Package Size
- Quantity to be ordered

Credit Card Information
- Name on Credit Card
- Billing Address with Country
- Credit Card Number
- Expiration Date
- Three or Four Digit Security Number (SSV)

Miscellaneous Information
- PO Number (if applicable)
- Special Shipping Instructions (if applicable)

Hours of Operation

Our hours of operation are 8:00 am through 5:30 pm, Monday through Thursday and 8:00 am and through 1:00 pm on Friday. Our offices are closed on Saturday and Sunday. *Phyto*Technology Laboratories® operates in the Central Time Zone (UTC -0600).

*Phyto*Technology Laboratories® is closed on the following holidays:
- Memorial Day (Last Monday in May)
- Independence Day (4 July)
- Labor Day (First Monday in September)
- Thanksgiving (4th Thursday & Friday in November)
- Winter Holidays (23 December to 02 January)

Follow Us On:

For more information about *Phyto*Technology Laboratories® products and services, for expert technical information, or to place an order, be sure to visit **www.phytotechlab.com**.

©2014 PhytoTechnology Laboratories®

General Information: 2-14
Ordering and general company & catalogue information.

Biochemicals: 15-54
General use biochemicals for use in the plant sciences.

Plant Tissue Culture Media: 55-128
Growth media fir plant tissue culture and micropropagation.

Molecular Biology: 129-148
Buffers, Reagents, and Antibiotics for use in plant molecular biology.

Microbiology: 149-156
Bacterial and fungal growth media for microbiology research.

Phytopathology: 157-160
Growth media for phytopathology research.

Seed Testing: 161-168
Media, antibiotics, stains and dyes for use in seed testing.

Phycology: 169-174
Media and biochemicals for use in algal biomass production and research.

Kits: 175-182
Educational classroom kits for demonstrating plant tissue culture.

Equipment: 183-214
Laboratory equipment for all fields of plant science and general use.

Technical Information: 215-288
Basic technical information on laboratory set up, tissue culture techniques, product applications, and more. Media formulation tables on pages 265 to 288.

Indices: 289-298
Technical Figures and Tables Index.
Alphabetical Index of all *Phyto*Technology Laboratories® Products.

About *Phyto*Technology Laboratories®

*Phyto*Technology Laboratories® was established in 1998, by Dr. Kenneth C. Torres, to provide a new source for pre-manufactured plant tissue culture media. In the years since, *Phyto*Technology Laboratories® has grown to provide a wide range of products for the plant sciences, including: plant tissue culture, plant molecular biology, phytopathology, seed testing,as well as microbiology, and phycology.

For over a decade, one thing has set *Phyto*Technology Laboratories® apart from its competitors: an unwavering dedication to quality. By providing quality products of consistent excellence, *Phyto*Technology Laboratories® enables their customers to produce controlled and repeatable results in experimental research and helps mass micropropagationists produce larger yields of plants through plant tissue culture.

*Phyto*Technology Laboratories® offers the world's largest selection of media for plant tissue culture, and with the other product lines offered, carries over 900+ products for plant sciences applications. They also offer a range of proprietary products including unique equipment like our ergonomic Glass Bead Sterilizers (product numbers S7510/S7520) and single-use disposable culture vessels (product numbers C1958/C2118/C1932).

*Phyto*Tech™ Standards of Quality

Biochemicals

*Phyto*Technology Laboratories® takes extra steps to source biochemicals of the highest quality for sale and manufacture. Biochemicals meet either United States Pharmacopeia (USP), European Pharmacopeia (EP), or American Chemical Society (ACS) specifications, as applicable to the product.

Media

*Phyto*Technology Laboratories® media is manufactured in-house at our main campus in Overland Park, KS. All media is manufactured in accordance with current Good Manufacturing Processes (cGMP) guidelines with a proprietary inventory tracking and management system that ensures minimal lot-to-lot variation in media production.

Sterile Liquids

*Phyto*Technology Laboratories® offers a range of sterile liquids, including: antibiotic solutions, plant growth regulator stock solutions, vitamin solutions, liquid media and more. Each solution is manufactured in-house and then filtered through a 0.2 µm filter. All sterile filtered liquids are confirmed sterile according to USP<71> protocols.

Physio-Chemical Testing

Prior to packaging, or use in manufacturing, all biochemicals must pass a series of physio-chemical testing. These tests are designed to ensure the product adheres to set specifications for: solubility, appearance, pH, and FTIR or HPLC identity confirmation.

Biological Testing

The vast majority of our biochemicals and media are then tested on commercially significant and product appropriate plant cell lines, to ensure conformity to expected standards and promote plant growth.

ISO Certification

ISO 9001:2008 REGISTERED FIRM

*Phyto*Technology Laboratories® was one of the first small business suppliers for the plant sciences to attain and maintain its ISO Certification. As an ISO 9001:2008 registered firm, *Phyto*Technology Laboratories® must pass an annual outside audit of our manufacturing and quality control processes to maintain this rating. An ISO certification is an independent and outside confirmation that you will be receiving products of superior quality when you purchase from *Phyto*Technology Laboratories®.

©2014 *Phyto*Technology Laboratories®

Understanding Catalogue Listings

Generally speaking, this catalogue uses two types of catalogue listings for chemicals. The first listing is for products that consist of one chemical, or chemical solution.

Denotes new product since last catalogue.

New Product

G3350 - Gentamicin Solution (50 mg/mL)

Product Number & Name
For your convenience, the product number and name link to the product web page

Gentamycin Sulfate
Aqueous Solution
Sterile Filtered

Product notes, full chemical name, and common aliases.

- Liquid
- CAS Number: 1405-41-0
- Formula: $C_{21}H_{43}N_5O_7 \cdot H_2SO_4$
- Molecular Weight: 575.67
- Miscible with Water
- Store at 2 to 6 °C



Form, CAS Number, Formula, Molecular Weight, Solubility, & Storage Temperature.

Dry Ice, Chemical Hazards and Hazardous Shipping Symbols. See "Catalogue Symbols" on page 11 for more information.

Available Package Sizes

10mL	25mL	100mL

Available Package Sizes
Listed from smallest to largest.
10LFB – Indicates a single-use foil bag instead of a plastic bottle.
10x1mL – A package of ten bottles in 1mL aliquots.
• Unless a "liquid" symbol is listed, 1L indicates the amount of powder needed for a 1L solutions.
Package sizes link to the product web page.

The second type of listing is for products that are manufactured by *Phyto*Technology Laboratories® from multiple chemicals, specifically media. This listing provides the formulation of the product.

L5138 - LB Broth, Lennox L

Product Number & Name
For your convenience, the product number and name link to the product web page

Contains the nutrients as described by Bertani (1951), and Luria and Burrows (1955). Formulation modified by Lennox L (1955).
Also known as Lysogeny Broth or Luria-Bertani Broth

Formulation reference, product notes and aliases.

- Store from 2 to 6 °C
- Soluble in Water
- Use at 20.00 grams per liter

Storage Temperature, Solubility and usage in grams per liter.

Formulation Legend
Most listings are mg/L

Components (mg/L)	
Sodium Chloride	5000
Tryptone	10,000
Yeast Extract	5000
Approximate pH at Room Temperature	6.0 - 7.5

Formulation., component name and amount in mg per liter.

Available Package Sizes

1L	500g	5Kg

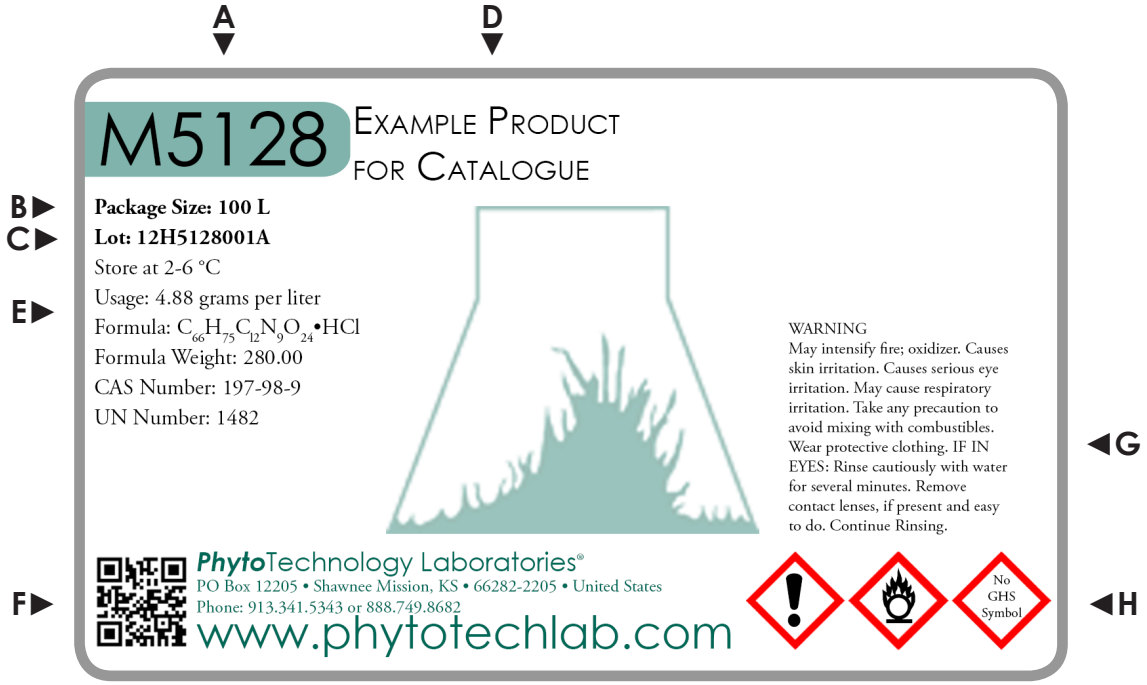
Available Package Sizes
Listed from smallest to largest.
10LFB – Indicates a single-use foil bag instead of a plastic bottle.
10x1mL – A package of ten bottles in 1mL aliquots.
• Unless a "liquid" symbol is listed, 1L indicates the amount of powder needed for a 1L solutions.
Package sizes link to the product web page.

Catalogue Listings Glossary

- Sterile Filtered – Solution has been filtered through a 0.2 µm filter. Product is confirmed sterile according to USP<71> protocols.
- Use at xx.x grams per liter – amount in grams of the product required to make a 1x solution in 1 liter of water.
- Solutions – Unless otherwise indicated, all solutions are prepared in DI Water.
- Products are listed alphabetically in the catalogue. Indexes by CAS Number and by Product Number can be found at the back of the catalogue.

Understanding our Labels

All products sold by *Phyto*Technology Laboratories® are labeled in a consistent fashion, which is designed to provide any and all pertinent information about the product. *Phyto*Technology Laboratories® makes every attempt to provide the most accurate product information possible, over time the specifics of our labels may change to keep in adherence with current government and international regulations. This section is intended to be a general guideline to our labeling practices.



A. **Product Number**

B. **Package Size**—This will indicate the minimum quantity of product in the package. For pre-weighed media, this will be the amount of powder required to prepare the media in the volume listed. The user should always measure the amount needed from the container.

C. **Lot Number**

D. **Product Name**—This will indicate the product's name as well as specific descriptions or synonyms.

E. **Storage Temperature, Usage, Chemical Formula, Formula (Molecular) Weight, CAS Number, UN Number, and Harmonized Commodities Code**—Storage temperatures indicated are for long-term storage of products (Products may be shipped under different conditions to reduce shipping cost, while still ensuring product quality).

Usage is used for products that have a specific usage requirements. Most commonly this appears on labels for plant tissue culture or microbiology media and the usage indicates the prescribed grams per liter usage to prepare one liter of media.

The Chemical Abstract Service (CAS) number is shown whenever available. CAS numbers vary in how specifically they describe a product, therefore, more than one CAS number may have been assigned to a product. Some chemicals have a UN Number which was assigned them by the United Nations. It relates to how hazardous a material may be, and can differ between liquids and solids of the same chemical. Harmonized Commodities Codes are schedule B export codes that can be specific to a chemical or a family of chemicals.

F. **QR Code:** Depending on the product, the QR code can take you to either the product's Certificate of Analysis for the specific lot, the Material Safety Data Sheet for the product, or to the Product Information Sheet.

G. **Hazard Information**—This provides a more complete description of the hazardous nature (if any), handling precautions, and emergency procedures that need to be followed when handling this product. Risk and Safety values are listed below this information. The user should always consult the Material Safety Data Sheet (MSDS) prior to the use of any product. See "Catalogue Symbols" on page 11 for a list of hazardous pictograms used in this catalogue and on our labels.

H. **Hazard Pictogram**—This lets the user know at a glance what safety hazards exist with this product. If no symbol is required, this diamond will indicate so by "No GHS Symbol."

©2014 PhytoTechnology Laboratories®

PhytoTechnology Laboratories®

PhytoDirect™ EU Distribution Programme



- Door to Door distribution of products; most delivered in 3-4 Business Days;
- Shipping includes clearing all products through customs and paying all duties and VAT (when provided with customer VAT);
- Flat rate shipping of $25.00 USD for all orders of $250.00 - 1000.00 USD of select products and package sizes;
- Free shipping on orders greater than $1000.00 USD of selected products and package sizes;
- Orders may be placed online at www.phytotechlab.eu.com or by e-mail or fax.
- E-mail confirmation and tracking number provided with each order.
- Programme does not apply to package sizes larger than 5 Kilograms.
- Programme is subject to change without notification.

Day One:
Product Leaves PhytoTech Labs in Overland Park, KS to distribution facility in France.

→

Day Two:
Product arrives in France and clears EU customs. Duties and VAT are paid.

→

Days Three - Four:
Product Leaves distribution facility in France and is delivered to any EU Member State.

Countries Included in the PhytoDirect™ EU Distribution Programme

Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden

*Phyto*Technology Laboratories® provides research quality products for plant tissue culture, plant molecular biology, and microbiology applications at competitive prices worldwide. **Quality**, **Innovation**, and **Service** are the backbone of the *Phyto*Tech™ Philosophy which has allowed *Phyto*Technology Laboratories to be a leader in the plant science market for over fifteen years. Discover the difference *Phyto*Tech Quality & Service can make!

www.phytotechlab.eu.com

PHYTOORGANIC

Organic Media for Potatoes

At the 2013 Society for In Vitro biology meeting, we presented a poster paper (Development of Organic-Based Micropropagation Media) that outlined the development and testing of our organic potato media. This poster is available at http://www.phytotechlab.com/pdf/SIVB2013OrganicMedia.pdf. In continuation to that previous study a comparison between different sources of vitamins has been examined. In this study, Organic Coconut Powder (Product No. C1780), a natural and organic source of vitamins, was tested against Gamborg Vitamin Solution 1000X (Product No. G219). Additionally, this study evaluates the overall performance of Phyto-Organic Potato Media (Product No. P6700 and P7000) with Murashige & Skoog (MS) Basal Salts when supplemented with organic PGRs and non-organic PGRs, respectively.

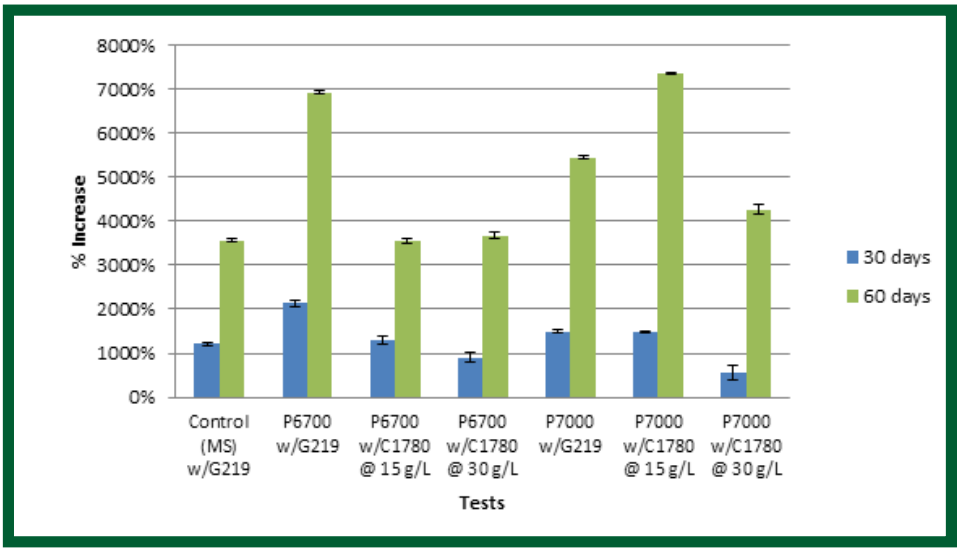


Figure 1: Results of fresh weights after 30 and 60 day periods of potato tissues on Phyto-Organic Potato Media 1 and 2. Control (MS) w/G219 was supplemented with 4.4 µM BA and 0.14 µM NAA. All organic-based media were supplemented with 2.5 mL/L Org. PGR A and 1 m/L Org. PGR B.

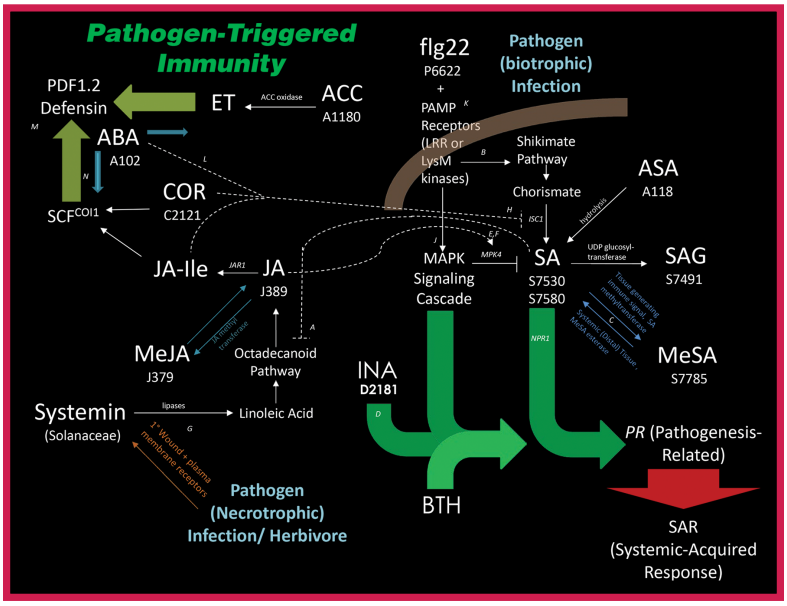
- Potato Medium 2 w/C1780 @ 15 g/L yielded an increase in fresh weight of 7346% while the MS control had an increase of 3566%.
- Although data collected were the results from one potato cultivar, both Potato Media supplemented with either G219 or C1780 showed similar or greater increase in fresh weight than those grown on MS w/G219.

Typical concentrations used to obtain the above results are listed in the following table:

Recommended Concentrations Per Liter		
Product Description	Product Number	Amount to use per liter
Phyto-OrganicTM Potato Medium 1	P6700	8.71 g/L
OR		
Phyto-OrganicTM Potato Medium 2	P7000	8.88 g/L
Supplemented with components listed below		
Organic PGR A (provided with media)		2.5 mL/L
Organic PGR B (provided with media)		1 mL/L
Phyto-OrganicTM Sucrose	S7761	30 g/L
Phyto-OrganicTM Coconut Powder	C1780	15 g/L
Phyto-OrganicTM Agar	A1000	6 g/L
Adjust Final pH to 5.6 – 5.8		

©2014 PhytoTechnology Laboratories®

New from PhytoTechnology Laboratories
Products for Plant Defense Research



Stress resistance, both abiotic and biotic, is a widely researched topic in plant science. We are introducing a new product line to aid researchers in deciphering Plant Defense and Immunity. This product line covers mostly biotic stress resistance and the pathogen-triggered innate arm of plants immune system. In pathogen-triggered immunity there are two-main pathways: Biotrophic (e.g., micro-organism induced infection) and Necrotrophic (herbivore/wound based infection), and there is cross-talk between key signals in each pathway.

The most well-characterized biotrophic infection comes from the N-terminus of the flagellin of *Pseudomonas aeruginosa*, a small conserved 22 amino-acid sequence (P6622) that interacts with PAMP (pathogen-associated molecular patterns) receptors and activates the MAPK (mitogen-activated protein kinase) pathway to ultimately induce SAR (systemic acquired resistance). Other biotrophic infections can utilize the shikimate pathway for accumulation of salicylic acid (S7530, S7580) which upregulates PR (pathogenesis-related proteins) and also leads to SAR.

In necrotrophic infections, the most well characterized pathway resulting from wounding comes from a peptide systemin which exists in the *Solanceae* family of plants. This path leads to accumulation of jasmonic acid (J379) and methyl jasmonate (J389) to warn nearby plants and express endogenous defensin peptides that often have anti-microbial and antifungal properties.

Product Number	Product Description	Package Size
P6622	**flg22 PEPTIDE** Peptide with its sequence derived from the flagellin N-terminus of *P. aeruginosa* and is known to elicit specific innate immune response in plants as well as animals.	1 mg 5 mg
A118	**Acetylsalicylic Acid** Hydrolyzes to form salicylic acid (S7530). One of the first exogenously applied chemicals to induce resistance to Tobacco Mosaic Virus.	100 g
A1180	**1-Aminocyclopropanecarboxylic acid (ACC)** ACC is a cyclic α-amino acid that is the immediate precursor of the plant hormone ethylene.	100 mg 500 mg 1 g
D2181	**2,6-Dichloroisonicotinic Acid (INA)** First synthetic chemical to induce SAR. Like salicylic acid it inhibits catalase to start the cascade of upregulating pathogenesis-related genes.	1 g 5 g
J379	**(+/-) Jasmonic Acid** Lipid-derived hormone generally induced from wounding response to regulate plant immunity and some aspects of development.	100 mg 500 mg
J389	**Methyl Jasmonate** Methyl ester of jasmonic acid (J379) which has significant vapor pressure so it can signal induction of defense responses to nearby plants.	5 g 25 g
S7785	**Methyl Salicylate** Involved in plant defense reactions, present in plant tissues as well as being an airborne defense signal.	500 mL 1 L
S7530	**Salicylic Acid** An endogenous signal mediating local and systemic plant defense responses against pathogens.	500 g 1 Kg
S7580	**Salicylic Acid, Sodium Salt** An endogenous signal mediating local and systemic plant defense responses against pathogens. A more water soluble form of S7530.	500 g 1 Kg
S7491	**Salicylic Acid Glucoside** A storage form of a defense signal against pathogens.	5 g 25 g

For more information call us at 913.341.5343 or visit www.phytotechlab.com

Accepted Forms of Payment

Credit Cards

*Phyto*Technology Laboratories® accepts American Express, Discover, MasterCard and Visa.



Other Accepted Forms of Payment

For your convenience *Phyto*Technology Laboratories® also will accept payment by international bank wires, Electronic Funds Transfer (EFT), and pre-payment by business checking. Please contact **sales@phytotechlab.com** for more information about paying by EFT or international wire.

Orders Requiring Pre-Payment

First Time Customers: Orders placed by any first-time customer require pre-payment.

Hobbyists and Personal Orders: Orders by hobbyists, individuals, and orders being shipped to residential addresses require pre-payment.

International Orders: All orders placed by companies or individuals outside the United States require pre-payment for their purchase. For your convenience we do accept pre-payment by international wire. Contact **sales@phytotechlab.com** for more information.

High Value Orders: For orders of high value, pre-payment in full may be required for purchase. Orders are considered to be high value solely at the discretion of *Phyto*Technology Laboratories®.

Term Payment and Credit

For those customers who desire term payment accounts (Net 30-Day terms), a credit application may be filled out and submitted for approval. We will attempt to approve this credit as soon as possible, but it is subject to the response time from the customer's trade references.

For those customers who qualify for Net 30-Day terms, payment will be required within 30 days. Delinquent accounts will be contacted first with a "Past-Due Notice" via e-mail and a fax or phone call. Any orders from customers with past-due balances will be held until such balances are paid in full. At 60 days past due, accounts will be turned over for collection unless prior payment arrangements have been made and all future orders must be paid in advance.

*Phyto*Technology Laboratories® is pleased to provide high-quality products and efficient service at competitive prices. However, in order to keep prices competitive, it is necessary for us to be paid in a timely manner. Thank you in advance for adherence to our credit policy.

Placing International Orders

In addition to ordering through our distributors *Phyto*Technology Laboratories® accepts and ships international orders directly from our main campus in the United States. International orders are shipped via Federal Express shipping, and depending on regional conditions, is either delivered by Federal Express or through one of Federal Express's shipping partners in your home country. International shipping usually takes somewhere between 3 to 5 days, but individual shipping times may vary based on regional conditions.

The customer is responsible for all duties, taxes, fees, and permits not included in the shipping cost, that may result from importing products. The customer assumes full responsibility for the shipment after it leaves *Phyto*Technology Laboratories®. If you require any special documentation before we ship your order, it is the customer's responsibility to contact customer service before their order has shipped.

*Phyto*Technology Laboratories® products are available to any country that enjoys unrestricted trade with the United States. At the printing of this catalogue, the only countries that we are unable to ship to are Cuba, Iran, North Korea, Sudan, and Syria.

A list of our International Distributors can be found on the inside back cover.

Orders to the European Union

*Phyto*Technology Laboratories® is pleased to announce direct distribution through France. Orders to the EU will be shipped duty free (with a customer VAT Number) and will typically arrive within 3 to 4 days. For more information contact:
sales@phytotechlab.eu.com
or visit: **www.phytotechlab.eu.com.**

©2014 PhytoTechnology Laboratories®

Shipping Information

Most products are shipped within 1 to 2 business days of receipt of order. If any items in the order are back-ordered you will be informed via phone or e-mail when the order is placed. Unless otherwise specified by the customer, all back-ordered items will ship separately, allowing any in-stock items to ship immediately. Please note the following:

- No orders are shipped on Fridays.
- Orders placed within 1 to 2 days of holidays observed by *Phyto*Technology Laboratories® may be shipped after the holiday.

Recommended Shipping Methods

To ensure the long-term stability of your items and that they arrive in optimal conditions, *Phyto*Technology Laboratories® recommends the following:

- Products intended for room temperature storage can ship by any method,
- Products intended for 2 to 6 °C storage should be shipped by two-day express service or faster, and
- Products that require storage in -20 to 0 °C storage should be shipped overnight.
- For orders requiring shipment on dry ice, see "Special Shipping Requirements" on page 11.

While refrigerator storage (at 2 to 6 °C) or freezer storage (at -20 to 0 °C) is recommended for the long-term stability of products marked with specific temperature storage ranges, up to seven days in air transit at ambient temperatures will not detrimentally affect the product's quality or shelf-life.

Shipping Charges

*Phyto*Technology Laboratories® makes every effort to provide you with cost-effective shipping solutions. Shipping fees are calculated based solely on the size and weight of the items being shipped and the distance being travelled. Please be advised of the following:

- For all orders, a $5.00 USD per box handling fee is included in the shipping cost.
- Orders cannot be shipped to a PO Box maintained by the United States Postal Service (USPS) without prior arrangements having been made with *Phyto*Technology Laboratories®.
- For large-volume orders we recommend shipping by FedEx freight. Should your order qualify for freight shipment you will be informed by a member of the *Phyto*Technology Laboratories® customer service department.
- You can choose to have your order billed to your personal Federal Express account number. A $5.00 USD per box handling fee will be applied to your order.
- Shipments to residential addresses typically incur additional shipping costs from FedEx.

Federal Express Shipping Options

*Phyto*Technology Laboratories® provides shipping through Federal Express (FedEx), which offers domestic and international shipping. For your convenience we allow the following shipping methods, organized below in increasing speed of delivery and cost:

Domestic Services

- FedEx Ground Service (See "FedEx Ground Service Map" on page 10)
- FedEx 2 Day Service
- FedEx Standard Overnight (delivery by 3:00 p.m. the next day)
- FedEx Priority Overnight (Delivery by 10:00 a.m. the next day; not available in some areas)

International Services

- FedEx International Ground Service (Canada only)
- FedEx International Economy Service
- FedEx International Priority Service

Other Services

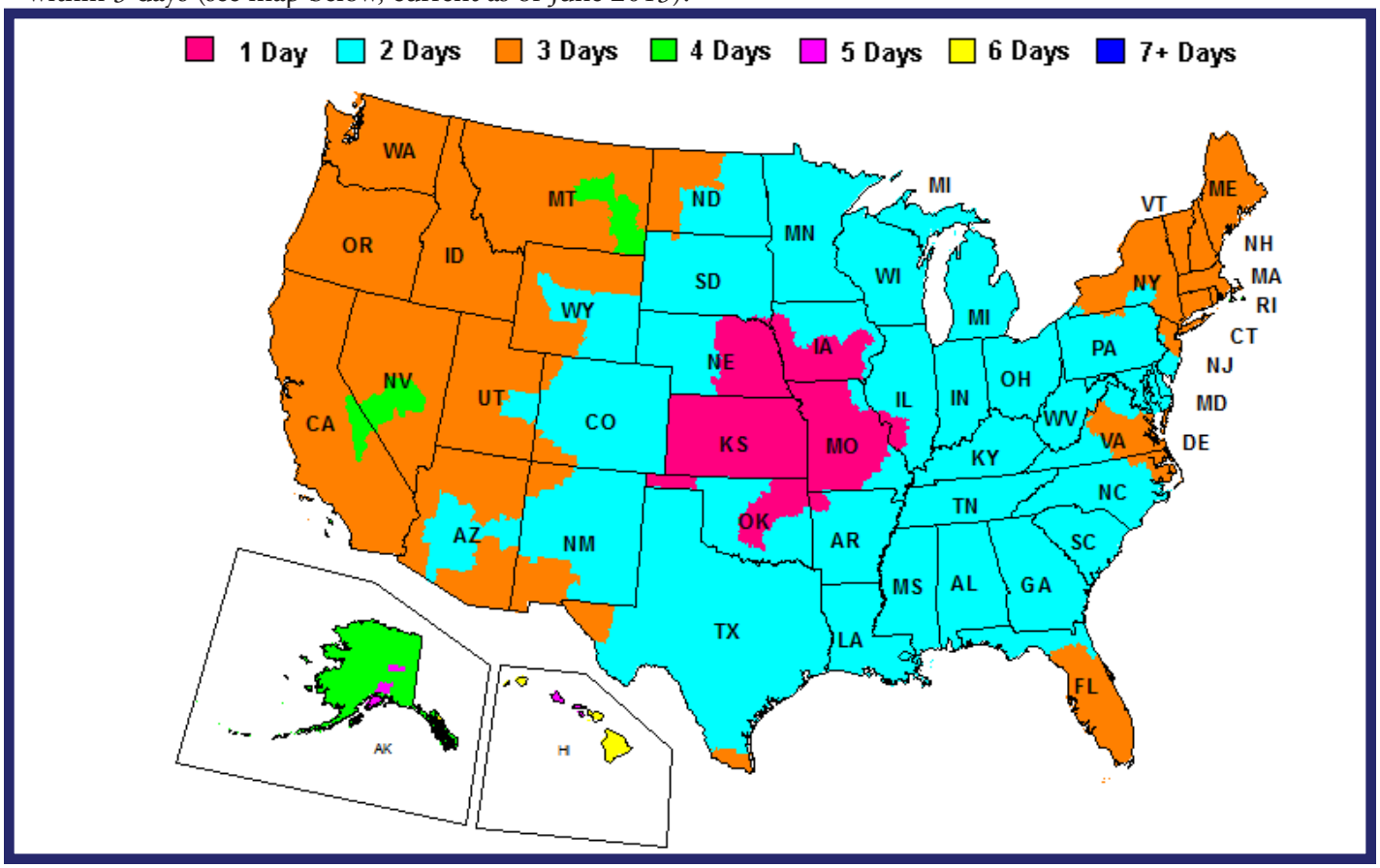
- FedEx Freight Service
- FedEx Hazardous Shipping Service (domestic, ground service shipping only)
- FedEx Smart Post

Shipping Quotes

*Phyto*Technology Laboratories® can, on request, provide shipping quotes for international or high volume shipments. You will be provided with an itemized quote, including freight charges that will be valid for ***30 days only***. Please be cognizant that shipping prices can fluctuate over time and as such we cannot provide shipping quotes that last longer than 30 days.

FedEx Ground Service Map

*Phyto*Technology Laboratories® makes every effort to ship products by the safest, most economical method possible. Products are shipped via traceable courier, unless the customer specifies an alternative method of shipping. Most products can be shipped anywhere within the continental United States via FedEx Ground within 3 days (see map below, current as of June 2013).



Please Remember:

- A business day does not include the initial ship date of the order, Saturdays, Sundays, or holidays.
  - Example: A package is shipped on Monday that takes 2 business days to arrive. The day the package is shipped does not count as a business day, so your package would arrive on Wednesday, the second business day after the ship date.
- The delivery schedule illustrated above is accurate at the time of this catalog printing; however, it is subject to change at the carrier's discretion.
- Keep in mind that shipping rates may change at any time without prior notice. **Shipping quotes are valid only for 30 days from the date of the quote.** Shipping charges are determined by weight and zone.
- Shipping rates may also be affected by the following:
  - A minimum $5.00 USD handling charge per box will be added to shipping charges. A surcharge may be added to shipments to residential addresses by the carrier.
  - Hazardous material surcharges range from $35.00 USD per Hazardous UN Number for ground shipments to $75.00 USD per Hazardous UN Number for air shipments.
  - Box size may affect rates on air shipments.
  - Products requiring shipping on Dry Ice or Blue Ice will incur a surcharge of $15.00 for domestic shipments and $35.00 USD for international shipments.
- Shipping charge quotes can be provided for domestic orders over $2500 and all international orders. Please bear in mind that these quotes are estimates and that the actual shipping charges are subject to change.

©2014 PhytoTechnology Laboratories®

Special Shipping Requirements

Hazardous Items

The International Air Transport Association (IATA), The International Civil Aviation Organization (ICAO), and the United States Department of Transportation (through Federal Regulation 49 CFR) classify certain products as hazardous products. Packaging and shipment of these products is regulated and all carriers impose Hazardous Material (HAZMAT) fees. [A minimum $35.00 USD charge is added for all HAZMAT ground shipments. For shipping hazardous items by air or internationally a minimum $75.00 USD fee applies.]

Temperature Sensitive Items

Products labeled for storage at -20 to 0 °C or lower will be shipped on Dry Ice or Blue Ice as needed to ensure product stability. Dry Ice and Blue Ice shipments require an additional fee of $15.00 USD minimum. For international shipments requiring Dry Ice or Blue Ice a fee of $35.00 USD will be charged (Prices are subject to change without notice).

Catalogue Symbols

	***Harmful:*** substances which can have limited effects on health and/or substances which can cause inflammation and/or irritation.
	***Health Hazard:*** substances which can cause serious and/or extremely serious acute, carcinogenic or chronic effects on health.
	***Toxic:*** substances which can be fatal if ingested, inhaled, or handled without appropriate personal protective equipment.
	***Corrosive:*** substances which can destroy living tissue. Can cause severe skin burns or eye damage. May be corrosive to metals.
	***Oxidizing:*** substances which can produce and/or intensify high exothermic reactions in contact with other substances.
	***Flammable:*** substances with a flash point greater than 21°C and less than or equal to 55°C. Keep away from heat, sparks, hot surfaces and open flame.
	***Dangerous for the Environment:*** substances which can cause serious effects on the environment.
	***Hazardous:*** substances deemed generally hazardous. Hazardous shipping fees apply to these products.
	***Liquid Solution:*** product is a liquid solution or is naturally a liquid product. Individual product listings will list liquid type (e.g., water or PBS Buffer).
	***Product is shipped on Dry or Blue Ice:*** to preserve product stability, dry or blue ice shipping is required. Dry or blue ice shipping fees apply.

Custom Services

Custom Dry Powder Media

*Phyto*Technology Laboratories® can custom manufacture proprietary and non-proprietary dry powder media for customers according to cGMP standards, and in accordance with ISO standards of quality, in an environmentally controlled manufacturing facility in Overland Park, KS. This service has proven to save time and money in media preparation:

- Custom media reduces the possibility of technician error in the formulation of media;
- In many cases, a single lot of a custom medium can be made to meet your annual research or production requirements, ensuring consistency in the medium throughout a research program or production cycle;
- Custom dry powder media can be manufactured in batch sizes ranging from 100L to 50,000L, depending upon the formulation's complexity.
- Custom dry powder media can be formulated to contain any or all of the following: basal salts, carbohydrates, plant growth regulators, gelling agents, and can be buffered and pH adjusted.
- A mutually signed confidentiality agreement provides assurance that all records pertaining to a custom medium will be held in the strictest confidence.
- *Phyto*Technology Laboratories® is currently providing this service for a number of agro-biotech firms, micropropagation labs, and bio-pharmaceutical companies.

Custom Liquids

The supply of liquid media offers scientists and production personnel sterile, ready-to-use media for bioreactors, micropropagation production, and research. SOPs specific for each phase of liquid media formulation, manufacturing and packaging are stringently followed.

- All liquid media products manufactured by *Phyto*Technology Laboratories® are sterility-tested according to US Pharmacopeia (USP) specifications;
- Custom media reduces the possibility of technician error in the formulation of the media;
- Custom liquid media can be manufactured in batch sizes ranging from 10L to 200L depending upon the complexity of the media;
- *Phyto*Technology Laboratories® can currently package Liquid Media in sizes ranging from 10mL bottles to 20L bags.

Custom Packaging

*Phyto*Technology Laboratories® can custom package proprietary and non-proprietary dry powder media for customers according to cGMP standards in their environmentally controlled packaging rooms. *Phyto*Technology Laboratories® currently maintains multiple environmentally controlled packaging and formulation rooms. With rooms dedicated to the packaging of either Non-Animal Derived Products, Animal Derived Products, or Antibiotics, ensuring no cross-contamination between product types.

- Media can be packaged in foil pouches or bottles in the amounts required by the end-user;
- Custom media packaging in ready-to-use sizes reduces the possibility of technician error in the preparation of the media; this helps to ensure the accuracy and batch-to- batch consistency of media prepared by in-house technicians;
- Biochemicals or other media components such as carbohydrates or gelling agents can be custom packaged in ready-to-use packages. This eliminates customers spending time weighing out chemicals, thus improving their efficiency;
- These services have proven to save time and money in media preparation for customers.

Custom Testing

*Phyto*Technology Laboratories® can offer custom testing services at an additional charge. These testing services are in addition to the normal testing of media conducted by the company. These services are fee-based and include, but are not limited to:

- ICP Elemental Analysis
- CHN Analysis
- USP Sterility Testing
- Bioburden Testing
- *Phyto*Technology Laboratories® can, in conjunction with the researcher, develop and/or optimize proprietary media and test to meet the requirements for any specific plant cell line provided by the customer.

©2014 PhytoTechnology Laboratories®

Custom Orders Process

To start a custom order process either visit **www.phytotechlab.com**, contact us by e-mail at **tech@phytotechlab.com** or contact us directly at 913.341.5343 and ask for a custom order form.

1. Fill out the custom order form. Making sure to fill out:
   - Your contact information,
   - The desired formulation of your custom media,
   - The batch and package sizes required, or
   - The custom testing services required (if applicable).
2. Return the form to **tech@phytotechlab.com** or by faxing it to 913.341.5442.
3. Indicate if a signed confidentiality agreement is required.
4. Custom orders usually take about a week to prepare a quote. We look to ensure and confirm:
   - Correct formulation,
   - Feasibility of manufacturing,
   - Availability of biochemical components,
   - Pricing of the order, and
   - When the order can be manufactured.
5. After the order has been reviewed and confirmed by both parties, manufacturing can generally occur within 1 to 3 business weeks.
6. The order will be physio-chemically tested to ensure that it was manufactured correctly.
7. Packaging of the order usually occurs within 24 to 48 hours after passing physio-chemical testing.
8. The order ships, to most locations in the United States, within 3 business days.

For custom testing, turnaround can be one to four weeks depending on the testing services desired.

Custom Media quotation forms can now be filled out entirely online at www.phytotechlab.com.

Use of Our Products

All products sold by *Phyto*Technology Laboratories® are intended for laboratory and research use only, and are not to be used on humans or animals, or for the production of food supplements, drugs, or cosmetics. United States government regulations require us to exercise *due diligence* in screening all orders and we are further expected to refuse to ship any order where improper use is indicated or suspected. Thus *Phyto*Technology Laboratories® reserves the right to refuse service to anyone suspected of misusing these products.

Our plant growth regulators and media containing plant growth regulators are intended only for laboratory use, plant tissue culture media preparation, plant micropropagation, and plant research purposes.

Products offered by *Phyto*Technology Laboratories® are intended for use by qualified professionals who are familiar with their potential hazards and trained in safe laboratory practices. Information pertaining to the potential hazards of our products is provided on our product labels and in our Material Safety Data Sheets.

Material Safety Data Sheets are available online at **www.phytotechlab.com**, as required by OSHA's Hazard Communication Standard, for products that are hazardous. The absence of a warning must not be interpreted as an indication of safety. The safe use of each product must be determined by the end user.

Safety Documentation

*Phyto*Technology Laboratories®, in accordance with ISO quality guidelines and local and federal regulations provides the following documentation for all products, as applicable:

- ***Material Safety Data Sheets:*** Also known as MSDS(s), a Material Safety Data Sheet is available for all chemicals sold and manufactured by *Phyto*Technology Laboratories®. These sheets include information on any potential hazards of the chemical, proper handling and storage recommendations, and shipping and regulatory information.

- ***Certificates of Analysis:*** Also known as CofA(s) and COA(s), Certificates of Analysis provide in-depth chemical and stability analysis of every chemical on a lot-to-lot basis. Each Certificate of Analysis covers only one manufacturing or packaging lot of a chemical, and specific information such as expected shelf-life can vary slightly from lot to lot.
- ***Product Information Sheets:*** Available for many *Phyto*Tech™ products, and are intended to provide information about a product's typical usage, applicable plant cell lines, and references to literature on the product. Product Information Sheets also contain media formulation tables for all non-proprietary media formulations.

All of these documents are available at **www.phytotechlab.com** or can be obtained by contacting **tech@phytotechlab.com**.

Warranties

*Phyto*Technology Laboratories® warrants that its products perform as described in *Phyto*Technology Laboratories® literature. The purchaser must determine the suitability of the products for his/her particular use. Should any product fail for reasons other than misuse, *Phyto*Technology Laboratories® will replace the product free of charge or refund the purchase price, at the company's discretion.

This warranty is exclusive, and *Phyto*Technology Laboratories® makes no other warranty, expressed or implied, including any implied warranty of merchantability of fitness for any particular purpose.

*Phyto*Technology Laboratories® shall not be liable for any incidental, consequential, or contingent damages.

Refund & Restocking Policies

The customer service department at *Phyto*Technology Laboratories® is available to assist you, should a problem arise. Please inspect your packages upon receipt and notify us immediately of any damage that may have occurred with any orders. Prior to returning any product, please contact our customer service department to obtain authorization and proper shipping procedures. *Phyto*Technology Laboratories® will do its best to accommodate your request to return products. However, to maintain the quality of our products, certain products may not be accepted for return. Sterile products, hazardous products, and products which require refrigerated or freezer storage may not be returned. There will be a 15% restocking fee applied to the return of any product. Returns must be made within 30 days of purchase.

©2014 PhytoTechnology Laboratories®

BIOCHEMICALS









Biochemicals

*Phyto*Technology Laboratories® provides an extensive line of biochemicals for use in plant tissue culture, microbiology, and molecular biology research. This section outlines many of these products. Most of the products listed in this section have a wide variety of uses. Products that are intended for, or used most commonly with one specific field of plant sciences are included in those sections. Please refer to the following sections:

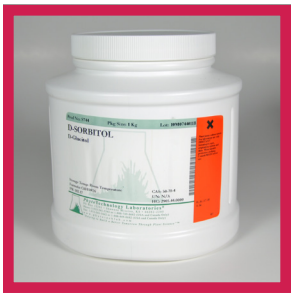
- Molecular Biology, page 129
- Microbiology, page 149
- Seed Testing, page 161
- Phycology, page 169

For assistance with locating products within the catalogue, please consult the indices at the back of this catalogue. **Be sure to check back at www.phytotechlab.com for new products often.**









Gelling Agents

*Phyto*Technology Laboratories® offers several different types of gelling agents for use in plant tissue culture, including agars, gellan gums, and carrageenans.

Agars:

- A111 - Agar, *Gracilaria*
- A296 - Agar, *Gelidium*
- A175 - Agar TC, Purified Grade

Gellan Gums:

- G434 - Gellan Gum
- G3251 - Gelzan™

Carrageenans:

- C257 - Carrageenan, Gelcarin
- C2000 - Carrageenan, High Clarity

Media Components

Most of the biochemical components used in the manufacture of *Phyto*Technology Laboratories® tissue culture media are available for purchase individually. This includes a wide variety of plant growth regulators, vitamins, amino acids, carbohydrates, and undefined organic supplements.

Featured in this section

- Agars
- Amino Acids
- Auxins
- Buffers
- Carbohydrates
- Carrageenans
- Cytokinins
- Enzymes
- Gellan Gums
- Gibberellins
- Macronutrients
- Micronutrients
- pH Adjustment
- Reagents
- Solvents
- Vitamins

©2014 PhytoTechnology Laboratories®

A102 - (+/-)-Abscisic Acid

ABA; Dormin; Abscisin II; (2*Z*,4*E*)-5-[(1*S*)-Hydroxy-2,6,6-trimethyl-4-oxo-2-cyclohexen-1-yl]-3-methyl-2,4-pentadienoic Acid
Abscission-accelerating plant hormone
Plant Tissue Culture Tested

- Powder
- CAS Number: 14375-45-2
- Formula: $C_{15}H_{20}O_4$
- Molecular Weight: 264.32
- Soluble in KOH
- Store at -20 to 0 °C
- *Merck* **13**, 9

Available Package Sizes

100mg	500mg	1g	5g

A256 - Acetic Acid, Glacial

Ethanoic Acid

- Liquid
- CAS Number: 64-19-7
- Formula: $C_2H_4O_2$
- Molecular Weight: 60.05
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 56



Available Package Sizes

10x1mL	10mL	25mL

A104 - Acetosyringone

See Molecular Biology Section for Complete Listing

A110 - Acetosyringone 100mM Solution

See Molecular Biology Section for Complete Listing

A118 - Acetylsalicylic Acid

2-(Acetyloxy)benzoic Acid; Salicilic acid acetate; Aspirin
Plant Tissue Culture Tested

- Powder
- CAS Number: 50-78-2
- Formula: $C_9H_8O_4$
- Molecular Weight: 180.16
- Soluble in Hot to Boiling Water or DMSO
- Store at Room Temperature
- *Merck* **13**, 856



Available Package Sizes

100g

A120 - Adenine

6-Aminopurine; Vitamin B_4
Plant Tissue Culture Tested

- Powder
- CAS Number: 73-24-5
- Formula: $C_5H_5N_5$
- Molecular Weight: 135.13
- Soluble in KOH
- Store at Room Temperature
- *Merck* **13**, 152

Available Package Sizes

25g	100g

A545 - Adenine Hemisulfate

6-Aminopurine Sulfate
Plant Tissue Culture Tested

- Powder
- CAS Number: 321-30-2
- Formula: $(C_5H_6N_5)_2SO_4$
- Molecular Weight: 368.34
- Soluble in Warm Water
- Store at Room Temperature
- *Merck* **13**, 152

Available Package Sizes

25g	100g

A296 - Agar, Plant TC Micropropagation Grade - *Gelidium*

Agar-Agar; Gum Agar
Gel Strength: minimum 700 g/cm^2
Plant Tissue Culture Tested

- Powder
- CAS Number: 9002-18-0
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 184

Available Package Sizes

9g	100g	500g	1Kg	5Kg	10Kg	25Kg

A111 - Agar, Plant TC Micropropagation Grade - *Gracilaria*

Agar-Agar; Gum Agar
Gel Strength: minimum 900 g/cm^2
Plant Tissue Culture Tested

- Powder
- CAS Number: 9002-18-0
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 184

Available Package Sizes

9g	100g	500g	1Kg	5Kg	10Kg	25Kg

Gelling Agents Usage Chart

See "Figure 19. Usage Guide for Gelling Agents" on page 242 in the Technical Section.

A175 - Agar, TC; Purified Grade - *Gelidium*

Agar-Agar; Gum Agar
Gel Strength: minimum 700 g/cm^2
Plant Tissue Culture Tested

- Powder
- CAS Number: 9002-18-0
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 184

Available Package Sizes

8g 100g 250g 500g 1Kg 2.5Kg 5Kg

A133 - Agargellan™

A proprietary blend of Gellan Gum and Micropropagation grade Agar.
Plant Tissue Culture Tested

- Powder
- Soluble in Boiling Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg 5Kg

A110 - Agarose

Gelling Temperature: >35°C
Plant Tissue Culture Tested

- Powder
- CAS Number: 9012-36-6
- Formula: $(C_{12}H_{14}O_5(OH)_4)_n$
- Low EEO
- Molecular Weight: Variable
- Soluble in Hot Water
- Store at Room Temperature

Available Package Sizes

100g

A1050 - LE Agarose

See Molecular Biology Section for Complete Listing

A105 - Agarose, Low Gelling Temperature

Gelling Temperature: 26 to 29 °C
Plant Tissue Culture Tested

- Powder
- CAS Number: 9012-36-6
- Formula: $(C_{12}H_{14}O_5(OH)_4)_n$
- Molecular Weight: Variable
- Soluble in Hot Water
- Store at Room Temperature

Available Package Sizes

100g

New Product

A1315 - Agarose, Low Gelling Temp, SeaPlaque®

Gelling Temperature: 26 to 30 °C
Gelling Strength (1% concentration): ≥200 g/cm^2
Plant Tissue Culture Tested

- Powder
- Low EEO
- CAS Number: 9012-36-6
- Formula: $(C_{12}H_{14}O_5(OH)_4)_n$
- Molecular Weight: Variable
- Soluble in Hot Water
- Store at Room Temperature

Available Package Sizes

25g

A121 - L-Alanine

USP Grade
(*S*)-2-Aminopropanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-41-7
- Formula: $C_3H_7NO_2$
- Molecular Weight: 89.09
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 203

Available Package Sizes

100g 500g 1Kg

A1286 - Alcian Blue

See Seed Testing Section for Complete Listing

A108 - Alginic Acid, Sodium Salt

Sodium Alginate

- Powder
- CAS Number: 9005-38-3
- Molecular Weight: 240,000 avg.
- Partially Soluble in Water – Forms Viscous Colloidal Suspension
- Store at Room Temperature
- *Merck* **13**, 238

Available Package Sizes

100g 250g 500g

©2014 PhytoTechnology Laboratories®

A127 - Aluminum Chloride Hexahydrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 7784-13-6
- Formula: $AlCl_3 \cdot 6H_2O$
- Molecular Weight: 241.43
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 335

Available Package Sizes

100g

A103 - p-Aminobenzoic Acid

4-Aminobenzoic Acid; PABA; Vitamin B_x; Vitamin H_1
Plant Tissue Culture Tested

- Powder
- CAS Number: 150-13-0
- Formula: $C_7H_7NO_2$
- Molecular Weight: 137.14
- Soluble in KOH/NaOH
- Slightly soluble in water at low concentrations
- Store at 2 to 6 °C
- *Merck* **13**, 422

Available Package Sizes

5g 25g 100g

A109 - Ammonium Chloride

Plant Tissue Culture Tested

- Powder
- CAS Number: 12125-02-9
- Formula: NH_4Cl
- Molecular Weight: 53.49
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 510

Available Package Sizes

100g 1Kg

A114 - Ammonium Citrate, Dibasic

Diammonium Citrate; Citric Acid Diammonium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 3012-65-5
- Formula: $(NH_4)_2HC_6H_5O_7$
- Molecular Weight: 226.19
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 513

Available Package Sizes

500g 1Kg

A112 - Ammonium Molybdate (VI) Tetrahydrate

Molybdic Acid, Ammonium Salt Tetrahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 12027-67-7
- Formula: $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$
- Molecular Weight: 1235.9
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 536

Available Package Sizes

25g 100g 500g 100g

Macronutriens Sources Chart

See "Figure 9. List of Macronutrient Sources & *Phyto*Tech™ Product Numbers" on page 232 in the Technical Section.

A300 - Ammonium Nitrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 6484-52-2
- Formula: NH_4NO_3
- Molecular Weight: 80.04
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 538

Available Package Sizes

500g 1Kg 5Kg 10Kg 15Kg

A113 - Ammonium Phosphate, Monobasic

Ammonium Dihydrogen Phosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7722-76-1
- Formula: $NH_4H_2PO_4$
- Molecular Weight: 115.03
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 547

Available Package Sizes

100g 500g 1Kg

A305 - Ammonium Sulfate

Sulfuric Acid Diammonium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 7783-20-2
- Formula: $(NH_4)_2SO_4$
- Molecular Weight: 132.14
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 559

Available Package Sizes

500g 1Kg

A116 - Ampicillin, Sodium Salt

See Molecular Biology Section for Complete Listing

A1116 - Ampicillin Solution (100mg/mL)

See Molecular Biology Section for Complete Listing

A123 - Ancymidol

α-Cyclopropyl-α-[4-methoxyphenyl]-5-pyrimidinemethanol
Plant Tissue Culture Tested

- Powder
- CAS Number: 12771-68-5
- Formula: $C_{15}H_{16}N_2O_2$
- Molecular Weight: 256.3
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 637

Available Package Sizes

100mg	500mg	1g

A1272 - Aniline Blue

See Seed Testing Section for Complete Listing

A126 - Antioxidant Mixture

A mixture of Ascorbic Acid and Citric Acid
Plant Tissue Culture Tested

Use 0.25 grams per liter to make a stock solution. This product is typically made up as a stock solution, and an explant is dipped into it before transferred to fresh medium. It may also be added directly to the medium in amounts determined by the user.

- Powder
- Formula: $C_6H_8O_6$/ $C_6H_8O_7$
- Molecular Weight: 176.13/ 192.14
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1L	10L

A124 - Apple Powder

A mixture of natural apple puree and maltodextrin.
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g	1Kg

A143 - L-Arginine, Free Base

(*S*)-2-Amino-5-[(aminoiminomethyl)amino]pentanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 74-79-3
- Formula: $C_6H_{14}N_4O_2$
- Molecular Weight: 174.20
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 785

Available Package Sizes

100g	500g	1Kg

A106 - L-Ascorbic Acid

3-Oxo-L-gulofuranolactone; Vitamin C
Plant Tissue Culture Tested

- Powder
- CAS Number: 50-81-7
- Formula: $C_6H_8O_6$
- Molecular Weight: 176.13
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 837

Available Package Sizes

100g	500g	1Kg

A107 - L-Asparagine

(*S*)-2,4-Diamino-4-oxobutanoic Acid Monohydrate;
α-Aminosuccinamic Acid Monohydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 5794-13-8
- Formula: $C_4H_8N_2O_3 \cdot H_2O$
- Molecular Weight: 150.1
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 842

Available Package Sizes

25g	100g	500g	1Kg

A117 - L-Aspartic Acid, Free Acid

(*S*)-Aminobutanedioic Acid; Aminosuccinic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-84-8
- Formula: $C_4H_7NO_4$
- Molecular Weight: 133.1
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 845

Available Package Sizes

100g	500g	1Kg

©2014 PhytoTechnology Laboratories®

A147 - Auxindole™

3-Bromooxindole-3-acetic Acid
Plant Tissue Culture Tested

Auxindole™ is the trade name of 3-bromooxindole-3-acetic acid, which is instantaneously and quantitatively converted to

3-methyleneoxindole [(MO);(FW = 145)] in aqueous solutions.

MO polymerizes readily at concentrations ≥1 mM; stock solutions should be diluted as soon as possible.

MO is a potent sulfhydryl reagent that forms adducts with sulfhydryl (-SH) compounds and sulfur-containing nucleophiles; therefore, such compounds should not be used as solvents or buffer components. The use of dimethyl sulfoxide (DMSO) as a solvent is particularly discouraged.

MO is sensitive to pH extremes. The biological activity of MO is best demonstrated between pH 5.7 and 6.8.

For instructions on how to use this product, review the product information available on our website.

- Powder
- Formula: $C_{10}H_8BrNO_3$
- Molecular Weight: 269.9
- Soluble in EtOH
- Store at -20 to 0 °C

Available Package Sizes

10mg	100mg

B852 - Banana Powder

A mixture of natural banana puree and maltodextrin.
Plant Tissue Culture Tested

- Powder
- Suspension in Water
- Store at Room Temperature

Available Package Sizes

30g	100g	500g	1Kg

B151 - *N*6-Benzoyladenine

Plant Tissue Culture Tested

- Powder
- CAS Number: 4005-49-6
- Formula: $C_{12}H_9N_5O$
- Molecular Weight: 239.2
- Soluble in DMSO
- Store at 2 to 6 °C

Available Package Sizes

1g	25g

Making Stock Solutions of Plant Growth Regulators

See "Figure 16. Stock Solution Dilution Chart" on page 238 in the Technical Section.

B800 - 6-Benzylaminopurine

BA; *N*6-Benzyladenine
N-(phenylmethyl)-1*H*-purin-6-amine
Plant Tissue Culture Tested

- Powder
- CAS Number: 1214-39-7
- Formula: $C_{12}H_{11}N_5$
- Molecular Weight: 225.3
- Soluble in KOH
- Store at Room Temperature

Available Package Sizes

1g	5g	25g	100g

B130 - 6-Benzylaminopurine Solution (1 mg/mL)

BA; *N*6-Benzyladenine
N-(phenylmethyl)-1*H*-purin-6-amine
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 1214-39-7
- Formula: $C_{12}H_{11}N_5$
- Molecular Weight: 225.3
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL	500mL	1L

X884 - Blue-Gal

See Molecular Biology Section for Complete Listing

B140 - D-Biotin

Hexahydro-2-oxo-1*H*-thieno[3,4-d]imidazole-4-pentanoic Acid; Vitamin H; Coenzyme R
Plant Tissue Culture Tested

- Powder
- CAS Number: 58-85-5
- Formula: $C_{10}H_{16}N_2O_3S$
- Molecular Weight: 244.31
- Soluble in Warm Water or KOH
- Store at Room Temperature
- *Merck* **13**, 1231

Available Package Sizes

1g	5g

B210 - Boric Acid

Plant Tissue Culture Tested

- Powder
- CAS Number: 10043-35-3
- Formula: H_3BO_3
- Molecular Weight: 61.83
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1326



Available Package Sizes

500g 1Kg

B619 - Boric Acid, USP Grade

Plant Tissue Culture Tested

- Powder
- CAS Number: 10043-35-3
- Formula: H_3BO_3
- Molecular Weight: 61.83
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1326



Available Package Sizes

500g 1Kg

B202 - *N*-Benzyl-9-(2-tetrahydropyranyl) Adenine

BPA
Plant Tissue Culture Tested

- Powder
- CAS Number: 2312-73-4
- Formula: $C_{17}H_{19}N_5O$
- Molecular Weight: 309.4
- Soluble in EtOH
- Store at -20 to 0 °C

Available Package Sizes

1g 5g 25g

B131 - Bialaphos

See Molecular Biology Section for Complete Listing

B1730 - Bialaphos Solution (1mg/mL)

See Molecular Biology Section for Complete Listing

B162 - BIS-TRIS

See Molecular Biology Section for Complete Listing

B441 - Bradford Reagent

See Molecular Biology Section for Complete Listing

B1714 - Bromoyhymol Blue

See Seed Testing Section for Complete Listing

B148 - 4-Bromophenoxyacetic Acid

Plant Tissue Culture Tested

- Powder
- CAS Number: 1878-91-7
- Formula: $C_8H_7BrO_3$
- Molecular Weight: 231.05
- Soluble in KOH
- Store at Room Temperature

Available Package Sizes

25g

B155 - Bromoxynil

3,5-Dibromo-4-hydroxybenzonitrile

- Powder
- CAS Number: 1689-84-5
- Formula: $C_7H_3Br_2NO$
- Molecular Weight: 276.92
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 1426



Available Package Sizes

100mg 250mg

B235 - Buffer Solution, pH Reference Standard, pH 4.0 ± 0.02 at 25 °C

Color Coded Red

Used for pH meter calibration

- Liquid
- Store at Room Temperature



Available Package Sizes

500mL 4L

B236 - Buffer Solution, pH Reference Standard, pH 7.0 ± 0.02 at 25 °C

Color Coded Yellow

Used for pH meter calibration

- Liquid
- Store at Room Temperature



Available Package Sizes

500mL 4L

©2014 PhytoTechnology Laboratories®

B237 - Buffer Solution, pH Reference Standard, pH 10.0 ± 0.02 at 25 °C

Color Coded Blue

Used for pH meter calibration

- Liquid
- Store at Room Temperature



Available Package Sizes

500mL 4L

C135 - Calcium Chloride Dihydrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 10035-04-8
- Formula: $CaCl_2 \cdot 2H_2O$
- Molecular Weight: 147.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1660

Available Package Sizes

500g 1Kg 5Kg

C266 - Calcium Chloride Anhydrous

FCC Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 10043-52-4
- Formula: $CaCl_2$
- Molecular Weight: 110.98
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1660

Available Package Sizes

500g 1Kg 5Kg

C625 - Calcium Chloride Anhydrous

USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 10043-52-4
- Formula: $CaCl_2$
- Molecular Weight: 110.98
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1660

Available Package Sizes

500g 1Kg

C231 - Calcium Gluconate Monohydrate

D-Gluconic Acid Calcium Salt Monohydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 299-28-5
- Formula: $C_{12}H_{22}O_{14}Ca \cdot H_2O$
- Molecular Weight: 448.39
- Soluble in Hot Water
- Store at Room Temperature
- *Merck* **13**, 1671

Available Package Sizes

500g 1Kg

C180 - Calcium Nitrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 13477-34-4
- Formula: $Ca(NO_3)_2 \cdot 4H_2O$
- Molecular Weight: 236.15
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1687



Available Package Sizes

500g 1Kg 5Kg

C186 - Calcium Pantothenate

USP Grade
N-[(2*R*)-2,4-Dihydroxy-3,3-dimethyl-1-oxobutyl]-β-alanine, Calcium Salt; D-Pantothenic Acid, Calcium Salt; Vitamin B_5
Plant Tissue Culture Tested

- Powder
- CAS Number: 137-08-6
- Formula: $C_{18}H_{32}O_{10}N_2Ca$
- Molecular Weight: 476.54
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 7085

Available Package Sizes

100g 500g 1Kg

C274 - Calcium Phosphate, Tribasic

Calcium Hydroxyphosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 12167-74-7
- Formula: $Ca_5(OH)(PO_4)_3$
- Molecular Weight: 502.31
- Soluble in HCl
- Store at Room Temperature

Available Package Sizes

100g 500g

C134 - Calcium Silicate

Calcium Metacilicate; Calcium Silicon oxide
Plant Tissue Culture Tested

- Powder
- CAS Number: 1344-95-2
- Formula: $CaSiO_3$
- Molecular Weight: 116.16
- Suspension in Water
- Store at Room Temperature
- *Merck* **13**, 1707

Available Package Sizes

25g 1Kg

New Product

C1933 - Calcofluor White M2R

Calcofluor White ST; Fluorescent Brightner 28 disodium salt
Calcofluor is a fluorescent stain used to indicate cell wall biosynthesis in both plant and fungal species. It can also be used as a viability stain.

- Powder
- CAS Number: 4193-55-9
- Formula: $C_{40}H_{42}N_{12}O_{10}S_2Na_2$
- Molecular Weight: 960.95
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1g 5g 25g

C346 - Carbenicillin, Disodium Salt

See Molecular Biology Section for Complete Listing

C540 - Carbenicillin Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

C2046 - Carbenicillin Solution (250 mg/mL)

See Molecular Biology Section for Complete Listing

C257 - Carrageenan

Gelcarin GP 812®; Irish Moss; Kappa-Type Carrageenan
Plant Tissue Culture Tested
Gelcarin GP 812® is a registered trademark of FMC BioPolymer.

- Powder
- CAS Number: 9000-07-1
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 1878

Available Package Sizes

250g 1Kg 5Kg 25Kg

New Product

C2000 - Carrageenan, High Clarity

Irish Moss; Kappa-Type Carrageenan
Plant Tissue Culture Tested

- Powder
- CAS Number: 9000-07-1
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 1878

Available Package Sizes

10g 100g 500g 1Kg 5Kg 10Kg

C184 - Casein, Enzymatic Hydrolysate

Plant Tissue Culture Tested

- Powder
- CAS Number: 9000-71-9
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

C380 - Cefotaxime, Sodium Salt

See Molecular Biology Section for Complete Listing

C537 - Cefotaxime Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

C1880 - Cefotaxime Solution (250 mg/mL)

See Molecular Biology Section for Complete Listing

C1842 - Cellobiose

See Seed Testing Section for Complete Listing

C224 - Cellulase, Onozuka R-10

Derived from *Trichoderma viride*

- Powder
- CAS Number: 9012-54-8
- Soluble in Water
- Store at 2 to 6 °C



Available Package Sizes

1g 10g

C214 - Cellulase, Onozuka RS

Derived from *Trichoderma viride*

- Powder
- CAS Number: 9012-54-8
- Soluble in Water
- Store at 2 to 6 °C



Available Package Sizes

1g 10g

C1970 - Cephalexin

See Seed Testing Section for Complete Listing

©2014 PhytoTechnology Laboratories®

C2112 - Cephalexin Solution (100mg/mL)

See Seed Testing Section for Complete Listing

Undefined Organic Supplements Used in Plant Tissue Culture

See "Figure 15. List of Common Undefined Organic Supplements & *Phyto*Tech™ Product Numbers" on page 236 in the Technical Section.

C325 - Charcoal, Activated

Carbon Black; Activated Carbon; Acid Washed
Plant Tissue Culture Tested



- Powder
- CAS Number: 7440-44-0
- Formula: C
- Molecular Weight: 12.01
- Suspension in Water
- Store at Room Temperature
- *Merck* **13**, 1818

Available Package Sizes

1Kg

C526 - CHAPS

See Molecular Biology Section for Complete Listing

C207 - Chlormequat Chloride

CCC; Chlorocholine Chloride;
[2-Chloroethyl]trimethylammonium Chloride
Plant Tissue Culture Tested



- Powder
- CAS Number: 999-81-5
- Formula: $C_5H_{13}Cl_2N$
- Molecular Weight: 158.07
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2120

Available Package Sizes

100mg 1g

C213 - p-Chlorophenoxyacetic Acid

CPA; 4-Chlorophenoxyacetic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 122-88-3
- Formula: $C_8H_7ClO_3$
- Molecular Weight: 186.59
- Soluble in KOH
- Store at Room Temperature

Available Package Sizes

25g 100g

V883 - Cholecalciferol

(3β,5*Z*,7*E*)-9,10-Secocholesta-5,7,10(19)-trien-3-ol; Vitamin D_3
Plant Tissue Culture Tested



- Powder
- CAS Number: 67-97-0
- Formula: $C_{27}H_{44}O$
- Molecular Weight: 384.65
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 10079

Available Package Sizes

1g

C232 - Choline Chloride

2-Hydroxy-*N,N,N*-trimethylethanaminium Chloride;
Vitamin B_4
Plant Tissue Culture Tested

- Powder
- CAS Number: 67-48-1
- Formula: $C_5H_{14}ClNO$
- Molecular Weight: 139.63
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2226

Available Package Sizes

100g 500g

C283 - *trans*-Cinnamic Acid

(*E*)-3-Phenyl-2-propenoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 140-10-3
- Formula: $C_9H_8O_2$
- Molecular Weight: 148.16
- Soluble in KOH
- Store at Room Temperature
- *Merck* **13**, 2321

Available Package Sizes

25g

C277 - Citric Acid Anhydrous

2-Hydroxy-1,2,3-propanetricarboxylic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 77-92-9
- Formula: $C_6H_8O_7$
- Molecular Weight: 192.14
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2350

Available Package Sizes

25g 500g 1Kg

C350 - Cobalt Chloride Hexahydrate

Cobalt(II) Chloride Hexahydrate; Cobaltous Chloride Hexahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7791-13-1
- Formula: $CoCl_2 \cdot 6H_2O$
- Molecular Weight: 237.84
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2462



Available Package Sizes

25g 100g

C193 - Cobalt Nitrate Hexahydrate

Cobalt(II) Nitrate Hexahydrate; Cobaltous Nitrate Hexahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10026-22-9
- Formula: $Co(NO_3)_2 \cdot 6H_2O$
- Molecular Weight: 291.04
- Soluble in Water
- Tariff Code: 2834.29.6050
- Store at Room Temperature
- *Merck* **13**, 2469



Available Package Sizes

25g 100g

Undefined Organic Supplements Chart

See "Figure 15. List of Common Undefined Organic Supplements & *Phyto*Tech™ Product Numbers" on page 236 in the Technical Section.

C187 - Coconut Powder

A mixture of natural coconut puree and maltodextrin.
Plant Tissue Culture Tested

- Powder
- Suspension in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

C195 - Coconut Water

Natural
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL 500mL 1L

C226 - Colchicine

N-[(7*S*)-5,6,7,9-Tetrahydro-1,2,3,10-tetramethoxy-9-oxobenzo[*a*]heptalen-7-yl]acetamide
Plant Tissue Culture Tested

Antimitotic commonly used for doubling chromosomes.

- Powder
- CAS Number: 64-86-8
- Formula: $C_{22}H_{25}NO_6$
- Molecular Weight: 399.44
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2496



Available Package Sizes

500mg 1g 25g

C466 - Copper(II) Sulfate Solution (4%)

See Molecular Biology Section for Complete Listing

C279 - 4-CPPU

N-(2-Chloro-4-pyridyl)-*N*-phenylurea
Plant Tissue Culture Tested

- Powder
- CAS Number: 68157-60-8
- Formula: $C_{12}H_{10}ClN_3O$
- Molecular Weight: 247.7
- Soluble in DMSO
- Store at -20 to 0 °C

Available Package Sizes

100mg 1g

C375 - Cupric Sulfate

ACS Grade
Copper(II) Sulfate Pentahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7758-99-8
- Formula: $CuSO_4 \cdot 5H_2O$
- Molecular Weight: 249.68
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2682

Available Package Sizes

250g 500g

©2014 PhytoTechnology Laboratories®

C628 - Cupric Sulfate Pentahydrate, USP Grade

Copper(II) Sulfate Pentahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7758-99-8
- Formula: $CuSO_4 \cdot 5H_2O$
- Molecular Weight: 249.68
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2682

Available Package Sizes

100g	500g	1Kg

C1830 - Crystal Violet

See Seed Testing Section for Complete Listing

H276 - CTAB

See Molecular Biology Section for Complete Listing

H3818 - CTAB Solution (100mg/mL)

See Molecular Biology Section for Complete Listing

C242 - Cyanocobalamin

USP Grade
5,6-Dimethylbenzimidazolyl Cyanocobalamide; Vitamin B_{12}
Plant Tissue Culture Tested

- Powder
- CAS Number: 68-19-9
- Formula: $C_{63}H_{88}CoN_{14}O_{14}P$
- Molecular Weight: 1355.36
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 10074

Available Package Sizes

500mg	1g	5g

C204 - L-Cysteine, Free Base

(*R*)-2-Amino-3-mercaptopropanoic Acid
Plant Tissue Culture Tested

Cysteine is readily oxidized to Cystine in neutral to slightly alkaline solutions or upon exposure to air in as little as 1 week at 2 to 6 °C. Cystine may precipitate at higher concentrations and a sulfur odor may be present. For short to long-term storage, Cysteine stocks are more stable in acidic conditions and should be stored at 2 to 6 °C.

- Powder
- CAS Number: 52-90-4
- Formula: $C_3H_7NO_2S$
- Molecular Weight: 121.16
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2810

Available Package Sizes

100g	500g	1Kg

C248 - L-Cystine, Free Base

[*R*-(*R**,*R**)]-3,3'-Dithiobis[2-aminopropanoic Acid]
Plant Tissue Culture Tested

Cystine is readily soluble in aqueous solutions with pH above 8 or below 2. It may precipitate out of neutral solutions at higher concentrations. Stocks are more stable in the acidic or alkaline conditions and should be stored at 2 to 6 °C.

- Powder
- CAS Number: 56-89-3
- Formula: $C_6H_{12}N_2O_4S_2$
- Molecular Weight: 240.3
- Soluble in KOH or HCl; Slightly Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2811

Available Package Sizes

25g	100g

New Product

D2362 - DAPI

DAPI dihydrochloride; 4',6-diamidino-2-phenylindole; 6-diamidine-2-phenylindole dihydrochloride.
An indole fluorescent dye used to stain cell nuclei.

- Powder
- CAS Number: 28718-90-3
- Formula: $C_{16}H_{17}Cl_2N_5$
- Molecular Weight: 350.25
- Soluble in Water, DMF
- Store at 2 to 6 °C

Available Package Sizes

10mg	25mg

D308 - Dextran Sulfate, Sodium Salt

- Powder
- CAS Number: 9011-18-1
- Molecular Weight: 500,000 Avg.
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2969

Available Package Sizes

25g	100g	500g

D159 - Dicamba

3,6-Dichloro-*o*-anisic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 1918-00-9
- Formula: $C_8H_6Cl_2O_3$
- Molecular Weight: 221.04
- Soluble in KOH
- Store at 2 to 6 °C
- *Merck* **13**, 3065

Available Package Sizes

100mg	500mg	1g

D165 - Dicamba Solution (1 mg/mL)

3,6-Dichloro-*o*-anisic Acid
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 1918-00-9
- Formula: $C_8H_6Cl_2O_3$
- Molecular Weight: 221.04
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL 25mL

D253 - Dichloroisocyanuric Acid, Sodium Salt

NaDCC
Plant Tissue Culture Tested
A disinfectant commonly used to surface-sterilize plant tissue.

- Powder
- CAS Number: 2893-78-9
- Formula: $C_3Cl_2N_3O_3Na$
- Molecular Weight: 219.9
- Soluble in Water
- Store at Room Temperature



Available Package Sizes

100g 500g 1Kg

D295 - 2,4-Dichlorophenoxyacetic Acid Solution (1 mg/mL)

2,4-D
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 94-75-7
- Formula: $C_8H_6Cl_2O_3$
- Molecular Weight: 221.04
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL 500mL 1L

D309 - 2,4-Dichlorophenoxyacetic Acid Solution (10 mg/mL)

2,4-D
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 94-75-7
- Formula: $C_8H_6Cl_2O_3$
- Molecular Weight: 221.04
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL 500mL 1L

D297 - Dikegulac

2,3:4,6-Bis-*O*-(methylethylidene)-α-L-*xylo*-2-hexulofuranosonic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 18467-77-1
- Formula: $C_{12}H_{18}O_7$
- Molecular Weight: 274.27
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 3222

Available Package Sizes

1g

D525 - 6-(γ,γ-Dimethylallylamino)purine

2iP; *N*6-[2-Isopentyl]adenine
Plant Tissue Culture Tested

- Powder
- CAS Number: 2365-40-4
- Formula: $C_{10}H_{13}N_5$
- Molecular Weight: 203.3
- Soluble in KOH
- Store at -20 to 0 °C

Available Package Sizes

100mg 500mg 1g 5g 10g 25g

D341 - 6-(γ,γ-Dimethylallylamino)purine Dihydrochloride

2iP-2HCl; *N*6-[2-Isopentyl]adenine Dihydrochloride
Plant Tissue Culture Tested

- Powder
- Formula: $C_{10}H_{13}N_5 \cdot 2HCl$
- Molecular Weight: 276.2
- Soluble in Water
- Store at -20 to 0 °C

Available Package Sizes

1g 10g

©2014 PhytoTechnology Laboratories®

D217 - 6-(γ,γ-Dimethylallylamino)purine Solution (1 mg/mL)

2iP; *N*6-[2-Isopentyl]adenine
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 2365-40-4
- Formula: $C_{10}H_{13}N_5$
- Molecular Weight: 203.3
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

100mL

D259 - Dithiothreitol

1,4-Dithiothreitol; DTT; Cleland's Reagent

- Powder
- CAS Number: 3483-12-3
- Formula: $C_4H_{10}O_2S_2$
- Molecular Weight: 154.2
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 3412

Available Package Sizes

1g 5g 25g

D548 - DNA Denaturing Solution

See Molecular Biology Section for Complete Listing

D544 - DNA Neutralizing Solution, pH 7.4

See Molecular Biology Section for Complete Listing

E244 - 2,4-Epibrassinolide

(22*R/S*, 23*R/S*, 24*R*)-2α,3α,22,23-Tetrahydroxy-*B*-homo-7-oxa-5α-ergostan-6-one
Plant Tissue Culture Tested

- Powder
- CAS Number: 78821-43-9
- Formula: $C_{28}H_{48}O_6$
- Molecular Weight: 480.68
- Slightly soluble in Water, DMSO
- Store at -20 to 0 °C

Available Package Sizes

10mg 100mg

E410 - Ethylenediaminetetraacetic Acid, Disodium Salt

Na_2-EDTA Dihydrate; Disodium Edetate Dihydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 6381-92-6
- Formula: $C_{10}H_{14}N_2O_8Na_2 \cdot 2H_2O$
- Molecular Weight: 372.24
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 3543

Available Package Sizes

100g 500g 1Kg

E349 - Ethylenediamine Bis(2-hydroxyphenylacetic Acid), Ferric-Sodium Salt

FeNa-EDDHA; Ethylenediamine Bis(2-hydroxyphenylacetic Acid), Iron(III)-Sodium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 16455-61-1
- Formula: $C_{18}H_{16}O_6N_2NaFe$
- Molecular Weight: 434.8
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

E676 - Ethylenediaminetetraacetic Acid, Ferric-Sodium Salt

FeNa-EDTA; Ethylenediaminetetraacetic Acid; Iron(III)-Sodium Salt; Ferric Sodium Edetate
Plant Tissue Culture Tested

- Powder
- CAS Number: 15708-41-5
- Formula: $C_{10}H_{12}N_2O_8NaFe$
- Molecular Weight: 367.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4062

Available Package Sizes

500g 1Kg 5Kg

E316 - Ethylenediaminetetraacetic Acid, Free Acid

See Molecular Biology Section for Complete Listing

E582 - EDTA Solution 0.5 M, pH 8.0

See Molecular Biology Section for Complete Listing

New Product

E2799 - Evans Blue

Direct Blue 53
An azo dye commonly used in viability testing; living cells reject the dye, while dead cells stain blue.

- Powder
- CAS Number: 314-13-6
- Formula: $C_{34}H_{24}N_6Na_4O_{14}S_4$
- Molecular Weight: 960.81
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

10g 50g 100g

F3178 - Fast Green (FCF) Stain

See Seed Testing Section for Complete Listing

Micronutrient Sources Chart

See "Figure 10. List of Micronutrient Sources & *Phyto*Tech™ Product Numbers" on page 233 in the Technical Section.

F374 - Ferric Ammonium Citrate

Ammonium Iron(III) Citrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 1185-57-5
- Formula: $C_6H_8O_7Fe_x(NH_3)_x$
- Molecular Weight: Varies
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 518

Available Package Sizes

100g 500g

F3138 - Ferric Ammonium Sulfate

See Phycology Section for Complete Listing

F2876 - Ferric Chloride, Anhydrous

See Phycology Section for Complete Listing

F383 - Ferric Chloride, Hexahydrate

Iron(III) Chloride Hexahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10025-77-1
- Formula: $FeCl_3 \cdot 6H_2O$
- Molecular Weight: 270.32
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4048

Available Package Sizes

100g 500g

F352 - Ferric Citrate

Iron(III) Citrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 3552-50-7
- Formula: $C_6H_5O_7Fe_x$
- Molecular Weight: 244.95
- Soluble in Boiling Water
- Store at Room Temperature

Available Package Sizes

250g

F318 - Ferrous Sulfate/Chelate Solution (100x)

Iron(II) Sulfate/EDTA Chelated Solution
Sterile Filtered
Plant Tissue Culture Tested
Use 10.0mL per liter for an equivalent Iron molar concentration to MS Basal Salts.

- Liquid
- CAS Number: 7782-63-0/ 6381-92-6
- Formula: $FeSO_4 \cdot 7H_2O$/ $C_{10}H_{14}N_2O_8Na_2 \cdot 2H_2O$
- Molecular Weight: 278.02/ 372.24
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL 500mL 1L

F388 - Ferric Sulfate Hydrate

Iron(III) Sulfate Hydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10028-22-5
- Formula: $Fe_2(SO_4)_3 \cdot xH_2O$
- Molecular Weight: 399.89+x(18.01)
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4065

Available Package Sizes

250g

F263 - Ferrous Sulfate Heptahydrate

Iron(II) Sulfate Heptahydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7782-63-0
- Formula: $FeSO_4 \cdot 7H_2O$
- Molecular Weight: 278.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4091

Available Package Sizes

100g 500g 1Kg

©2014 PhytoTechnology Laboratories®

F629 - Ferrous Sulfate Heptahydrate

Iron(II) Sulfate Heptahydrate
USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 7782-63-0
- Formula: $FeSO_4 \cdot 7H_2O$
- Molecular Weight: 278.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4091

Available Package Sizes

100g	500g

Stains & Dyes Usage Table

See "Figure 34. Stains & Dyes Usage Table" on page 259 in the Technical Section.

New Product

F2950 - Fluorescein Diacetate (FDA)

3,6-Diacetoxyfluoran, Di-O-acetylfluorescein
Fluorescein is used in seed and cell viability testing, fluorescing green in the presence of viable tissues.

- Powder
- CAS Number: 596-09-8
- Formula: $C_{24}H_{16}O_7$
- Molecular Weight: 416.38
- Soluble in DMSO, Ethanol, or Acetone
- Store at -20 to 0 °C

Available Package Sizes

5g	10g	25g

F357 - Fluridone

1-Methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1*H*)-pyridinone
Plant Tissue Culture Tested

- Powder
- CAS Number: 59756-60-4
- Formula: $C_{19}H_{14}F_3NO$
- Molecular Weight: 329.32
- Soluble in DMSO
- Store at 2 to 6 °C

Available Package Sizes

100mg

F376 - Flurprimidol

α-(1-Methylethyl)-α-[4-(trifluoromethoxy)phenyl]-5-pyrimidinemethanol
Plant Tissue Culture Tested



- Powder
- CAS Number: 56425-91-3
- Formula: $C_{15}H_{15}F_3N_2O_2$
- Molecular Weight: 312.29
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 4230

Available Package Sizes

10mg	100mg

F430 - Folic Acid

N-[4-[[(2-Amino-1,4-dihydro-4-oxo-6-pteridinyl)methyl]amino]benzoyl]-L-glutamic Acid; Vitamin M
Plant Tissue Culture Tested

- Powder
- CAS Number: 59-30-3
- Formula: $C_{19}H_{19}N_7O_6$
- Molecular Weight: 441.45
- Soluble in KOH; Slightly Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4247

Available Package Sizes

5g	25g

F563 - D-(-)-Fructose

USP/FCC Grade
Fruit Sugar, D-Levulose
Plant Tissue Culture Tested

- Powder
- CAS Number: 57-48-7
- Formula: $C_6H_{12}O_6$
- Molecular Weight: 180.16
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4295

Available Package Sizes

500g	1Kg	5Kg

F356 - Fumaric Acid, Free Acid

(*E*)-2-Butenedioic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 110-17-8
- Formula: $C_4H_4O_4$
- Molecular Weight: 116.07
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4308

Available Package Sizes

100g	500g

G810 - G418 Sulfate

See Molecular Biology Section for Complete Listing

Gelling Agents Usage Chart

See "Figure 19. Usage Guide for Gelling Agents" on page 242 in the Technical Section.

G434 - Gellan Gum Powder

CultureGel™ Type I – Biotech Grade
Transparency: minimum 80%
Gel Strength: minimum 800 g/cm^2
Plant Tissue Culture Tested

See also G3251, Gelzan™

- Powder
- CAS Number: 71010-52-1
- Soluble in Boiling Water
- Store at Room Temperature
- *Merck* **13**, 4394

Available Package Sizes

2g 100g 500g 1Kg 5Kg

New Product

G3251 - Gelzan™

A Gellan Gum Powder derived from bacterial fermentation by *Sphingomonas elodea*.
Transparency: Minimum 80%
Gel Strength: 400 to 700 g/cm^2
Plant Tissue Culture Tested
Gelzan™ is a trademark of CP Kelco®.

- Powder
- CAS Number: 71010-52-1
- Soluble in Boiling Water
- Store at Room Temperature

Available Package Sizes

2g 100g 500g 1Kg 5Kg

G500 - Gibberellic Acid

GA_3; Gibberellin A_3
Plant Tissue Culture Tested

- Powder
- CAS Number: 77-06-5
- Formula: $C_{19}H_{22}O_6$
- Molecular Weight: 346.41
- Soluble in KOH and Ethanol
- Store at 2 to 6 °C
- *Merck* **13**, 4430

Available Package Sizes

1g 5g

G198 - Gibberellic Acid Solution (1 mg/mL)

GA_3; Gibberellin A_3
Plant Tissue Culture Tested

- Liquid
- CAS Number: 77-06-5
- Formula: $C_{19}H_{22}O_6$
- Molecular Weight: 346.41
- Miscible with Water
- Store at 2 to 6 °C



Available Package Sizes

100mL

G362 - Gibberellic Acid Solution (13 mg/mL) (13,000 ppm)

GA_3; Gibberellin A_3
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 77-06-5
- Formula: $C_{19}H_{22}O_6$
- Molecular Weight: 346.41
- Miscible with Water
- Store at 2 to 6 °C
- *Merck* **13**, 4430



Available Package Sizes

15mL 100mL

G358 - Gibberellins A_4 + A_7

Plant Tissue Culture Tested

- Powder
- Soluble in KOH
- Store at 2 to 6 °C
- *Merck* **13**, 4431

Available Package Sizes

1g

Carbohydrate Selection Guide

See "Figure 12. Choosing a Carbohydrate" on page 234 in the Technical Section.

G386 - D-(+)-Glucose Anhydrous

Dextrose; Corn Sugar
USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 50-99-7
- Formula: $C_6H_{12}O_6$
- Molecular Weight: 180.16
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4472

Available Package Sizes

500g 1Kg 5Kg 25Kg

©2014 PhytoTechnology Laboratories®

G360 - D-(+)-Glucose Monohydrate

Dextrose Monohydrate; Corn Sugar
Plant Tissue Culture Tested

- Powder
- CAS Number: 77938-63-7
- Formula: $C_6H_{12}O_6 \cdot H_2O$
- Molecular Weight: 198.2
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1Kg	5Kg	25Kg

G399 - L-Glutamic Acid

(*S*)-2-Aminopentanedioic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-86-0
- Formula: $C_5H_9NO_4$
- Molecular Weight: 147.13
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4482

Available Package Sizes

100g	1Kg

G229 - L-Glutamine

(*S*)-2,5-Diamino-5-oxopentanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-85-9
- Formula: $C_5H_{10}N_2O_3$
- Molecular Weight: 146.14
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4484

Available Package Sizes

100g	500g	1Kg	5Kg

New Product

G3399 - Glutathione (Reduced), Free Acid

γ-L-Glutamyl-L-cysteinyl-glycine
Plant Tissue Culture Tested

- Powder
- CAS Number: 70-80-8
- Formula: $C_{10}H_{17}N_3O_6S$
- Molecular Weight: 307.33
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1g	10g

G381 - Glycerol

Glycerin; 1,2,3-Propanetriol
Plant Tissue Culture Tested



- Liquid
- CAS Number: 56-81-5
- Formula: $C_3H_8O_3$
- Molecular Weight: 92.09
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 4497

Available Package Sizes

100mL	500mL	1L

Amino Acids Used in Plant Tissue Culture

See "Figure 14. List of Amino Acids by Type & *Phyto*Tech™ Product Numbers" on page 236 in the Technical Section.

G503 - Glycine

Aminoacetic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-40-6
- Formula: $C_2H_5NO_2$
- Molecular Weight: 75.08
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 4504

Available Package Sizes

100g	500g	1Kg

G345 - Glyphosate

N-(Phosphonomethyl)glycine
Plant Tissue Culture Tested



- Powder
- CAS Number: 1071-83-6
- Formula: $C_3H_8NO_5P$
- Molecular Weight: 169.07
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 4525

Available Package Sizes

1g	5g

G3574 - Guaiacol

See Seed Testing Section for Complete Listing

G3300 - Guanidine Thiocyanate

See Molecular Biology Section for Complete Listing

H326 - HEPES, Free Acid

See Molecular Biology Section for Complete Listing

H397 - Hygromycin B

See Molecular Biology Section for Complete Listing

H370 - Hygromycin B Solution, 50 mg/mL in PBS Buffer

See Molecular Biology Section for Complete Listing

H385 - Hygromycin B Solution, 100 mg/mL in Distilled Water

See Molecular Biology Section for Complete Listing

I4068 - Indigo Carmine

See Seed Testing Section for Complete Listing

I885 - Indole-3-Acetic Acid

IAA; Heteroauxin
Plant Tissue Culture Tested

- Powder
- CAS Number: 87-51-4
- Formula: $C_{10}H_9NO_2$
- Molecular Weight: 175.19
- Soluble in KOH
- Store at -20 to 0 °C
- *Merck* **13**, 4986

Available Package Sizes

5g 25g 100g

I364 - Indole-3-Acetic Acid Solution (1 mg/mL)

IAA; Heteroauxin
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 87-51-4
- Formula: $C_{10}H_9NO_2$
- Molecular Weight: 175.19
- Miscible with Water
- Store at -20 to 0 °C
- *Merck* **13**, 4986



Available Package Sizes

100mL

I538 - Indole-3-Butyric Acid

IBA; 4-[3-Indolyl]butyric Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 133-32-4
- Formula: $C_{12}H_{13}NO_2$
- Molecular Weight: 203.24
- Soluble in KOH
- Store at 2 to 6 °C
- *Merck* **13**, 4987



Available Package Sizes

5g 25g 100g

Plant Growth Regulators Usage and Storage Chart

See "Figure 18. Plant Growth Regulators Usage and Storage Chart" on page 240 in the Technical Section.

I560 - Indole-3-Butyric Acid, Potassium Salt

K-IBA; 4-[3-Indolyl]butyric Acid, Potassium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 60096-23-3
- Formula: $C_{12}H_{12}NO_2K$
- Molecular Weight: 241.3
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

5g 25g 100g

I460 - Indole-3-Butyric Acid Solution (1 mg/mL)

IBA; 4-[3-Indolyl]butyric Acid
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 133-32-4
- Formula: $C_{12}H_{13}NO_2$
- Molecular Weight: 203.24
- Miscible with Water
- Store at -20 to 0 °C
- *Merck* **13**, 4987



Available Package Sizes

100mL

I409 - Indole-3-Propionic Acid

IPA
Plant Tissue Culture Tested

- Powder
- CAS Number: 830-96-6
- Formula: $C_{11}H_{11}NO_2$
- Molecular Weight: 189.2
- Soluble in KOH
- Store at 2 to 6 °C

Available Package Sizes

5g

©2014 PhytoTechnology Laboratories®

I703 - myo-Inositol

i-Inositol; *meso*-Inositol;
1,2,3,5/4,6-Hexahydroxycyclohexane
Plant Tissue Culture Tested

- Powder
- CAS Number: 87-89-8
- Formula: $C_6H_{12}O_6$
- Molecular Weight: 180.16
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5001

Available Package Sizes

100g	500g	1Kg	5Kg

I331 - Iron Chelate

Sequestrene® 330;
Sodium ferric diethylenetriaminepentaacetate; NaFe - DTPA
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g	500g

I373 - Isopropyl-β-D-thiogalactopyranoside

See Molecular Biology Section for Complete Listing

K378 - Kanamycin Monosulfate

See Molecular Biology Section for Complete Listing

K586 - Kanamycin Monosulfate Solution (50 mg/mL)

See Molecular Biology Section for Complete Listing

K4751 - Kanamycin Monosulfate Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

K559 - Kasugamycin Hydrochloride Monohydrate

See Molecular Biology Section for Complete Listing

K424 - Keiki Paste

Contains Lanolin, *trans*-Cinnamic Acid, *myo*-Inositol, 6-Benzylaminopurine, Thiamine HCl, and Adenine Hemisulfate

- Paste
- Store at Room Temperature

Available Package Sizes

50mL

K750 - Kinetin

6-Furfurylaminopurine
Plant Tissue Culture Tested

- Powder
- CAS Number: 525-79-1
- Formula: $C_{10}H_9N_5O$
- Molecular Weight: 215.2
- Soluble in KOH
- Store at -20 to 0 °C
- *Merck* **13**, 5329

Available Package Sizes

1g	5g	25g

K483 - Kinetin Solution (1 mg/mL)

6-Furfurylaminopurine
Sterile Filtered
Plant Tissue Culture Tested



- Liquid
- CAS Number: 525-79-1
- Formula: $C_{10}H_9N_5O$
- Molecular Weight: 215.2
- Miscible with Water
- Store at -20 to 0 °C
- *Merck* **13**, 5329

Available Package Sizes

100mL	500mL

L451 - Lanolin

Wool Fat; Lanolin Wax

- Waxy Solid
- CAS Number: 8006-54-0
- Soluble in Hot Alcohol, Chloroform and Ether
- Store at Room Temperature
- *Merck* **13**, 5001

Available Package Sizes

454g

L574 - L-Leucine

(*S*)-2-Amino-4-methylpentanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 61-90-5
- Formula: $C_6H_{13}NO_2$
- Molecular Weight: 131.2
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5470

Available Package Sizes

100g	500g

L594 - L-Lysine Monohydrochloride

(*S*)-2,6-Diaminohexanoic Acid Monohydrochloride
Plant Tissue Culture Tested

- Powder
- CAS Number: 657-27-2
- Formula: $C_6H_{14}O_2N_2 \cdot HCl$
- Molecular Weight: 182.65
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5656

Available Package Sizes

100g 500g 1Kg

M481 - Macerozyme R-10

A mixture of pectinase, cellulase, and hemicellulase.
Derived from *Rhizopus sp.*

- Powder
- CAS Number: 9032-75-1
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1g 10g

M521 - Magnesium Chloride Hexahydrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 7791-18-6
- Formula: $MgCl_2 \cdot 6H_2O$
- Molecular Weight: 203.3
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5684

Available Package Sizes

100g 500g 1Kg

M542 - Magnesium Nitrate Hexahydrate

Nitromagnesite
Plant Tissue Culture Tested



- Powder
- CAS Number: 13446-18-9
- Formula: $Mg(NO_3)_2 \cdot 6H_2O$
- Molecular Weight: 256.41
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5697

Available Package Sizes

500g 1Kg 5Kg

M200 - Magnesium Sulfate Heptahydrate

Epsom Salts
Plant Tissue Culture Tested

- Powder
- CAS Number: 10034-99-8
- Formula: $MgSO_4 \cdot 7H_2O$
- Molecular Weight: 246.48
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5715

Available Package Sizes

500g 1Kg 5Kg 10Kg

M150 - Magnesium Sulfate Anhydrous

Plant Tissue Culture Tested

- Powder
- CAS Number: 7487-88-9
- Formula: $MgSO_4$
- Molecular Weight: 120.37
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5715

Available Package Sizes

500g 1Kg

M635 - Magnesium Sulfate Anhydrous

USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 7487-88-9
- Formula: $MgSO_4$
- Molecular Weight: 120.37
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5715

Available Package Sizes

1Kg

M573 - Malachite Green Oxalate

Basic Green; Aniline Green



- Powder
- CAS Number: 2437-29-8
- $C_{23}H_{25}N_2 \cdot C_2HO_4 \cdot 0.5C_2H_2O_4$
- Molecular Weight: 463.5
- Soluble in Water and Ethanol
- Store at Room Temperature
- *Merck* **13**, 5722

Available Package Sizes

25g 100g

©2014 PhytoTechnology Laboratories®

M471 - L-Maleic Acid

cis-Butenedioic Acid; *cis*-1,2-Ethylenedicarboxylic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 110-16-7
- Formula: $C_4H_4O_4$
- Molecular Weight: 116.07
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5726



Available Package Sizes

100g 500g

M494 - Maleic Acid Hydrazide

Maleic Hydrazide; 1,2-Dihydro-3,6-pyridazinedione
Plant Tissue Culture Tested

- Powder
- CAS Number: 123-33-1
- Formula: $C_4H_4N_2O_2$
- Molecular Weight: 112.10
- Soluble in Hot Water and DMSO
- Store at Room Temperature
- *Merck* **13**, 5728

Available Package Sizes

25g 100g

New Product

M5536 - DL-Malic Acid

DL-Hydroxybutanedioic acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 6915-15-7
- Formula: $C_4H_6O_5$
- Molecular Weight: 134.09
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5730

Available Package Sizes

500g 1Kg 5Kg

M474 - Malt Extract

Co-extract of Corn and Malted Barley
Plant Tissue Culture Tested

- Powder
- CAS Number: 8002-48-0
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

M588 - D-Maltose Monohydrate

4-*O*-α-D-Glucopyranosyl-D-glucose
Plant Tissue Culture Tested

- Powder
- CAS Number: 6363-53-7
- Formula: $C_{12}H_{22}O_{11}•H_2O$
- Molecular Weight: 360.32
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5736

Available Package Sizes

100g 500g 1Kg 5Kg 10Kg 25Kg

M455 - Manganese Chloride Tetrahydrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 13446-34-9
- Formula: $MnCl_2•4H_2O$
- Molecular Weight: 197.91
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5751

Available Package Sizes

100g

M250 - Manganese Sulfate Monohydrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 10034-96-5
- Formula: $MnSO_4•H_2O$
- Molecular Weight: 169.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5763



Available Package Sizes

100g 500g

M637 - Manganese Sulfate Monohydrate

USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 10034-96-5
- Formula: $MnSO_4•H_2O$
- Molecular Weight: 169.02
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5763



Available Package Sizes

100g 500g

M562 - D-Mannitol

USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 69-65-8
- Formula: $C_6H_{14}O_6$
- Molecular Weight: 182.2
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5769

Available Package Sizes

500g 1Kg 5Kg

M486 - D-(+)-Mannose

Plant Tissue Culture Tested

- Powder
- CAS Number: 3458-28-4
- Formula: $C_6H_{12}O_6$
- Molecular Weight: 180.16
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5772

Available Package Sizes

25g 250g

M567 - Meat Extract

Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

New Product

M5856 - Media Coloration Sampler

Media Coloration Sampler comes with four 1 gram package sizes of red (Product Number F323), green (Product Number F320), blue (Product Number F322), and yellow (Product Number F321) media dyes.
Plant Tissue Culture Tested

Recommended 0.01 to 0.1g per liter.

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

4x1g Kit

F322 - Media Dye, Blue

Brilliant Blue FCF; FD&C Blue #1
Plant Tissue Culture Tested

Recommended 100 mg to 250 mg per liter.
For our media coloration sampler containing four different media dyes, see product M5856.

- Powder
- CAS Number: 3844-45-9
- Formula: $C_{37}H_{34}N_2Na_2O_9S_3$
- Molecular Weight: 792.86
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 1359

Available Package Sizes

1g 10g 100g

F320 - Media Dye, Green

Pyla-Cert Green MX-415
A mixture of FD&C Green #3 and FD&C Yellow #5
Plant Tissue Culture Tested

Recommended 100 mg to 250 mg per liter.
For our media coloration sampler containing four different media dyes, see product M5856.

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1g 10g 100g

F323 - Media Dye, Red

Erythrosine; FD&C Red #3
Plant Tissue Culture Tested

Recommended 100 mg to 250 mg per liter.
For our media coloration sampler containing four different media dyes, see product M5856.

- Powder
- CAS Number: 16423-68-0
- Formula: $C_{20}H_6I_4Na_2O_5$
- Molecular Weight: 879.86
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 3727

Available Package Sizes

1g 10g 100g

©2014 PhytoTechnology Laboratories®

F321 - Media Dye, Yellow

Tartrazine; FD&C Yellow #5
Plant Tissue Culture Tested

Recommended 100 mg to 250 mg per liter.
For our media coloration sampler containing four different media dyes, see product M5856.

- Powder
- CAS Number: 1934-21-0
- Formula: $C_{16}H_9N_4Na_3O_9S_2$
- Molecular Weight: 534.37
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9160

Available Package Sizes

1g	10g	100g

M5781 - Methylene Blue

See Seed Testing Section for Complete Listing

M539 - L-Methionine

(*S*)-2-Amino-4-(methylthio)butanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 63-68-3
- Formula: $C_5H_{11}NO_2S$
- Molecular Weight: 149.21
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6004

Available Package Sizes

25g	100g

M488 - Molybdenum Trioxide

Molybdenum(VI) Oxide; Molybdic Anhydride
Plant Tissue Culture Tested



- Powder
- CAS Number: 1313-27-5
- Formula: MoO_3
- Molecular Weight: 143.94
- Soluble in NaOH or KOH; Slightly soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6261

Available Package Sizes

100g	500g

M572 - MOPS-EDTA-Sodium Acetate Buffer Solution (10x)

See Molecular Biology Section for Complete Listing

M631 - MOPS, Free Acid

See Molecular Biology Section for Complete Listing

M565 - MTT

See Molecular Biology Section for Complete Listing

M569 - MUG

See Molecular Biology Section for Complete Listing

Plant Growth Regulators Usage and Storage Chart

See "Figure 18. Plant Growth Regulators Usage and Storage Chart" on page 240 in the Technical Section.

N600 - α-Naphthaleneacetic Acid

NAA; 1-Naphthaleneacetic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 86-87-3
- Formula: $C_{12}H_{10}O_2$
- Molecular Weight: 186.2
- Soluble in KOH
- Store at Room Temperature
- *Merck* **13**, 6397

Available Package Sizes

25g	100g

N605 - α-Naphthaleneacetic Acid Solution (1 mg/mL)

NAA; 1-Naphthaleneacetic Acid
Sterile Filtered
Plant Tissue Culture Tested



- Liquid
- CAS Number: 86-87-3
- Formula: $C_{12}H_{10}O_2$
- Molecular Weight: 186.2
- Miscible with Water
- Store at 2 to 6 °C
- *Merck* **13**, 6397

Available Package Sizes

100mL	500mL	1L

N610 - α-Naphthaleneacetic Acid, Potassium Salt

K-NAA; 1-Naphthaleneacetic Acid, Potassium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 15165-79-4
- Formula: $C_{12}H_9KO_2$
- Molecular Weight: 224.3
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

5g	25g	100g

New Product

N6179 - 1-Naphthol

α-Naphthol
Has been used for staining or visualization of glycoglycerolipids and in Molisch's test for the detection of carbohydrates. Applying 1-Naphthol to barley seeds stimulates seedling growth significantly.

- Powder
- CAS Number: 90-15-3
- Formula: $C_{10}H_8O$
- Molecular Weight: 144.17
- Soluble in Ethanol
- Store at Room Temperature

Available Package Sizes

10g 100g

N564 - β-Naphthoxyacetic Acid

BNOA; *O*-(2-Naphthyl)glycolic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 120-23-0
- Formula: $C_{12}H_{10}O_3$
- Molecular Weight: 202.21
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 6423

Available Package Sizes

25g 100g

N609 - Niacinamide

Nicotinamide; 3-Pyridinecarboxamide; Vitamin B_3; Vitamin PP
Plant Tissue Culture Tested

- Powder
- CAS Number: 98-92-0
- Formula: $C_6H_6N_2O$
- Molecular Weight: 122.12
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6550

Available Package Sizes

25g 100g

N478 - Nickel (II) Chloride Hexahydrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 7791-20-0
- Formula: $NiCl_2 \cdot 6H_2O$
- Molecular Weight: 237.7
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6529

Available Package Sizes

5g 100g

N458 - Nickel (II) Sulfate Hexahydrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 10101-97-0
- Formula: $NiSO_4 \cdot 6H_2O$
- Molecular Weight: 262.84
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6541

Available Package Sizes

5g 100g 500g 1Kg

N765 - Nicotinic Acid

Niacin; Pyridine-3-carboxylic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 59-67-6
- Formula: $C_6H_5NO_2$
- Molecular Weight: 123.12
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6552

Available Package Sizes

100g 500g

N617 - Nitric Acid Solution 1.0 N

Aquafortis
Plant Tissue Culture Tested



- Liquid
- CAS Number: 7697-37-2
- Formula: HNO_3
- Molecular Weight: 63.01
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 6608

Available Package Sizes

1L 4L

N602 - Nitroblue Tetrazolium

NBT; 2,2'-Di-ρ-nitrophenyl-5,5'-diphenyl-3,3'-(3,3'-dimethoxy-4,4'-diphenylene)-ditetrazolium Chloride



- Powder
- CAS Number: 298-83-9
- Formula: $C_{40}H_{30}Cl_2N_{10}O_6$
- Molecular Weight: 817.6
- Soluble in DMSO
- Store at 2 to 6 °C

Available Package Sizes

100mg 1g

N604 - 2-Nitrophenyl-β-D-galactopyranoside

See Molecular Biology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

N618 - 4-Nitrophenyl-β-D-glucuronide

See Molecular Biology Section for Complete Listing

O626 - L-Ornithine Hydrochloride

2,5-Diaminopentanoic Acid Hydrochloride
Plant Tissue Culture Tested

- Powder
- CAS Number: 3184-13-2
- Formula: $C_5H_{12}N_2O_2$•HCl
- Molecular Weight: 168.65
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g 100g

Stains & Dyes Usage Table

See "Figure 34. Stains & Dyes Usage Table" on page 259 in the Technical Section.

New Product

O6350 - Orange G

Acid Orange 10; 7-Hydroxy-8-phenylazo-1,3-naphthalene disulphonic acid disodium salt; Wool Orange 2G
Orange G is a plant tissue culture stain, and one of the three components in Flemming's triple stain. It is an azo dye used primarily as a histological stain.

- Powder
- CAS Number: 1936-15-8
- Formula: $C_{16}H_{10}N_2Na_2O_7S_2$
- Molecular Weight: 452.37
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g 100g

O630 - Oryzalin

4-(Dipropylamino)-3,5-dinitrobenzenesulfonamide
Plant Tissue Culture Tested



- Powder
- CAS Number: 19044-88-3
- Formula: $C_{12}H_{18}N_4O_6S$
- Molecular Weight: 346.36
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 6953

Available Package Sizes

500mg 1g

P687 - Paclobutrazol

1-*tert*-butyl-2-(*p*-chlorobenzyl)-2-(1,2,4-triazol-1-yl)ethanol
Plant Tissue Culture Tested



- Powder
- CAS Number: 76738-62-0
- Formula: $C_{15}H_{20}ClN_3O$
- Molecular Weight: 293.80
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 7053

Available Package Sizes

25g 100g

P686 - Pectolyase Y-23

Derived from *Aspergillus japonicus*



- Powder
- CAS Number: 9033-35-6
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1 g

P6737 - Pentachloronitrobenzene (PCNB)

See Seed Testing Section for Complete Listing

P777 - Penicillin G

See Seed Testing Section for Complete Listing

P6767 - Penicillin G Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

P775 - Peptone, Type 1, Peptic Digest of Meat

Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

P780 - Peptone, Glysate

Enzymatic Digest of Gelatin
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

P721 - Peptone, From Soymeal

Papainic; Enzymatic Digest of Soybean
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

P778 - L-Phenylalanine

(*S*)-2-amino-3-phenylpropanoic acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 63-91-2
- Formula: $C_9H_{11}NO_2$
- Molecular Weight: 165.19
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7355

Available Package Sizes

25g 100g 500g

P711 - PIPES

See Molecular Biology Section for Complete Listing

P679 - DL-Phosphinothricin, Monoammonium Salt

See Molecular Biology Section for Complete Listing

G523 - DL-Phosphinothricin Solution (1 mg/mL)

See Molecular Biology Section for Complete Listing

P694 - Phloroglucinol

1,3,5-Trihydroxybenzene
Plant Tissue Culture Tested

- Powder
- CAS Number: 108-73-6
- Formula: $C_6H_6O_3$
- Molecular Weight: 126.12
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7413

Available Package Sizes

25g 100g

P717 - Picloram

4-Amino-3,5,6-trichloropicolinic Acid
Plant Tissue Culture Tested



- Powder
- CAS Number: 1918-02-1
- Formula: $C_6H_3Cl_3N_2O_2$
- Molecular Weight: 241.48
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 7482

Available Package Sizes

100mg 1g 5g 10g

P862 - Pineapple Powder

A mixture of natural pineapple puree and maltodextrin.
Plant Tissue Culture Tested

- Powder
- Suspension in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

P770 - Pluronic® F-68

Poloxamer 188
Plant Tissue Culture Tested
Pluronic® is a registered trademark of BASF Corporation.

- Powder
- CAS Number: 9003-11-6
- Formula: $(C_3H_6O•C_2H_4O)_x$
- Molecular Weight: 8400 Avg.
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7645

Available Package Sizes

100g

P714 - Polyethylene Glycol, PEG-3350

Carbowax
Plant Tissue Culture Tested

- Powder
- CAS Number: 25322-68-3
- Formula: $H(C_2H_4O)_nOH$
- Molecular Weight: 3000-3700
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7651

Available Package Sizes

1Kg 5Kg

©2014 PhytoTechnology Laboratories®

P725 - Polyethylene Glycol , PEG-1500

Carbowax
Plant Tissue Culture Tested

- Waxy Solid
- CAS Number: 25322-68-3
- Formula: $H(C_2H_4O)_nOH$
- Molecular Weight: 1300-1600
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7651

Available Package Sizes

500g 1Kg 5Kg 10Kg

P741 - Polyethylene Glycol, PEG-8000

Carbowax
Plant Tissue Culture Tested

- Powder
- CAS Number: 25322-68-3
- Formula: $H(C_2H_4O)_nOH$
- Molecular Weight: 7000-9000
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7651

Available Package Sizes

1 Kg

P6809 - Polymyxin B Sulfate

See Seed Testing Section for Complete Listing

P6719 - Polymyxin B Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

P720 - Polyoxyethylenesorbitan Monolaurate

Tween® 20; Polysorbate 20
Plant Tissue Culture Tested
Tween® is a registered trademark of ICI America, Inc.



- Liquid
- CAS Number: 9005-64-5
- Formula: $C_{58}H_{114}O_{26}$
- Molecular Weight: 1227.5
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 7664

Available Package Sizes

100mL 500mL 1L

P738 - Polyoxyethylenesorbitan Monooleate

Tween® 80; Polysorbate 80
Plant Tissue Culture Tested
Tween® is a registered trademark of ICI America, Inc.



- Liquid
- CAS Number: 9005-65-6
- Formula: $C_{64}H_{124}O_{26}$
- Molecular Weight: 1309.63
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 7664

Available Package Sizes

100mL 500mL 1L

P728 - Polyvinylpyrrolidone

PVP-40; Povidone
Plant Tissue Culture Tested

- Powder
- CAS Number: 9003-39-8
- Formula: $(C_6H_9NO)_n$
- Molecular Weight: 40,000 Average
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7783

Available Package Sizes

100g 500g 1Kg

P661 - Potassium Acetate

Plant Tissue Culture Tested

- Powder
- CAS Number: 127-08-2
- Formula: $KC_2H_3O_2$
- Molecular Weight: 98.14
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7687

Available Package Sizes

100g 500g 1Kg

P671 - Potassium Acetate Solution 3.0 M, pH 5.0

See Molecular Biology Section for Complete Listing

New Product

P6905 - Potassium Bromide

Commonly used as FTIR matrix.

- Powder
- CAS Number: 7758-02-3
- Formula: KBr
- Molecular Weight: 119.0
- Soluble in Water
- Store at Room Temperature
- *Merck* **13,** 7701

Available Package Sizes

100g

P614 - Potassium Carbonate

Sesquihydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 6381-79-9
- Formula: $K_2CO_3 \cdot 1.5H_2O$
- Molecular Weight: 165.23
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7702

Available Package Sizes

100g 500g 1Kg

P704 - Potassium Chloride

Plant Tissue Culture Tested

- Powder
- CAS Number: 7447-40-7
- Formula: KCl
- Molecular Weight: 74.55
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7704

Available Package Sizes

500g 1Kg 5Kg

P729 - Potassium Citrate Monohydrate

Tripotassium Citrate Monohydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 6100-05-6
- Formula: $C_6H_5K_3O_7 \cdot H_2O$
- Molecular Weight: 324.41
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g

P672 - Potassium Hydroxide

Plant Tissue Culture Tested

- Pellets
- CAS Number: 1310-58-3
- Formula: KOH
- Molecular Weight: 56.11
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7724



Available Package Sizes

500g 1Kg 5Kg

P682 - Potassium Hydroxide Solution 1.0 N

Plant Tissue Culture Tested

- Liquid
- CAS Number: 1310-58-3
- Formula: KOH
- Molecular Weight: 56.11
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 7724



Available Package Sizes

500mL 1L 4L

P840 - Potassium Iodide

Plant Tissue Culture Tested

- Powder
- CAS Number: 7681-11-0
- Formula: KI
- Molecular Weight: 166.0
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7727

Available Package Sizes

100g 500g

P640 - Potassium Iodide

USP Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 7681-11-0
- Formula: KI
- Molecular Weight: 166
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7727

Available Package Sizes

100g

©2014 PhytoTechnology Laboratories®

Macronutriens Sources Chart

See "Figure 9. List of Macronutrient Sources & *Phyto*Tech™ Product Numbers" on page 232 in the Technical Section.

P100 - Potassium Nitrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 7757-79-1
- Formula: KNO_3
- Molecular Weight: 101.10
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7733

Available Package Sizes

500g 1Kg 5Kg 10Kg 15Kg

P705 - Potassium Phosphate, Dibasic Anhydrous

Dipotassium Phosphate; Dipotassium Hydrogen Phosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7758-11-4
- Formula: K_2HPO_4
- Molecular Weight: 174.18
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7743

Available Package Sizes

100g 500g 1Kg

P846 - Potassium Phosphate, Monobasic Anhydrous

Monopotassium Phosphate; Potassium Dihydrogen Phosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7778-77-0
- Formula: KH_2PO_4
- Molecular Weight: 136.09
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7744

Available Package Sizes

100g 500g 1Kg 5Kg 10Kg

P6780 - Potassium Sodium Tartrate

See Seed Testing Section for Complete Listing

P854 - Potassium Sulfate, Anhydrous

Plant Tissue Culture Tested

- Powder
- CAS Number: 7778-80-5
- Formula: K_2SO_4
- Molecular Weight: 174.26
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7759

Available Package Sizes

500g 1Kg 5Kg

Undefined Organic Supplements Chart

See "Figure 15. List of Common Undefined Organic Supplements & PhytoTech™ Product Numbers" on page 236 in the Technical Section.

P692 - Potato Powder

Plant Tissue Culture Tested

- Powder
- Suspension in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

P698 - L-Proline

(*S*)-2-Pyrrolidinecarboxylic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 147-85-3
- Formula: $C_5H_9NO_2$
- Molecular Weight: 115.13
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7871

Available Package Sizes

100g 500g 1Kg

P6698 - L-Proline 2.5 M Solution

(*S*)-2-Pyrrolidinecarboxylic Acid
Sterile Filtered
Plant Tissue Culture Tested



- Liquid
- CAS Number: 147-85-3
- Formula: $C_5H_9NO_2$
- Molecular Weight: 115.13
- Miscible with Water
- Store at 2 to 6 °C
- *Merck* **13**, 7871

Available Package Sizes

25mL 100mL

P733 - Putrescine Dihydrochloride

1,4-Butanediamine Dihydrochloride; Tetramethylenediamine Dihydrochloride
Plant Tissue Culture Tested

- Powder
- CAS Number: 333-93-7
- Formula: $C_4H_{12}N_2$•2HCl
- Molecular Weight: 161.1
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8038

Available Package Sizes

1g 10g 25g

Vitamins Used in Plant Tissue Culture

See "Figure 13. List of Vitamins used in plant tissue culture & *Phyto*Tech™ Product Numbers" on page 235 in the Technical Section.

P866 - Pyridoxine Hydrochloride

5-Hydroxy-6-methyl-3,4-pyridinedimethanol Hydrochloride; Vitamin B_6 Hydrochloride
Plant Tissue Culture Tested

- Powder
- CAS Number: 58-56-0
- Formula: $C_8H_{11}NO_3$•HCl
- Molecular Weight: 205.64
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8072

Available Package Sizes

25g 100g

P684 - Pyruvic Acid, Potassium Salt

α-Ketopropionic Acid, Potassium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 4151-33-1
- Formula: $C_3H_3KO_3$
- Molecular Weight: 126.15
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

25g 100g

New Product

R7228 - Rhodamine B

Basic Violet 10, Brilliant Pink B, Rhodamine O, Tetraethylrhodamine
Rhodamine B is a protein-specific fluorescent stain commonly used in fluorescence microscopy; it stains plant tissue trichomes.

- Powder
- CAS Number: 81-88-9
- Formula: C28H31ClN2O3
- Molecular Weight: 479.01
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1g 5g 25g 100g

R795 - Ribavirin

1-β-D-Ribofuranosyl-1*H*-1,2,4-triazole-3-carboxamide; Virazole
Plant Tissue Culture Tested

Plant Tissue Culture Antiviral

- Powder
- CAS Number: 36791-04-5
- Formula: $C_8H_{12}N_4O_5$
- Molecular Weight: 244.2
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 8282



Available Package Sizes

1g

R779 - Riboflavin

USP Grade
7,8-dimethyl-10-(D-*ribo*-2,3,4,5-tetrahydroxypentyl)-isoalloxazine; Vitamin B_2
Plant Tissue Culture Tested

- Powder
- CAS Number: 83-88-5
- Formula: $C_{17}H_{20}N_4O_6$
- Molecular Weight: 376.37
- Soluble in KOH
- Store at Room Temperature
- *Merck* **13**, 8284

Available Package Sizes

25g

R7171 - Rose Bengal

See Seed Testing Section for Complete Listing

R7278 - Ruthenium Red

See Seed Testing Section for Complete Listing

S7775 - Saline Solution (0.85%)

See Seed Testing Section for Complete Listing

©2014 PhytoTechnology Laboratories®

For More Information on Stains & Dyes

See "Figure 34. Stains & Dyes Usage Table" on page 259 in the Technical Section.

New Product

S7400 - Safranin O

Basic Red 2, Cotton Red, Gossypimine, Safranin T, Safranin Y or A
A biological stain, often used as a counter-stain to Crystal Violet (C1830)

- Powder
- CAS Number: 477-73-6
- Formula: $C_{20}H_{19}ClN_4$
- Molecular Weight: 350.84
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g 100g

Amino Acids Used in Plant Tissue Culture

See "Figure 14. List of Amino Acids by Type & *Phyto*Tech™ Product Numbers" on page 236 in the Technical Section.

S807 - L-Serine

(*S*)-2-amino-3-hydroxypropanoic acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-45-1
- Formula: $C_3H_7O_3N$
- Molecular Weight: 105.09
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8534

Available Package Sizes

25g 500g

S169 - Silver Nitrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 7761-88-8
- Formula: $AgNO_3$
- Molecular Weight: 169.89
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8591



Available Package Sizes

25g 100g

S803 - Sodium Bicarbonate

USP Grade
Sodium Hydrogen Carbonate; Baking Soda
Plant Tissue Culture Tested

- Powder
- CAS Number: 144-55-8
- Formula: $NaHCO_3$
- Molecular Weight: 84.01
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8655

Available Package Sizes

25g 500g

S7550 - Sodium Carbonate

See Phycology Section for Complete Listing

S624 - Sodium Chloride

Plant Tissue Culture Tested

- Powder
- CAS Number: 7647-14-5
- Formula: NaCl
- Molecular Weight: 58.44
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8671

Available Package Sizes

500g 1Kg 5Kg

S663 - Sodium Citrate Dihydrate

Trisodium Citrate Dihydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 6132-04-3
- Formula: $C_6H_5Na_3O_7 \cdot 2H_2O$
- Molecular Weight: 294.1
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8675

Available Package Sizes

500g 1Kg

S844 - Sodium Dodecyl Sulfate

See Molecular Biology Section for Complete Listing

S845 - Sodium Hydroxide

Soda Lye
Plant Tissue Culture Tested

- Pellets
- CAS Number: 1310-73-2
- Formula: NaOH
- Molecular Weight: 40.00
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8701



Available Package Sizes

500g 1Kg

S835 - Sodium Hydroxide Solution 1.0 N

Soda Lye
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 1310-73-2
- Formula: NaOH
- Molecular Weight: 40.00
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 8701



Available Package Sizes

100mL 500mL 1L 4L

S7834 - Sodium Metasilicate

See Phycology Section for Complete Listing

Micronutrient Sources Chart

See "Figure 10. List of Micronutrient Sources & *Phyto*Tech™ Product Numbers" on page 233 in the Technical Section.

M651 - Sodium Molybdate (VI) Dihydrate

Molybdic Acid, Sodium Salt Dihydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10102-40-6
- Formula: $Na_2MoO_4 \cdot 2H_2O$
- Molecular Weight: 241.95
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8718

Available Package Sizes

100g 500g

S802 - Sodium Nitrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 7631-99-4
- Formula: $NaNO_3$
- Molecular Weight: 84.99
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8720



Available Package Sizes

500g 1Kg 5Kg

S515 - Sodium Phosphate, Monobasic Monohydrate

Sodium Dihydrogen Phosphate Monohydrate
Monosodium Phosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10049-21-5
- Formula: $NaH_2PO_4 \cdot H_2O$
- Molecular Weight: 137.99
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8734

Available Package Sizes

100g 500g 1Kg 5Kg

S745 - Sodium Phosphate, Dibasic Heptahydrate

Disodium Hydrogen Phosphate Heptahydrate
Disodium Phosphate
Plant Tissue Culture Tested

- Powder
- CAS Number: 7782-85-6
- Formula: $Na_2HPO_4 \cdot 7H_2O$
- Molecular Weight: 268.07
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8733

Available Package Sizes

500g 1Kg 5Kg

S843 - Sodium Sulfate Anhydrous

Plant Tissue Culture Tested

- Powder
- CAS Number: 7757-82-6
- Formula: Na_2SO_4
- Molecular Weight: 142.04
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8755

Available Package Sizes

100g 500g

©2014 PhytoTechnology Laboratories®

S620 - Sodium Thiosulfate, Anhydrous

Sodium Hyposulfite
Plant Tissue Culture Tested

- Powder
- CAS Number: 7772-98-7
- Formula: $Na_2S_2O_3$
- Molecular Weight: 158.11
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8769

Available Package Sizes

500g 1Kg

S744 - D-Sorbitol

D-Glucitol
Plant Tissue Culture Tested

- Powder
- CAS Number: 50-70-4
- Formula: $C_6H_{14}O_6$
- Molecular Weight: 182.17
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8797

Available Package Sizes

500g 1Kg 5Kg 25Kg

S742 - Spectinomycin Dihydrochloride

See Molecular Biology Section for Complete Listing

S837 - Spermidine, Free Base

N-(3-Aminopropyl)-1,4-butanediamine
Plant Tissue Culture Tested

- Solid that melts at Room Temperature
- CAS Number: 124-20-9
- Formula: $C_7H_{19}N_3$
- Molecular Weight: 145.25
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 8816



Available Package Sizes

1g 5g 25g

S716 - SSC Buffer Solution (20x), pH 7.0

See Molecular Biology Section for Complete Listing

S677 - SSPE Buffer Solution (10x)

See Molecular Biology Section for Complete Listing

S739 - Streptomycin Sulfate

See Molecular Biology Section for Complete Listing

S7739 - Streptomycin Sulfate Solution (250 mg/mL)

See Molecular Biology Section for Complete Listing

S746 - Succinic Acid 2,2-Dimethylhydrazide

Daminozide; SADH
Plant Tissue Culture Tested

- Powder
- CAS Number: 1596-84-5
- Formula: $C_6H_{12}N_2O_3$
- Molecular Weight: 160.17
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 2836

Available Package Sizes

10g 100g

New Product

S7750 - Sudan IV

Biebrich scarlet R fat soluble, Fat Ponceau R or 4, Lipid Crimson, Oil Red IV, Scarlet Red Scharlach, Solvent Red 24, Sudan R or BB
Sudan IV is a biological stain used primarily to stain lipids and fatty substances present in cells and tissues.

- Powder
- CAS Number: 85-83-6
- Formula: $C_{24}H_{20}N_4O$
- Molecular Weight: 380.44
- Soluble in Isopropanol and Chloroform
- Store at Room Temperature

Available Package Sizes

25g 100g

Carbohydrate Selection Guide

See "Figure 12. Choosing a Carbohydrate" on page 234 in the Technical Section.

S391 - D-Sucrose

β-D-Fructofuranosyl-α-D-glucopyranoside; D(+)saccharose; Cane Sugar
Plant Tissue Culture Tested

- Powder
- CAS Number: 57-50-1
- Formula: $C_{12}H_{22}O_{11}$
- Molecular Weight: 342.34
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8966

Available Package Sizes

30g 500g 1Kg 5Kg 25Kg

S829 - D-Sucrose, Ultra-Pure

β-D-Fructofuranosyl-α-D-glucopyranoside; D(+)Saccharose; Cane Sugar
Plant Tissue Culture Tested

- Powder
- CAS Number: 57-50-1
- Formula: $C_{12}H_{22}O_{11}$
- Molecular Weight: 342.34
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8966

Available Package Sizes

500g	1Kg	5Kg	25Kg

S804 - Sulfuric Acid Solution 1.0 N

Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 7664-93-9
- Formula: H_2SO_4
- Molecular Weight: 98.07
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 9064



Available Package Sizes

500mL	1L

S7664 - Sulfuric Acid, 0.1% Solution

See Phycology Section for Complete Listing

New Product

T8199 - Tetrazolium Blue

BTC, Blue Tetrazolium Chloride, TZ
Tetrazolium Blue is a colorless tetrazolium that forms a colored formazan when reduced; it is therefore used as an assay of reducing sugars. Tetrazolium Blue is used as an indicator for germination capacity.

- Powder
- CAS Number: 1871-22-3
- Formula: $C_{40}H_{32}Cl_2N_8O_2$
- Molecular Weight: 727.64
- Soluble in Methanol
- Store at Room Temperature

Available Package Sizes

1g	5g	10g	25g

Vitamins Used in Plant Tissue Culture

See "Figure 13. List of Vitamins used in plant tissue culture & *Phyto*Tech™ Product Numbers" on page 235 in the Technical Section.

T390 - Thiamine Hydrochloride

3-[(4-Amino-2-methyl-5-pyrimidinyl)methyl]-5-(2-hydroxyethyl)-4-methylthiazolium chloride Hydrochloride; Vitamin B_1 Hydrochloride
Plant Tissue Culture Tested

- Powder
- CAS Number: 67-03-8
- Formula: $C_{12}H_{17}ClN_4OS{\bullet}HCl$
- Molecular Weight: 337.27
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9366

Available Package Sizes

25g	100g

T888 - Thidiazuron

TDZ; 1-Phenyl-3-(1,2,3-thiadiazol-5-yl)urea
Plant Tissue Culture Tested
Purity: minimum 98%

- Powder
- CAS Number: 51707-55-2
- Formula: $C_9H_8N_4OS$
- Molecular Weight: 220.3
- Soluble in DMSO
- Store at -20 to 0 °C
- *Merck* **13**, 9384

Available Package Sizes

100mg	500mg	1g

T438 - Thidiazuron (95%)

TDZ; 1-Phenyl-3-(1,2,3-thiadiazol-5-yl)urea
Purity: 95%
Plant Tissue Culture Tested

- Powder
- CAS Number: 51707-55-2
- Formula: $C_9H_8N_4OS$
- Molecular Weight: 220.3
- Soluble in DMSO
- Store at -20 to 0 °C
- *Merck* **13**, 9384

Available Package Sizes

100mg	500mg	1g

T7982 - Thiourea

See Seed Testing Section for Complete Listing

©2014 PhytoTechnology Laboratories®

T857 - L-Threonine, Methyl Ester, Hydrochloride

Plant Tissue Culture Tested

- Powder
- CAS Number: 39994-75-7
- Formula: $C_5H_{11}O_3N$•HCl
- Molecular Weight: 169.6
- Soluble in Water
- Store at -20 to 0 °C

Available Package Sizes

5g

T869 - Timentin

See Molecular Biology Section for Complete Listing

T767 - Timentin Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

T7869 - Timentin Solution (50 mg/mL)

See Molecular Biology Section for Complete Listing

T8092 - Toluidine Blue O

See Seed Testing Section for Complete Listing

T872 - Tomato Powder

A mixture of natural tomato puree and maltodextrin.
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

T841 - *meta*-Topolin

6-(3-Hydroxybenzylamino)purine
Plant Tissue Culture Tested

- Powder
- CAS Number: 75737-38-1
- Formula: $C_{12}H_{10}N_5OH$
- Molecular Weight: 241.5
- Soluble in KOH or NaOH
- Store at -20 to 0 °C

Available Package Sizes

100mg 500mg 1g

New Product

T7885 - *meta*-Topolin Solution (1mg/mL)

6-(3-Hydroxybenzylamino)purine
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 75737-38-1
- Formula: $C_{12}H_{10}N_5OH$
- Molecular Weight: 241.50
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

10mL 25mL 100mL

T7968 - Trehalose Dihydrate

See Seed Testing Section for Complete Listing

T818 - 1-Triacontanol

1-Hydroxytriacontane; Melissyl Alcohol
Plant Tissue Culture Tested

- Powder
- CAS Number: 593-50-0
- Formula: $C_{30}H_{62}O$
- Molecular Weight: 438.82
- Soluble in Hot EtOH
- Store at 2 to 6 °C
- *Merck* **13**, 9665

Available Package Sizes

1g

T828 - Trifluralin

α,α,α-Trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine
Plant Tissue Culture Tested

- Powder
- CAS Number: 1582-09-8
- Formula: $C_{13}H_{16}F_3N_3O_4$
- Molecular Weight: 335.28
- Soluble in DMSO
- Store at Room Temperature
- *Merck* **13**, 9757



Available Package Sizes

100mg 250mg

T850 - 2,3,5-Triiodobenzoic Acid

TIBA
Plant Tissue Culture Tested

- Powder
- CAS Number: 88-82-4
- Formula: $C_7H_3O_2I_3$
- Molecular Weight: 499.8
- Soluble in KOH
- Store at -20 to 0 °C

Available Package Sizes

5g 10g

T761 - Trinexapac-Ethyl

Ethyl 4-cyclopropyl(hydroxyl)methylene-3,5-dioxocyclohexanecarboxylate
Plant Tissue Culture Tested

- Powder
- CAS Number: 95266-40-3
- Formula: $C_{13}H_{16}O_5$
- Molecular Weight: 252.3
- Soluble in Water
- Store at 2 to 6 °C



Available Package Sizes

100mg 250mg

T8164 - 2,3,5-Triphenyl Tetrazolium Chloride (TTC)

See Seed Testing Section for Complete Listing

T769 - Tris Acetate EDTA Buffer Solution (50x), pH 8.1 ± 0.1

See Molecular Biology Section for Complete Listing

T838 - Tris Base

See Molecular Biology Section for Complete Listing

T831 - Tris Borate EDTA Buffer

See Molecular Biology Section for Complete Listing

T773 - Tris Borate EDTA Buffer Solution (5x)

See Molecular Biology Section for Complete Listing

T774 - Tris Borate EDTA Buffer Solution (10x)

See Molecular Biology Section for Complete Listing

T855 - Tris-EDTA Buffer

See Molecular Biology Section for Complete Listing

T752 - Tris EDTA Buffer Solution (10X), pH 8.0

See Molecular Biology Section for Complete Listing

T814 - Tris-Glycine Buffer

See Molecular Biology Section for Complete Listing

T821 - Tris Glycine SDS Buffer

See Molecular Biology Section for Complete Listing

T749 - Tris-Glycine-SDS Buffer Solution (10x)

See Molecular Biology Section for Complete Listing

T858 - Tris Hydrochloride

See Molecular Biology Section for Complete Listing

T764 - Tris HCl Solution 1.0 M, pH 7.5

See Molecular Biology Section for Complete Listing

T832 - Tryptone

Enzymatic digest of Casein
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g 1Kg

T851 - L-Tryptophan

(*S*)-α-Amino-1*H*-indole-3-propanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 73-22-3
- Formula: $C_{11}H_{12}N_2O_2$
- Molecular Weight: 204.2
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9868

Available Package Sizes

100g 500g

T848 - Tryptose

Enzymatic Hydrolysate of Protein; Trypticase
Plant Tissue Culture Tested

- Powder
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

500g

T8110 - Tyrothricin

See Seed Testing Section for Complete Listing

T8020 - Tyrothricin Solution (10mg/mL)

See Seed Testing Section for Complete Listing

T873 - L-Tyrosine, Free Base

(*S*)-α-Amino-4-hydroxybenzenepropanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 60-18-4
- Formula: $C_9H_{11}NO_3$
- Molecular Weight: 181.21
- Soluble in HCl; Slightly soluble in water
- Store at Room Temperature
- *Merck* **13**, 9907

Available Package Sizes

5g 100g 500g 1Kg

©2014 PhytoTechnology Laboratories®

U890 - Urea

Carbonyldiamide; Carbamide
Plant Tissue Culture Tested

- Powder
- CAS Number: 57-13-6
- Formula: CH_4N_2O
- Molecular Weight: 60.06
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9935

Available Package Sizes

500g	1Kg	5Kg

V878 - L-Valine

(*S*)-2-amino-3-methylbutanoic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 72-18-4
- Formula: $C_5H_{11}NO_2$
- Molecular Weight: 117.17
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9975

Available Package Sizes

25g	100g

V886 - Vinegar, White Distilled

5% Acetic Acid

- Liquid
- CAS Number: 64-19-7
- Formula: $C_2H_4O_2$
- Molecular Weight: 60.06
- Miscible with Water
- Store at Room Temperature



Available Package Sizes

15mL

X874 - X-Gal

See Molecular Biology Section for Complete Listing

X877 - X-Gluc, Monocyclohexyl Ammonium Salt

See Molecular Biology Section for Complete Listing

X871 - X-Gluc, Sodium Salt

See Molecular Biology Section for Complete Listing

X8451 - X-Gluc Solution (20mg/mL)

See Molecular Biology Section for Complete Listing

Y892 - Yeast Extract

Microbiological Grade
Plant Tissue Culture Tested

- Powder
- CAS Number: 8013-01-2
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

500g	1Kg	2.5Kg

Making Stock Solutions of Plant Growth Regulators

See "Figure 16. Stock Solution Dilution Chart" on page 238 in the Technical Section.

Z125 - Zeatin, *trans* Isomer

(2*E*)-2-methyl-4-(1*H*-purin-6-ylamino)-2-buten-1-ol
Plant Tissue Culture Tested

- Powder
- CAS Number: 1637-39-4
- Formula: $C_{10}H_{13}N_5O$
- Molecular Weight: 219.25
- Soluble in KOH
- Store at -20 to 0 °C
- *Merck* **13**, 10170

Available Package Sizes

10mg	50mg	100mg	250mg	500mg	1g

Z875 - Zeatin Riboside Solution (1 mg/mL), *trans* Isomer

9-(ß-D-Ribofuranosyl)-trans-zeatin, *N*6-(trans-4-Hydroxy-3-methyl-2-buten-1-yl)adenosine
Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 6025-53-2
- Formula: $C_{15}H_{21}N_5O_5$
- Molecular Weight: 351.4
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

10mL

Z899 - Zeatin Riboside, *trans* Isomer

9-(ß-D-Ribofuranosyl)-trans-zeatin, *N*6-(trans-4-Hydroxy-3-methyl-2-buten-1-yl)adenosine
Plant Tissue Culture Tested

- Powder
- CAS Number: 6025-53-2
- Formula: $C_{15}H_{21}N_5O_5$
- Molecular Weight: 351.4
- Soluble in KOH
- Store at -20 to 0 °C

Available Package Sizes

10mg	50mg	100mg	250mg	1g

Z860 - Zeatin Solution (1 mg/mL), *trans* Isomer

(2*E*)-2-methyl-4-(1*H*-purin-6-ylamino)-2-buten-1-ol
Sterile Filtered
Plant Tissue Culture Tested



- Liquid
- CAS Number: 1637-39-4
- Formula: $C_{10}H_{13}N_5O$
- Molecular Weight: 219.25
- Miscible with Water
- Store at -20 to 0 °C
- *Merck* **13**, 10170

Available Package Sizes

10mL

Z897 - Zinc Nitrate Hexahydrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 10196-18-6
- Formula: $Zn(NO_3)_2 \cdot 6H_2O$
- Molecular Weight: 297.48
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 10197

Available Package Sizes

100g	500g	1Kg

Z101 - Zinc Sulfate Heptahydrate

Plant Tissue Culture Tested



- Powder
- CAS Number: 7446-20-0
- Formula: $ZnSO_4 \cdot 7H_2O$
- Molecular Weight: 287.54
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 10213

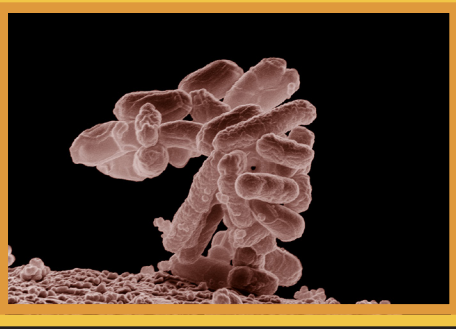
Available Package Sizes

100g	500g

Find Microbiology Media on Pages 149 to 156

- *LB Agars and Broths*
- *Tryptic Soy Broth*
- *YEP Media*
- *Hanahan's Broth*
- *Peptone Waters*

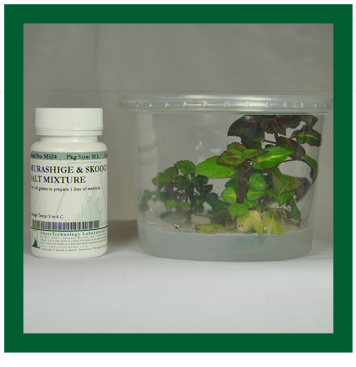




©2014 PhytoTechnology Laboratories®

PLANT TISSUE CULTURE MEDIA









Plant Tissue Culture Media

*Phyto*Technology Laboratories® offers a large selection of ready-to-use plant tissue culture media. The media outlined in this section are for plant tissue micropropagation. Media for other applications, please refer to the following sections:

- Microbiology, page 149
- Phytopathology, page 157
- Seed Testing, page 161
- Phycology, page 169

The formulation for each non-proprietary media is detailed in the product listings on the following pages. To compare media formulations, please consult the formulation tables in the technical section (pages 265 to 288) or visit **www.phytotechlab.com**.

For instructions on media preparation and usage please consult "Powdered Media" on page 228 or visit **www.phytotechlab.com**.

For assistance locating products within this catalogue, please consult the indices at the back of this catalogue. Be sure to check back at **www.phytotechlab.com** for new products!

Custom Media Formulations

In addition to the many popular formulations offered, *Phyto*Technology Laboratories® also offers custom manufacturing services for proprietary research formulations. Custom formulations provide all of the benefits of pre-made media but can be tailored to specific research needs. Eliminate variability from batch to batch by taking advantage of custom media manufacturing. All custom media meets ISO 9001:2008 and cGMP standards of quality.

See "Custom Services" on page 12 for more information about Custom Media.









Featured in this section

- Agronomic Media
- Crop Specific Media
- Deficient Media
- MS Media
- Orchid Media
- Stock Solutions
- Woody Plant Media
- Vitamins

Murashige & Skoog Formulations

Many of the media formulations offered by *Phyto*Technology Laboratories® are derivatives of the formulation popularized by Toshio Murashige and Folke Skoog in 1962. On the following page is provided a breakdown of the MS formulations offered by *Phyto*Technology Laboratories® by media types.

Our Product Definitions

Basal Salts – contain macronutrients and micronutrients. Does not include vitamins, plant growth regulators, or carbohydrates.

Basal Media – contains macronutrients and micronutrients, as well as some organic components. Generally lacks either vitamins, plant growth regulators, or carbohydrates, and is therefore not considered a "complete medium".

Media – typically considered complete and requires only gelling agents, if desired.

©2014 PhytoTechnology Laboratories®

Murashige & Skoog Media Family

Deficient Media

M502 - MS Macronutrient Salt Base
M654 - MS Macronutrient Stock Solution
M554 - MS Micronutrient Salt Base
M529 - MS Micronutrient Stock Solution (10x)
M407 - MS Basal Salts without N, P, & K
M561 - MS Basal Mixture with 1/2 NH_4NO_3 & KNO_3
M571 - MS Basal Salt Mixture without NH_4NO_3
M531 - MS Basal Salt Mixture without Nitrogen
M290 - MS Modified Basal Salt Mixture with 1/2 NH_4NO_3, KNO_3, & CaCl
M153 - MS Basal Salt Mixture with 1/2 Macro- & Micronutrients

Basal Salts

M524 - MS Basal Salt Mixture
M576 - MS Basal Salt Concentrate Solution (20x)
M489 - MS Basal Salts with FeNaEDTA
M5541 - MS Basal Salt Mixture, Van Der Salm Modification
M504 - MS Basal Salts, Finer & Nagasawa Modification
M153 - MS Basal Salt Mixture with 1/2 Macro- & Micronutrients

Media with Vitamins

L689 - Linsmaier & Skoog (LS) Medium
M5800 - MS Medium with FeNaEDTA
M541 - MS Modified Medium with Casein & Adenine; without KH_2PO_4
M535 - MS Modified Medium with Adenine
M536 - MS Modified Medium with Adenine
M5642 - MS Medium, Van Der Salm Modification
M519 - MS Medium with Vitamins
M404 - MS Medium with Gamborg's Vitamins
M5531 - MS Medium with 1.0 g/L MES
L477 - LS Medium with 1.0 g/L MES

Media with Vitamins & Sucrose

M5615 - MS Medium with 15.0 g/L Sucrose & Glucose
M5501 - MS Medium with Vitamins &Sucrose
M5530 - MS Medium Solution (1x) with Vitamins & Sucrose
M5707 - MS Medium with 10.0 g/L Sucrose & 20.0 g/L Glucose
L473 - LS Medium with 30.0 g/L Sucrose &1.0 mg/L MES

Media with Vitamins, Sucrose & Agar

L467 - LS Medium with 30.0 g/L Sucrose & 7.0 g/L Agar
L452 - LS Medium with 30.0 g/L Sucrose, 7.0 g/L Agar, & 1.0 g/L MES

Media with Vitamins & PGRs

M516 - MS BC Potato Medium
M401 - MS Modified Medium
M550 - MS Modified Medium with Kinetin & 2,4-D
M701 - MS Modified Medium with 2iP, IAA, & Adenine
M702 - MS Modified Medium with 2iP, IAA, & Adenine
M555 - MS Modified Multiplication Medium with Kinetin
M517 - MS African Violet/Gloxinia Multiplication Medium
M518 - MS African Violet/Gloxinia Pretransplant Medium
M508 - MS Fern Multiplication Medium with Kinetin & NAA
M509 - MS Gerbera Multiplication Medium with Kinetin & IAA
M510 - MS Gerbera Pretransplant Medium with IAA
M511 - MS Kalanoche Multiplication Medium with 2iP
M512 - MS Kalanoche Pretransplant Medium with IAA
M527 - MS Multiplication Medium with Kinetin & IAA
M491 - MS Multiplication Medium with 2iP & IAA
M507 - Murashige Cattleya Orchid Medium with IAA, IBA, & NAA

Crop Specific Media

M516 - MS BC Potato Medium
M517 - MS African Violet/Gloxinia Multiplication Medium
M518 - MS African Violet/Gloxinia Pretransplant Medium
M508 - MS Fern Multiplication Medium with Kinetin & NAA
M509 - MS Gerbera Multiplication Medium with Kinetin & IAA
M510 - MS Gerbera Pretransplant Medium with IAA
M511 - MS Kalanoche Multiplication Medium with 2iP
M512 - MS Kalanoche Pretransplant Medium with IAA
B144 - Banana AGS Medium
M462 - Musa (Banana) Multiplication Medium
M507 - Murashige Cattleya Orchid Medium with IAA, IBA, & NAA
H435 - Hosta Initiation/Multiplication Medium
H436 - Hosta Multiplication Medium
H437 - Hosta Pretransplant Medium
H3959 - Hosta Initiation/Multiplication Medium II
B468 - BY-2 Medium (for tobacco)

Murashige & Skoog Media

Toshio Murashige and Folke Skoog developed the original formulation of Murashige & Skoog Medium for use with tobacco callus cultures in 1962. The basal salts and vitamins described, have become the most popular plant tissue culture media. MS Medium is effective on a wide variety of plants and there are many popular modifications designed for specific plants or growth requirements.

The original formulations are:
M524 - MS Basal Salt Mixture
M519 - MS Medium with Vitamins

A267 - Anderson Basal Salt Mixture

Contains the macro- and micronutrients as described by Anderson (1978, 1980).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.89 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	74.5
Ferrous Sulfate•$7H_2O$	55.7
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.3
Potassium Nitrate	480
Sodium Phosphate, Monobasic•H_2O	330.6
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L

B129 - Bacteria Screening Medium 523

See Phytopathology Section for Complete Listing

B144 - Banana AGS Basal Medium

Contains the macro- and micronutrients, vitamins, and plant growth regulators required to culture bananas.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.71 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	295
Zinc Sulfate•$7H_2O$	8.6
6-(γ,γ-Dimethylallylamino)purine	10
Indole-3-acetic Acid	1.0
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

BG-11 Blue Green Media

See Phycology Section for Complete Listings

Find Biochemicals on Pages 15 to 54

- *Gelling Agents*
- *Plant Growth Regulators*
- *Media Components*
- *Stains and Dyes*
- *Carbohydrates*





©2014 PhytoTechnology Laboratories®

B514 - Blaydes Basal Medium

Contains the macro- and micronutrients, sucrose, and thiamine as described by Blaydes (1966).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 31.86 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1000
Boric Acid	1.6
Calcium Nitrate	241.1
$Na_2EDTA•2H_2O$	74.5
Ferrous Sulfate•$7H_2O$	55.7
Magnesium Sulfate, Anhydrous	17.1
Manganese Sulfate•H_2O	4.4
Potassium Chloride	100
Potassium Iodide	0.8
Potassium Nitrate	65
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•$7H_2O$	1.5
Glycine	2.0
Sucrose	30,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	3.5 ± 0.75

Available Package Sizes

1L 10L 50L

B138 - BM-1 Terrestrial Orchid Medium Without Agar

Contains the macro- and micronutrients, vitamins, and supplements required to culture orchids.
Especially suited for terrestrial orchids, Paphiopedilum, and Phragmipedium.
Seed germination may be enhanced by the addition of 50 mL/L Coconut Water (Product Number C195).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 21.22 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	10
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.25
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	100
Manganese Sulfate•H_2O	25
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•$7H_2O$	10
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	500
Folic Acid	0.5
L-Glutamine	100
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	0.5
Approximate pH at Room Temperature	5.5 ± 0.75

Available Package Sizes

1L 10L 50L

Terrestrial Orchid Media Selection Guide

See "Figure 21. Terrestrial Orchid Media Selection Guide" on page 245 in the Technical Section.

Tissue Culture Kits



*Phyto*Technology Laboratories® offers a selection of plant tissue culture kits for educational use. For more information please see pages 175 to 182.

Kits for:
– African Violet,
– Carrot,
– Carnivorous Plants,
– Fern,
– Hosta,
– Lily,
– Orchids, and
– Potato.

B141 - BM-1 Terrestrial Orchid Medium With Agar

Contains the macro- and micronutrients, vitamins, and supplements required to culture orchids.
Especially suited for terrestrial orchids, Paphiopedilum, and Phragmipedium.
Seed germination may be enhanced by the addition of 50 mL/L Coconut Water (Product Number C195).

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling Water
- Use at 26.22 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	10
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.25
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	100
Manganese Sulfate•H_2O	25
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•7H_2O	10
Agar	5000
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	500
Folic Acid	0.5
L-Glutamine	100
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	0.5
Approximate pH at Room Temperature	5.5 ± 0.75

Available Package Sizes

1L 10L 50L

Tissue Culture & Orchids

See "Tissue Culture & Orchids" on page 245 to 251 in the Technical Section.

B470 - BM-2 Terrestrial Orchid Medium Without Agar

Contains 0.2 mg/L 6-Benzylaminopurine (BA, Product Number B800).
Contains the macro- and micronutrients, vitamins, and supplements required to culture orchids.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 21.22 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	10
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.25
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	100
Manganese Sulfate•H_2O	25
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•7H_2O	10
6-Benzylaminopurine	0.2
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	500
Folic Acid	0.5
L-Glutamine	100
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	0.5
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

B142 - BM-2 Terrestrial Orchid Medium With Agar

Contains 0.2 mg/L 6-Benzylaminopurine (BA, Product Number B800).
Contains the macro- and micronutrients, vitamins, and supplements required to culture orchids.
Especially suited for terrestrial orchids, *Paphiopedilum* and *Phragmipedium*.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling Water
- Use at 27.22 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	10
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.25
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	100
Manganese Sulfate•H_2O	25
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•$7H_2O$	10
Agar	6000
6-Benzylaminopurine	0.2
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	500
Folic Acid	0.5
L-Glutamine	100
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	0.5
Approximate pH at Room Temperature	5.5 ± 0.5

Available Package Sizes

1L 10L 50L

B1650 - Bold's Basal Media (BBM)

See Phycology Section for Complete Listings

New Product

B1396 - Broadleaf Tree Basal Medium

Contains the micro- and macro-nutrients and vitamins described by Chalupa (1984).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	82.5
Ammonium Sulfate	120
Boric Acid	1.55
Calcium Chloride, Anhydrous	16.6
Calcium Nitrate	222
Cobalt Chloride, Hexahydrate	0.005
Cupric Sulfate•$5H_2O$	0.063
$Na_2EDTA•2H_2O$	9.325
Ferrous Sulfate•$7H_2O$	6.95
Magnesium Sulfate, Anhydrous	90
Manganese Sulfate•H_2O	4.225
Molybdic Acid, Disodium Salt•$2H_2O$	0.063
Potassium Iodide	0.038
Potassium Nitrate	95
Potassium Phosphate, Monobasic, Anhydrous	85
Potassium Sulfate, Anhydrous	430
Zinc Nitrate•$6H_2O$	2.15
myo-Inositol	50
Nicotinic Acid	0.25
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

C206 - Cape Sundew/Venus Flytrap Multiplication Basal Medium

Contains the macro- and micronutrients, vitamins, and plant growth regulators required to culture Cape Sundew and Venus Flytrap.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.12 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	74.5
Ferrous Sulfate•$7H_2O$	55.7
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Nitrate	480
Sodium Phosphate, Monobasic•H_2O	380
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
6-(γ,γ-Dimethylallylamino)purine	1.0
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L

C216 - Cape Sundew/Venus Flytrap Pretransplant Basal Medium

Contains the macro- and micronutrients, vitamins, and plant growth regulators required to culture Cape Sundew and Venus Flytrap.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.20 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166.5
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
Ferric Sodium EDTA	18.35
Magnesium Sulfate, Anhydrous	90.5
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•$7H_2O$	4.3
myo-Inositol	50
Thiamine•HCl	0.2
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

Find Molecular Biology Products on Pages 129 to 148

- *Antibiotics*
- *Buffers*
- *DNA Extraction Kits*
- *Sterile Solutions*
- *IPTG, X-Gal & X-Gluc*





©2014 PhytoTechnology Laboratories®

New Product

C1935 - Carnivorous Plant (*Nepenthes*) Basal Salt Mixture

This medium is commonly supplemented with MS Vitamins (e.g., M533, M553) and 25 g/L sucrose (Product Number S391).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.65 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	160.1
Boric Acid	9.275
Calcium Chloride, Anhydrous	33.94
Cobalt Chloride•$6H_2O$	0.024
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	36.72
Magnesium Sulfate, Anhydrous	36.11
Manganese Sulfate•H_2O	16.90
Molybdic Acid, Disodium Salt•$2H_2O$	0.242
Potassium Iodide	0.830
Potassium Nitrate	202.2
Sodium Phosphate, Monobasic	138.01
Zinc Sulfate•$7H_2O$	11.502
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

C212 - Carrot Callus Initiation Basal Medium

Contains the macro- and micronutrients, vitamins, and plant growth regulators required to initiate carrot callus from root tissue.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	134
Boric Acid	3.0
Calcium Chloride, Anhydrous	113.24
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	122.09
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.75
Potassium Nitrate	2500
Sodium Phosphate, Monobasic•H_2O	150
Zinc Sulfate•$7H_2O$	2.0
2,4-Dichlorophenoxyacetic Acid	1.0
myo-Inositol	100
Nicotinic Acid	1.0
Pyridoxine•HCl	1.0
Thiamine•HCl	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

C222 - Carrot Shoot Development Basal Medium

Contains the macro- and micronutrients, vitamins, and plant growth regulators required to initiate shoots from carrot callus.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	134
Boric Acid	3.0
Calcium Chloride, Anhydrous	113.24
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	122.09
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.75
Potassium Nitrate	2500
Sodium Phosphate, Monobasic•H_2O	150
Zinc Sulfate•7H_2O	2.0
myo-Inositol	100
Kinetin	0.2
Nicotinic Acid	1.0
Pyridoxine•HCl	1.0
Thiamine•HCl	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

C287 - Chee & Pool C2d *Vitis* Basal Medium

Contains the macro- and micronutrients and vitamins as described by Chee & Pool (1987).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.49 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Nitrate	492.3
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.6
Manganese Sulfate•H_2O	0.845
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
myo-Inositol	10
Nicotinic Acid	1.0
Pyridoxine•HCl	1.0
Thiamine•HCl	1.0
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

C149 - Chu N6 Vitamin Solution (1000x)

Contains the vitamins as described by Chu *et al.* (1975).

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of medium
- Plant Tissue Culture Tested



Components (mg/L)	
Glycine	2000
Nicotinic Acid	500
Pyridoxine•HCI	500
Thiamine•HCI	1000
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

100mL

©2014 PhytoTechnology Laboratories®

C167 - Chu N6 Basal Medium with Vitamins

Contains the macro- and micronutrients and vitamins as described by Chu *et al.* (1975).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.99 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	463
Boric Acid	1.6
Calcium Chloride, Anhydrous	125.33
Na_2 EDTA·$2H_2O$	37.25
Ferrous Sulfate·$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.37
Manganese Sulfate·H_2O	3.3
Potassium Iodide	0.8
Potassium Nitrate	2830
Potassium Phosphate, Monobasic, Anhydrous	400
Zinc Sulfate·$7H_2O$	1.5
Glycine	2.0
Nicotinic Acid	0.5
Pyridoxine·HCl	0.5
Thiamine·HCl	1.0
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

C416 - Chu N6 Basal Salt Mixture

Contains the macro- and micronutrients as described by Chu *et al.* (1975).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.98 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	463
Boric Acid	1.6
Calcium Chloride, Anhydrous	125.33
Na_2 EDTA•$2H_2O$	37.25
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.37
Manganese Sulfate•H_2O	3.3
Potassium Iodide	0.8
Potassium Nitrate	2830
Potassium Phosphate, Monobasic, Anhydrous	400
Zinc Sulfate•$7H_2O$	1.5
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

C442 - Corn Meal Agar

See Phytopathology Section for Complete Listing

Czapek-Dox Broth & Agar

See Phytopathology Section for Complete Listings

D146 - DCR Basal Salt Mixture

Contains the macro- and micronutrients as described by Gupta & Durzan (1985).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.64 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Chloride, Anhydrous	64.14
Calcium Nitrate	386.31
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate·$5H_2O$	0.25
Na_2EDTA•$2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	22.3
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Nickel Chloride•$6H_2O$	0.025
Potassium Iodide	0.83
Potassium Nitrate	340
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

New Product

D2206 - De Greef & Jacobs Medium

Contains the macro- and micronutrients and vitamins as described by De Greef & Jacobs (1979).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.91 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	400
Boric Acid	10.62
Calcium Chloride, Anhydrous	226.5
Cobalt Chloride	0.0025
Cupric Sulfate	0.0025
Ferrous Sulfate	27.8
Magnesium Sulfate, anhydrous	244.33
Manganese Sulfate, monohydrate	1.68
Disodium EDTA, dihydrate	37.26
Potassium Chloride	600
Potassium Iodide	1.58
Potassium Nitrate	2000
Sodium Phosphate, monobasic	250
Sodium Molybdate	0.0025
Zinc Sulfate	1.06
myo-Inositol	100
Nicotinic Acid	1
Pyridoxine HCl	1
Thiamine HCl	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

D191 - DKW Basal Medium

Contains 10 g/L Sucrose; without vitamins.
Contains the macro- and micronutrients as described by Driver & Kuniyuki (1984) and McGranahan *et al.* (1987).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 15.22 grams per liter
- Plant Tissue Culture Tested

Note: The high calcium level in this medium may inhibit many gellan gums from completely melting during autoclaving. For this reason the use of Gellan Gum or Agargellan with this medium is not recommended as a clear, firm gel may not be obtained.

Components (mg/L)	
Ammonium Nitrate	1416
Boric Acid	4.8
Calcium Chloride, Anhydrous	112.5
Calcium Nitrate	1367
Cupric Sulfate•5H_2O	0.25
Na_2EDTA•2H_2O	45.4
Ferrous Sulfate•7H_2O	33.8
Magnesium Sulfate, Anhydrous	361.49
Manganese Sulfate•H_2O	33.5
Molybdic Acid, Disodium Salt•2H_2O	0.39
Nickel Sulfate•6H_2O	0.005
Potassium Phosphate, Monobasic, Anhydrous	265
Potassium Sulfate, Anhydrous	1559
Zinc Nitrate•6H_2O	17
Sucrose	10,000
Approximate pH at Room Temperature	4.0 ± 0.5

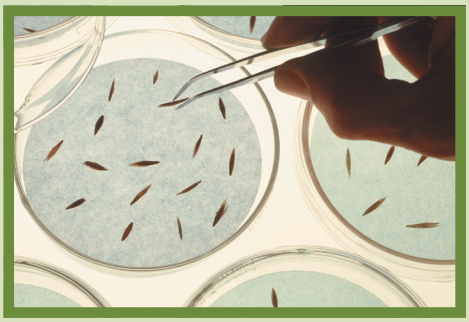
Available Package Sizes

1L 10L 50L

Find Seed Testing Products on Pages 161 to 168

- *PhytoSelect Basal Medium*
- *mD5A Medium*
- *Stains & Dyes*
- *King's B Medium*
- *Selection Agents*





©2014 PhytoTechnology Laboratories®

D189 - DKW Basal Medium

Contains 30 g/L Sucrose; without vitamins.
Contains the macro- and micronutrients as described by Driver & Kuniyuki (1984) and McGranahan *et al.* (1987).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 35.22 grams per liter
- Plant Tissue Culture Tested

Note: The high calcium level in this medium may inhibit many gellan gums from completely melting during autoclaving. For this reason the use of Gellan Gum or Agargellan with this medium is not recommended as a clear, firm gel may not be obtained.

Components (mg/L)	
Ammonium Nitrate	1416
Boric Acid	4.8
Calcium Chloride, Anhydrous	112.5
Calcium Nitrate	1367
Cupric Sulfate•$5H_2O$	0.25
$Na_2EDTA•2H_2O$	45.5
Ferrous Sulfate•$7H_2O$	33.8
Magnesium Sulfate, Anhydrous	361.49
Manganese Sulfate•H_2O	33.5
Molybdic Acid, Disodium Salt•$2H_2O$	0.39
Nickel Sulfate•$6H_2O$	0.005
Potassium Phosphate, Monobasic, Anhydrous	265
Potassium Sulfate, Anhydrous	1559
Zinc Nitrate•$6H_2O$	17
Sucrose	30,000
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

D190 - DKW Basal Salt Mixture

Contains the macro- and micronutrients as described by Driver & Kuniyuki (1984) and McGranahan *et al.* (1987).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.22 grams per liter
- Plant Tissue Culture Tested

Note: The high calcium level in this medium may inhibit many gellan gums from completely melting during autoclaving. For this reason the use of Gellan Gum or Agargellan with this medium is not recommended as a clear, firm gel may not be obtained.

Components (mg/L)	
Ammonium Nitrate	1416
Boric Acid	4.8
Calcium Chloride, Anhydrous	112.5
Calcium Nitrate	1367
Cupric Sulfate•$5H_2O$	0.25
$Na_2EDTA•2H_2O$	45.4
Ferrous Sulfate•$7H_2O$	33.8
Magnesium Sulfate, Anhydrous	361.49
Manganese Sulfate•H_2O	33.5
Molybdic Acid, Disodium Salt•$2H_2O$	0.39
Nickel Sulfate•$6H_2O$	0.005
Potassium Phosphate, Monobasic, Anhydrous	265
Potassium Sulfate, Anhydrous	1559
Zinc Nitrate•$6H_2O$	17
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

Find Phycology Products on Pages 169 to 174

- *Bold's Basal Medium*
- *Blue-Green Medium*
- *Tris Acetate Phosphate*
- *Seawater*
- *Sueoka's High Salt Medium*





New Product

D2470 - DKW Basal Medium with Vitamins

Contains the macro- and micronutrients as described by Driver & Kuniyuki (1984) and McGranahan *et al.* (1987).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.32 grams per liter
- Plant Tissue Culture Tested

Note: The high calcium level in this medium may inhibit many gellan gums from completely melting during autoclaving. For this reason the use of Gellan Gum or Agargellan with this medium is not recommended as a clear, firm gel may not be obtained.

Components (mg/L)	
Ammonium Nitrate	1416
Boric Acid	4.8
Calcium Chloride, Anhydrous	112.5
Calcium Nitrate	1367
Cupric Sulfate•$5H_2O$	0.25
$Na_2EDTA•2H_2O$	45.4
Ferrous Sulfate•$7H_2O$	33.8
Magnesium Sulfate, Anhydrous	361.49
Manganese Sulfate•H_2O	33.5
Molybdic Acid, Disodium Salt•$2H_2O$	0.39
Nickel Sulfate•$6H_2O$	0.005
Potassium Phosphate, Monobasic, Anhydrous	265
Potassium Sulfate, Anhydrous	1559
Zinc Nitrate•$6H_2O$	17
myo-Inositol	100
Glycine	2
Nicotinic Acid	1
Thiamine·HCl	2
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

E575 - Economou & Read Basal Medium

Contains the macro- and micronutrients and vitamins as described by Economou & Read (1984).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.84 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Ammonium Sulfate	132
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Iron Chelate, Sequestrene 330	56
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Nitrate	202
Potassium Phosphate, Monobasic, Anhydrous	408
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

E330 - Eriksson Vitamin Solution (1000x)

Contains the vitamins as described by Eriksson (1965).

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of medium
- Plant Tissue Culture Tested



Components (mg/L)	
Glycine	2000
Nicotinic Acid	500
Pyridoxine•HCl	500
Thiamine•HCl	500
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

100mL

©2014 PhytoTechnology Laboratories®

E333 - EXS IIIa™ Basal Medium with Adenine

Contains Adenine Hemisulfate (Product Number A545) and vitamins. Does not contain carbohydrates or gelling agents. EXS IIIa™ is a proprietary plant cell culture medium that was originally developed for the culture of foliage plants such as *Syngonium*, *Ficus* and *Spathiphyllum*.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.95 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

E337 - EXS III™ Basal Medium without Adenine

Contains vitamins. Without Adenine Hemisulfate. Does not contain carbohydrates or gelling agents.
EXS III™ is a proprietary plant cell culture medium that was originally developed for the culture of foliage plants such as *Syngonium*, *Ficus* and *Spathiphyllum*.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.87 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

f/2 Guillard's Marine Enriched Seawaters

See Phycology Section for Complete Listings

Custom Media & Services



*Phyto*Technology Laboratories® offers custom manufacturing and testing services. For more information please see page 12.

- Custom Dry Powder Media
- Custom Liquid Media
- Custom Packaging
- Testing Services

F522 - Fast Terrestrial Orchid Medium

Contains the macro- and micronutrients, vitamins, sucrose and fructose supplements required to culture terrestrial orchids. Contains Agar.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 27.84 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Aluminum Chloride	0.03
Ammonium Nitrate	167
Boric Acid	1
Calcium Nitrate	40.1
Cupric Sulfate•$5H_2O$	0.03
FeNaEDTA	17
Ferric Chloride•H_2O	1
Magnesium Sulfate, Anhydrous	19.8
Manganese Sulfate•H_2O	0.8
Nickle Chloride•$6H_2O$	0.03
Potassium Chloride	167
Potassium Iodide	0.01
Potassium Phosphate, Dibasic	83
Zinc Sulfate•$7H_2O$	1
Agar	7000
D-Biotin	0.01
Fructose	5000
Nicotinic Acid	0.1
Peptone from Meat	1670
Sucrose	11,670
Yeast Extract	2000
Approximate pH at Room Temperature	6.5 ± 0.5

Available Package Sizes

1L 10L 50L

Selecting Terrestrial Orchid Media by Genus

See "Figure 23. Terrestrial Orchid Media Selection Guide by Genus" on page 246 in the Technical Section.

G398 - Gamborg B-5 Basal Medium

Contains the macro- and micronutrients and vitamins as described by Gamborg *et al.* (1968).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	134
Boric Acid	3.0
Calcium Chloride, Anhydrous	113.24
Cobalt Chloride·6H_2O	0.025
Cupric Sulfate·5H_2O	0.025
Na_2 EDTA·2H_2O	37.26
Ferrous Sulfate·7H_2O	27.8
Magnesium Sulfate, Anhydrous	122.09
Manganese Sulfate·H_2O	10
Molybdic Acid, Disodium Salt·2H_2O	0.25
Potassium Iodide	0.75
Potassium Nitrate	2500
Sodium Phosphate, Monobasic·H_2O	150
Zinc Sulfate·7H_2O	2.0
myo-Inositol	100
Nicotinic Acid	1.0
Pyridoxine·HCl	1.0
Thiamine·HCl	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

G768 - Gamborg Basal Salt Mixture (B-5 Salts)

Contains the macro- and micronutrients as described by Gamborg *et al.* (1968).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.10 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	134
Boric Acid	3.0
Calcium Chloride, Anhydrous	113.24
Cobalt Chloride·6H_2O	0.025
Cupric Sulfate·5H_2O	0.025
Na_2 EDTA·2H_2O	37.26
Ferrous Sulfate·7H_2O	27.8
Magnesium Sulfate, Anhydrous	122.09
Manganese Sulfate·H_2O	10
Molybdic Acid, Disodium Salt·2H_2O	0.25
Potassium Iodide	0.75
Potassium Nitrate	2500
Sodium Phosphate, Monobasic·H_2O	150
Zinc Sulfate·7H_2O	2.0
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L

G249 - Gamborg Vitamin Powder (1000x)

Contains the vitamins as described by Gamborg *et al.* (1968). *myo*-Inositol may precipitate out of the prepared stock solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Soluble in Water
- Use 11.20 grams to make 100 mL of 1000x stock
- Use at 1.0 mL per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
myo-Inositol	100,000
Nicotinic Acid (Free Acid)	1000
Pyridoxine•HCl	1000
Thiamine•HCl	10,000
Approximate pH at Room Temperature	3.25 ± 0.5

Available Package Sizes

100 mL

©2014 PhytoTechnology Laboratories®

G219 - Gamborg Vitamin Solution (1000x)

Contains the vitamins as described by Gamborg *et al.* (1968). *myo*-Inositol may precipitate out of the prepared stock solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
myo-Inositol	100,000
Nicotinic Acid	1000
Pyridoxine•HCl	1000
Thiamine•HCl	10,000
Approximate pH at Room Temperature	3.5 ± 0.75

Available Package Sizes

100mL 500mL

Vitamins Mixtures for use in Plant Tissue Culture

See "Vitamin Formulations Table" on page 282 in the Technical Section.

Find Culture Vessels in the Equipment Section



For our full line of culture vessels, consult the equipment section on pages 183 to 214.

- Sterile Culture Vessels
- Reusable Culture Vessels
- Petri Dishes
- Culture Tubes

G371 - Gresshoff & Doy Basal Medium

Contains the macro- and micronutrients and vitamins as described by Gresshoff & Doy (1974).

- Store at 2 to 6 °C
- Soluble in Hot Water
- Use at 2.71 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1000
Boric Acid	0.3
Calcium Nitrate	241.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.25
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	17.1
Manganese Sulfate•H_2O	1.0
Molybdic Acid, Disodium Salt•$2H_2O$	0.025
Potassium Chloride	65
Potassium Iodide	0.8
Potassium Nitrate	1000
Potassium Phosphate, Monobasic, Anhydrous	300
Zinc Sulfate•$7H_2O$	0.3
D-Biotin	0.2
Glycine	4.0
myo-Inositol	10
Nicotinic Acid	0.1
Pyridoxine•HCl	0.1
Thiamine•HCl	1.0
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

H289 - Hanahan's Broth

See Microbiology Section for Complete Listing

H396 - Heller/White Modified Basal Salt Mixture

Without Molybdenum Trioxide
Contains the macro- and micronutrients as described by Heller (1953) and White (1963).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.04 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Aluminum Chloride•$6H_2O$	0.03
Boric Acid	1.24
Calcium Nitrate	300
Cupric Sulfate•$5H_2O$	0.03
Ferric Sulfate•xH_2O	25
Magnesium Sulfate, Anhydrous	351.63
Manganese Sulfate•H_2O	0.01
Nickel Chloride•$6H_2O$	0.03
Potassium Chloride	65
Potassium Iodide	0.01
Potassium Nitrate	80
Sodium Phosphate, Monobasic•H_2O	16.5
Sodium Sulfate, Anhydrous	200
Zinc Sulfate•$7H_2O$	1.0
Approximate pH at Room Temperature	3.5 ± 0.75

Available Package Sizes

1L 10L 50L 100L

O612 - H1 Oat Medium

Contains the macro- and macronutrients and supplements required for the symbiotic culture of orchids. Contains Agar and Sucrose.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 12.52 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Calcium Nitrate	96.6
Magnesium Sulfate	23.9
Potassium Chloride	100
Potassium Phosphate, Monobasic	200
Agar	7000
Sucrose	2000
Rolled Oats	3000
Yeast Extract	100
Approximate pH at Room Temperature	6.0 ± 1.0

Available Package Sizes

1L 10L

O622 - H2 Oat Medium

Contains the macro- and micronutrients and supplements required for the symbiotic culture of orchids. Contains Agar and Glucose.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 12.52 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Calcium Nitrate	96.6
Magnesium Sulfate	23.9
Potassium Chloride	100
Potassium Phosphate, Monobasic	200
Agar	7000
Glucose	2000
Rolled Oats	3000
Yeast Extract	100
Approximate pH at Room Temperature	6.0 ± 1.0

Available Package Sizes

1L 10L

H393 - Heller Basal Salt Mixture

Contains the macro- and micronutrients as described by Heller (1953).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.64 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Aluminum Chloride•$6H_2O$	0.0543
Boric Acid	1.0
Calcium Chloride, Anhydrous	56.7
Cupric Sulfate•$5H_2O$	0.03
Ferric Chloride•$6H_2O$	1.0
Magnesium Sulfate, Anhydrous	122.1
Manganese Sulfate•H_2O	0.0758
Molybdenum Trioxide	0.03
Potassium Chloride	750
Potassium Iodide	0.01
Sodium Nitrate	600
Sodium Phosphate, Monobasic•H_2O	108.75
Zinc Sulfate•$7H_2O$	1.0
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

H353 - Hoagland Modified Basal Salt Mixture

Contains Ferrous Sulfate
Contains the macro- and micronutrients as described by Hoagland & Arnon (1950).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.63 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	115.03
Boric Acid	2.86
Calcium Nitrate	656.4
Cupric Sulfate•5H_2O	0.08
$Na_2EDTA•2H_2O$	3.35
Ferrous Sulfate•7H_2O	2.50
Magnesium Sulfate, Anhydrous	240.76
Manganese Chloride•4H_2O	1.81
Molybdenum Trioxide	0.016
Potassium Nitrate	606.6
Zinc Sulfate•7H_2O	0.22
Approximate pH at Room Temperature	4.75 ± 0.5

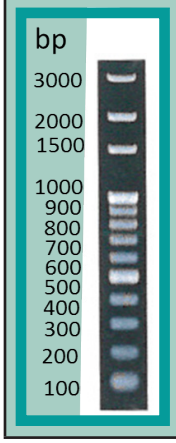
Available Package Sizes

1L 10L 50L 100L

For Help Preparing Tissue Culture Media

See "Figure 7. Basic Steps to Preparing 1 Liter of Medium" on page 229 in the Technical Section.

Molecular Biology Kits



*Phyto*Technology Laboratories® offers a variety of kits for molecular biology. Please see the molecular biology section on pages 129 to 148 for more information.

- RNA Extraction Kits
- Genomic DNA Extraction Kits
- Plasmid DNA Extraction Kits
- DNA Ladder Kits

New Product

H3959 - Hosta Initiation/Multiplication Medium II

A modification of the macro- and micronutrients of Murashige and Skoog Basal Medium (M524) with vitamins, PGRs, Sucrose and Agar.

- Store at 2 to 6 °C
- Partially soluble in Water
- Use at 43.4 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
6-Benzylaminopurine	2
Adenine Hemisulfate	160
Agar	8000
Ammonium Nitrate	1650
α-Naphthaleneacetic Acid	0.02
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Casein Hydrolysate	500
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferrous Sulfate•7H_2O	27.8
Glycine	2
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
myo-Inositol	100
$Na_2EDTA•2H_2O$	37.26
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	300
Sodium Phosphate, Monobasic•H_2O	170
Sucrose	30,000
Thiamine•HCl	0.4
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.5 ± 0.75

Available Package Sizes

1L 10L 50L

H435 - Hosta Initiation/ Multiplication Medium

Stage I/II Medium
Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains sucrose and agar.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling/Hot Water
- Use at 43.40 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	300
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	160
Agar	8000
6-Benzylaminopurine	2.0
Casein, Enzymatic Hydrolysate	500
Glycine	2.0
myo-Inositol	100
α-Naphthaleneacetic Acid	0.5
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.5 ± 0.75

Available Package Sizes

1L 10L 50L

H436 - Hosta Multiplication Medium

Stage II Medium
Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains Sucrose and Agar.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling/Hot Water
- Use at 43.39 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	300
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	160
Agar	8000
6-Benzylaminopurine	0.1
Casein, Enzymatic Hydrolysate	500
Glycine	2.0
myo-Inositol	100
α-Naphthaleneacetic Acid	0.5
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.5 ± 0.75

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

H437 - Hosta Rooting Medium

Stage III Medium
Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains Sucrose and Agar.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling/Hot Water
- Use at 43.23 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	300
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•$7H_2O$	8.6
Agar	8000
6-Benzylaminopurine	0.1
Casein, Enzymatic Hydrolysate	500
myo-Inositol	100
α-Naphthaleneacetic Acid	0.5
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.0 ± 0.75

Available Package Sizes

1L 10L 50L

I365 - Ichihashi New *Phalaenopsis* (NP) Medium

Contains the components as described by Ichihashi (1992); modified to contain 82.0 mg/L Ammonium Nitrate (Product Number A300).

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Boiling/Hot Water
- Use at 25.35 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	82
Ammonium Sulfate	303.9
Boric Acid	3.1
Calcium Nitrate	637.6
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
$Na_2EDTA•2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Nitrate•$6H_2O$	256.4
Manganese Sulfate•H_2O	11.2
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	424
Potassium Phosphate, Monobasic, Anhydrous	462.7
Zinc Sulfate•$7H_2O$	4.3
Gellan Gum, CultureGel™ – Biotech	3000
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

K427 - Kao & Michayluk Modified Basal Medium

Contains the macro- and micronutrients, vitamins, and organic supplements as described by Kao & Michayluk (1975).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.90 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	600
Boric Acid	3.0
Calcium Chloride, Anhydrous	453
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	146.55
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Chloride	300
Potassium Iodide	0.75
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	2.0
p-Aminobenzoic Acid	0.02
L-Ascorbic Acid	2.0
D-Biotin	0.01
Calcium Pantothenate	1.0
Cholecalciferol; Vitamin D_3	0.01
Choline Chloride	1.0
Citric Acid, Anhydrous	40
Cyanocobalamin; Vitamin B_{12}	0.02
Folic Acid	0.4
Fumaric Acid, Free Acid	40
Malic Acid	40
myo-Inositol	100
Niacinamide	1.0
Pyridoxine•HCl	1.0
Pyruvic Acid, Potassium Salt	20
Retinol; Vitamin A	0.01
Riboflavin	0.2
Thiamine•HCl	1.0
Approximate pH at Room Temperature	3.5 ± 0.75

Available Package Sizes

1L 10L 50L 100L

K413 - Kao & Michayluk Basal Salt Mixture

Contains the macro- and micronutrients as described by Kao & Michayluk (1975).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.65 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	600
Boric Acid	3.0
Calcium Chloride, Anhydrous	453
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2 EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	146.55
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Chloride	300
Potassium Iodide	0.75
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	2.0
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

Custom Media & Services



*Phyto*Technology Laboratories® offers custom manufacturing and testing services. For more information please see page 12.

- Custom Dry Powder Media
- Custom Liquid Media
- Custom Packaging
- Testing Services

©2014 *Phyto*Technology Laboratories®

K421 - Kao & Michayluk Vitamin Solution (100x)

Contains the vitamins as described by Kao & Michayluk (1975).

- Store at -20 to 0 °C
- Sterile Filtered
- Miscible with Water
- Use at 10.0 mL per liter of Medium
- Plant Tissue Culture Tested



Components (mg/L)	
p-Aminobenzoic Acid	2.0
L-Ascorbic Acid	200
D-Biotin	1.0
Calcium Pantothenate	100
Choline Chloride	100
Cyanocobalamin; Vitamin B_{12}	2.0
Folic Acid	40
myo-Inositol	10,000
Niacinamide	100
Pyridoxine•HCl	100
Retinol; Vitamin A	1.0
Riboflavin	20
Thiamine•HCl	100
Approximate pH at Room Temperature	5.25 ± 1.75

Available Package Sizes

100mL 500mL 1L

K5013 - King's B Medium

See Seed Testing Section for Complete Listing

K400 - Knudson C Orchid Medium Morel Modification

Contains the components as described by Knudson (1946) as modified by Morel (1965).
For optimal results, this medium may be supplemented with 5-10% (v/v) Cocount Water (Product Number C195) or 30-50 g/L Banana Powder (Product Number B852).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 22.00 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	500
Ammonium Sulfate	500
Calcium Nitrate	347.2
Ferrous Sulfate•$7H_2O$	25
Magnesium Sulfate, Anhydrous	122.13
Manganese Sulfate•H_2O	5.68
Potassium Chloride	250
Potassium Phosphate, Monobasic, Anhydrous	250
Sucrose	20,000
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

Epiphytic Orchid Media Selection Guide

See "Figure 22. Epiphytic Orchid Media Selection Guide" on page 245 in the Technical Section.

K425 - Knudson C Modified Plus Orchid Medium

Proprietary Formulation
A complete orchid replate and seed sowing medium.
Contains Activated Charcoal, Sucrose, Banana Powder, and a Gelling Agent.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 79.11 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

LB Broths & Agars

See Microbiology Section for Complete Listings

L476 - Leifert & Waites Sterility Test Medium

See Phytopathology Section for Complete Listing

L154 - Lloyd & McCown Woody Plant Basal Salt Mixture

Contains the macro- and micronutrients as described by Lloyd & McCown (1981).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.30 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Chloride, Anhydrous	72.5
Calcium Nitrate	386
Cupric Sulfate•$5H_2O$	0.25
$Na_2EDTA•2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	22.3
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Phosphate, Monobasic, Anhydrous	170
Potassium Sulfate, Anhydrous	990
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L 100L

L472 - Lindemann Orchid Basal Medium

Contains the macro- and micronutrients as described by Lindemann *et al.* (1970); contains Sucrose and Vitamins. A complete orchid replate and seed sowing medium.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Warm to Hot Water
- Use at 22.71 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Aluminum Chloride•$6H_2O$	0.0561
Ammonium Sulfate	1000
Boric Acid	1.014
Calcium Nitrate	347.2
Cupric Sulfate•$5H_2O$	0.019
Ferric Citrate	4.4
Magnesium Sulfate, Anhydrous	58.62
Manganese Sulfate•H_2O	0.0515
Nickel Chloride•$6H_2O$	0.0312
Potassium Chloride	1050
Potassium Iodide	0.099
Potassium Phosphate, Monobasic, Anhydrous	135
Zinc Sulfate•$7H_2O$	0.565
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	1.0
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

Find Phytopathology Media on Pages 157 to 160

- *Oat Meal Agar*
- *Czapex & Dox Agar & Broth*
- *Bacterial Screening Media*
- *Potato Dextrose Agar & Broth*
- *Corn Meal Agar*





©2014 PhytoTechnology Laboratories®

L467 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose & 7 g/L Agar

Contains the macro- and micronutrients and vitamins as described by Linsmaier & Skoog (1965). Also contains 30 g/L Sucrose and 7 g/L Agar.
This medium may be sold as Murashige & Skoog (MS) Medium with Minimal Organics (MSMO) by some media suppliers.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 41.43 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Agar	7000
myo-Inositol	100
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

L452 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose & 7 g/L Agar

pH Adjusted and Buffered
Contains the macro- and micronutrients and vitamins as described by Linsmaier & Skoog (1965). Also contains 30 g/L Sucrose and 7 g/L Agar.
This medium may be sold as Murashige & Skoog (MS) Medium with Minimal Organics (MSMO) by some media suppliers.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 42.53 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Hydroxide	100
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Agar	7000
myo-Inositol	100
MES (Free Acid) •H_2O	1000
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

L689 - Linsmaier & Skoog Basal Medium

Contains the macro- and micronutrients and vitamins as described by Linsmaier & Skoog (1965).
This medium may be sold as Murashige & Skoog (MS) Minimal Organics (MSMO) by some media suppliers.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.43 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA{\cdot}2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

L473 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose

pH Adjusted and Buffered
Contains the macro- and micronutrients and vitamins as described by Linsmaier & Skoog (1965). This medium may be sold as Murashige & Skoog (MS) Medium with Minimal Organics (MSMO) by some media suppliers.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 35.53 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA{\bullet}2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Hydroxide	100
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
MES (Free Acid)•H_2O	1000
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

L477 - Linsmaier & Skoog Modified Basal Medium

pH Adjusted and Buffered
Contains the macro- and micronutrients and vitamins as described by Linsmaier & Skoog (1965).
This medium may be sold as Murashige & Skoog (MS) Medium with Minimal Organics (MSMO) by some media suppliers.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.53 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
$Na_2EDTA•H_2O$	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Hydroxide	100
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
myo-Inositol	100
MES•H_2O	1000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

L546 - Litvay Basal Salt Mixture

Contains the macro- and micronutrients as described by Litvay *et al.* (1981).
Originally developed for the culture of both juvenile and mature tissues of Douglas-fir (*Pseudotsuga menziesii*) and Loblolly pine (*Pinus taeda*).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.95 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	31
Calcium Chloride, Anhydrous	16.61
Cobalt Chloride•6H_2O	0.125
Cupric Sulfate•5H_2O	0.5
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	903.38
Manganese Sulfate•H_2O	21
Molybdic Acid, Disodium Salt•2H_2O	1.25
Potassium Iodide	4.15
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	340
Zinc Sulfate•7H_2O	43
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

L444 - Lloyd & McCown Woody Plant Micronutrient Mixture

Contains the micronutrients as described by Lloyd & McCown (1981).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.53 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	6.2
Calcium Chloride, Anhydrous	72.5
Cupric Sulfate•5H_2O	0.25
Na_2 EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	22.3
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

L449 - Lloyd & McCown Woody Plant Basal Medium with Vitamins

Contains the macro- and micronutrients and vitamins as described by Lloyd & McCown (1981).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Chloride, Anhydrous	72.5
Calcium Nitrate	386
Cupric Sulfate•5H_2O	0.25
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	22.3
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Phosphate, Monobasic, Anhydrous	170
Potassium Sulfate, Anhydrous	990
Zinc Sulfate•7H_2O	8.6
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	1.0
Approximate pH at Room Temperature	4.0 ± 0.5

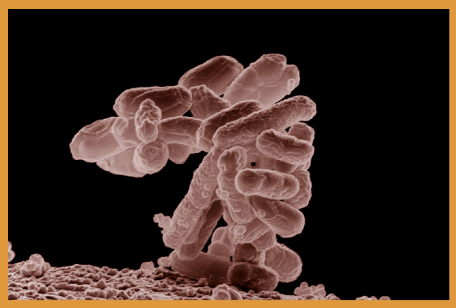
Available Package Sizes

1L 10L 50L

Find Microbiology Media on Pages 149 to 156

- *LB Agars and Broths*
- *Tryptic Soy Broth*
- *YEP Media*
- *Hanahan's Broth*
- *Peptone Waters*





©2014 PhytoTechnology Laboratories®

M551 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose

Contains the macro- and micronutrients, agar, and organic components as described by Malmgren (1996). Does not contain Sucrose.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 28.84 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Calcium Phosphate, Tribasic	75
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Potassium Phosphate, Monobasic, Anhydrous	75
Activated Charcoal	1000
Agar	7000
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	400
Folic Acid	0.5
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pineapple Powder	20,000
Pyridoxine•HCl	5.0
Thiamine•HCl	10
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

M534 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose & Agar

Contains the macro- and micronutrients, and organic components as described by Malmgren (1996). Does not contain Sucrose or Agar.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 21.84 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Calcium Phosphate, Tribasic	75
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Potassium Phosphate, Monobasic, Anhydrous	75
Activated Charcoal	1000
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	400
Folic Acid	0.5
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pineapple Powder	20,000
Pyridoxine•HCl	5.0
Thiamine•HCl	10
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

M482 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose, Agar, & Pineapple Powder

Contains the macro- and micronutrients, and organic components as described by Malmgren (1996). Does not contain Sucrose, Agar, or Pineapple Powder.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 1.84 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Calcium Phosphate, Tribasic	75
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Potassium Phosphate, Monobasic, Anhydrous	75
Activated Charcoal	1000
D-Biotin	0.05
Casein, Enzymatic Hydrolysate	400
Folic Acid	0.5
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	5.0
Thiamine•HCl	10
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

Malt Extract Broth & Agar

See Microbiology Section for Complete Listings

M5516 - mD5A Medium

See Seed Testing Section for Complete Listing

M419 - MG Basal Salt Mixture

Modified Murashige & Skoog/Gamborg Basal Salt Mixture Contains the macronutrients as described by Murashige & Skoog (1962) and the micronutrients as described by Gamborg *et al.* (1968).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.88 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	33.5
Boric Acid	2.3
Calcium Chloride, Anhydrous	111.36
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
Na_2 EDTA•$2H_2O$	18.64
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	75.7
Manganese Sulfate•H_2O	6.7
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.4
Potassium Nitrate	1100
Potassium Phosphate, Monobasic, Anhydrous	42.5
Sodium Nitrate	437.8
Sodium Phosphate, Monobasic•H_2O	32.6
Zinc Sulfate•$7H_2O$	2.7
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

M579 - Mitra Maintenance/Replate Medium

Contains the macro- and micronutrients, vitamins, and supplements as described by Mitra *et al.* (1976) for the culture of orchids. Contains Activated Charcoal, Agar, and Sucrose.

- Store at 2 to 6 °C
- Soluble in Water (Partially), Fully Soluble in Hot/Boiling Water
- Use at 29.82 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	100
Boric Acid	0.6
Calcium Nitrate	100
Cobalt Nitrate•$6H_2O$	0.05
Cupric Sulfate•$5H_2O$	0.05
$Na_2EDTA•2H_2O$	22.3
Ferrous Sulfate•$7H_2O$	16.7
Manganese Chloride•$4H_2O$	0.4
Magnesium Sulfate, Anhydrous	250
Molybdic Acid, Disodium Salt•$2H_2O$	0.05
Potassium Iodide	0.03
Potassium Nitrate	180
Sodium Phosphate•H_2O	150
Zinc Sulfate•$7H_2O$	0.05
Activated Charcoal	2000
Agar	7000
D-Biotin	0.05
Folic Acid	0.3
Nicotinic Acid	1.25
Pyridoxine•HCl	0.3
Riboflavin	0.05
Sucrose	20,000
Thiamine•HCl	0.3
Approximate pH at Room Temperature	5.75 ± 0.75

Available Package Sizes

1L 10L 50L

Terrestrial Orchid Media Selection Guide

See "Figure 21. Terrestrial Orchid Media Selection Guide" on page 245 in the Technical Section.

M587 - Morel & Martin Vitamin Solution (100x)

Contains the vitamins as described by Morel & Martin (1955). *myo*-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 10 mL per liter of medium
- Plant Tissue Culture Tested



Components (mg/L)	
D-Biotin	0.1
D-Calcium pantothenate	100
myo-Inositol	10,000
Nicotinic Acid	100
Pyridoxine•HCl	100
Approximate pH at Room Temperature	4.3 ± 0.75

Available Package Sizes

100mL

M580 - Modified Melin-Norkrans Medium

See Microbiology Section for Complete Listing

Find Culture Vessels in the Equipment Section



For our full line of culture vessels, consult the equipment section on pages 183 to 214.

- Sterile Culture Vessels
- Reusable Culture Vessels
- Petri Dishes
- Culture Tubes

New Product

M5800 - Murashige & Skoog Basal Medium with EDTA Ferric-Sodium Salt

Contains the macro- and micronutrients and vitamins as described by Murashige and Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.41 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
FeNaEDTA	36.7
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine (Free Base)	2
myo-Inositol	100
Nicotinic Acid (Free Acid)	0.5
Pyridoxine HCl	0.5
Thiamine HCl	0.1
Approximate pH at Room Temperature	5.0 ± 0.75

Available Package Sizes

1L 10L 50L 100L

M519 - Murashige & Skoog Basal Medium with Vitamins

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.43 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• $2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 5L 10L 10LFB 50L 100L

For Find Media for the Various Stages of Tissue Culture Plant Growth

See "Figure 5. Examples of Media Designed for a Specific Stage of Growth" on page 227 in the Technical Section.

©2014 PhytoTechnology Laboratories®

New Product

M5501 - Murashige & Skoog Basal Medium with Vitamins and Sucrose

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 34.43 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• 2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	30,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L 100L

New Product

M5530 - Murashige & Skoog Basal Medium with Vitamins and Sucrose Solution (1x)

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Sterile Filtered
- 1x Solution
- Plant Tissue Culture Tested



Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• 2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	30,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

500mL 1L

Find Biochemicals on Pages 15 to 54

- *Gelling Agents*
- *Plant Growth Regulators*
- *Media Components*
- *Stains and Dyes*
- *Carbohydrates*





New Product

M5615 - Murashige & Skoog Basal Medium with Vitamins, Glucose and Sucrose Solution (1x)

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Sterile Filtered
- 1x Solution
- Plant Tissue Culture Tested



Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• $2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	15,000
Glucose	15,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

500mL 1L

New Product

M5707 - Murashige & Skoog Basal Medium with Vitamins, Glucose, and Sucrose

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 34.43 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• $2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
D-Glucose	20,000
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	10,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L 100L

©2014 PhytoTechnology Laboratories®

New Product

M5825 - Murashige & Skoog Basal Medium with Vitamins, Sucrose and Gelzan

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Partially soluble in Water
- Use at 36.43 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• $2H_2O$	0.25
Gelzan	2000
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	30,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 5L 10L 50L

New Product

M5642 - Murashige & Skoog Basal Medium, Van Der Salm Modification

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the iron source as described by Van der Salm *et al.* (1994).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.46 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
FeNa-EDDHA	96
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.1
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

New Product

M5541 - Murashige & Skoog Basal Salt Mixture Van der Salm Modification

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962) with the iron source as described by Van der Salm *et al.* (1994).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.36 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
FeNa-EDDHA	96.0
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	approx. 5.0

Available Package Sizes

1L 10L 50L

M576 - Murashige & Skoog Basal Salt Concentrate (20x)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 50.0 mL per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	33,000
Boric Acid	124
Calcium Chloride, Anhydrous	6644
Cobalt Chloride•6H_2O	0.5
Cupric Sulfate•5H_2O	0.5
Na_2EDTA•2H_2O	745.2
Ferrous Sulfate•7H_2O	556
Magnesium Sulfate, Anhydrous	3614
Manganese Sulfate•H_2O	338
Molybdic Acid, Disodium Salt•2H_2O	5.0
Potassium Iodide	16.6
Potassium Nitrate	38,000
Potassium Phosphate, Monobasic, Anhydrous	3400
Zinc Sulfate•7H_2O	172
Approximate pH at Room Temperature	3.25 ± 0.5

Available Package Sizes

500mL 1L

Find Molecular Biology Products on Pages 129 to 148

- *Antibiotics*
- *Buffers*
- *DNA Extraction Kits*
- *Sterile Solutions*
- *IPTG, X-Gal & X-Gluc*





©2014 PhytoTechnology Laboratories®

M524 - Murashige & Skoog Basal Salt Mixture

Contains the macro- and micronutrients as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.33 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 5L 10L 10LFB 50L 100L

For Help Preparing Tissue Culture Media

See "Figure 7. Basic Steps to Preparing 1 Liter of Medium" on page 229 in the Technical Section.

M502 - Murashige & Skoog Macronutrient Salt Base

Contains the macronutrients as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.23 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Calcium Chloride, Anhydrous	332.2
Magnesium Sulfate, Anhydrous	180.7
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Approximate pH at Room Temperature	4.75 ± 0.75

Available Package Sizes

1L 10L 50L 100L

M654 - Murashige & Skoog Macronutrient Stock Solution (10x)

Contains the macronutrients as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 100.0 mL per liter
- Plant Tissue Culture Tested



Components (mg/L)	
Ammonium Nitrate	16,500
Calcium Chloride, Anhydrous	3322
Magnesium Sulfate, Anhydrous	1807
Potassium Nitrate	19,000
Potassium Phosphate, Monobasic, Anhydrous	1700
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

500mL 1L

M554 - Murashige & Skoog Micronutrient Salt Base

Contains the micronutrients as described by Murashige & Skoog (1962).

- Store at -20 to 0 °C
- Soluble in Water
- Use at 0.10 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	6.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.3 ± 0.5

Available Package Sizes

1L 10L 50L 100L

New Product

M5531 - Murashige & Skoog Medium with 1g/L MES

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.43 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt• $2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.1
MES	1000
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M535 - Murashige & Skoog Modified Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains 80 mg/L Adenine Hemisulfate. Comporable to Linsmaier & Skoog Basal Medium (L689) with an added 80 mg/L Adenine Hemisulfate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.51 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L 100L

©2014 PhytoTechnology Laboratories®

M701 - Murashige & Skoog Modified Basal Medium

This medium may be sold as Murashige Begonia Multiplication Medium by some media suppliers. Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains (mg/L): 30.0 Adenine Hemisulfate, 10.0 2iP, 1.0 IAA, and Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	30.0
6-(γ,γ-Dimethylallylamino)purine; 2iP	10.0
Indole-3-acetic Acid	1.0
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

M541 - Murashige & Skoog Modified Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and modified vitamins with the following exception: Without Potassium Phosphate Monobasic. Also contains (mg/L):
300 Sodium Phosphate Monobasic, 150 Adenine Hemisulfate, 1000 Casein, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.69 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Sodium Phosphate, Monobasic•H_2O	300
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	150
Casein, Enzymatic Hydrolysate	1000
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	1.0
Thiamine•HCl	0.5
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

M401 - Murashige & Skoog Modified Basal Medium

Contains the macro- and micronutrients and vitamins as described by Murashige & Skoog (1962); modified with the addition of (mg/L): 1.0 BA and 0.1 NAA. Also contains 30 g/L Sucrose.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 34.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
6-Benzylaminopurine	1.0
Glycine	2.0
myo-Inositol	100
α-Naphthaleneacetic Acid	0.1
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M404 - Murashige & Skoog Modified Basal Medium with Gamborg Vitamins

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Gamborg *et al.* (1968).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
Nicotinic Acid	1
Pyridoxine•HCl	1
Thiamine•HCl	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

©2014 PhytoTechnology Laboratories®

M504 - Murashige & Skoog Modified Basal Salt Mixture

Finer & Nagasawa (1988) Modification
Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exceptions: Contains 1.6x Potassium Nitrate, 0.5x Ammonium Nitrate, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.61 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	180.54
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	3030
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

M499 - Murashige & Skoog Modified Basal Salt Mixture

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exception: Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.30 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.75 ± 0.5

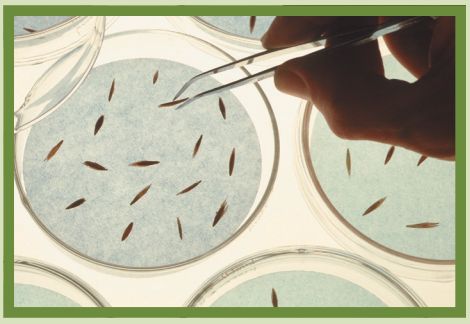
Available Package Sizes

1L 10L 50L 100L

Find Seed Testing Products on Pages 161 to 168

- *PhytoSelect Basal Medium*
- *mD5A Medium*
- *Stains & Dyes*
- *King's B Medium*
- *Selection Agents*





M290 - Murashige & Skoog Modified Basal Salt Mixture (½x Nitrates & ½x Calcium)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exceptions: ½ Ammonium Nitrate, ½ Potassium Nitrate, and ½ Calcium Chloride.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.39 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	6.2
Calcium Chloride, Anhydrous	166.1
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L 100L

M153 - Murashige & Skoog Modified Basal Salt Mixture (½x Macros & Micros)

Contains ½ the macro- and micronutrients as described by Murashige & Skoog (1962).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.17 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166.1
Cobalt Chloride•6H_2O	0.0125
Cupric Sulfate•5H_2O	0.0125
Na_2EDTA•2H_2O	18.63
Ferrous Sulfate•7H_2O	13.9
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•2H_2O	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•7H_2O	4.3
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

M561 - Murashige & Skoog Modified Basal Salt Mixture (½x Nitrates)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exceptions: ½ Ammonium Nitrate and ½ Potassium Nitrate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.56 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M531 - Murashige & Skoog Modified Basal Salt Mixture (Without Nitrogen)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exceptions: Without Ammonium Nitrate & Potassium Nitrate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.78 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M407 - Murashige & Skoog Modified Basal Salt Mixture (Without Nitrogen, Phosphorous, and Potassium)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exceptions: Without Ammonium Nitrate, Potassium Nitrate, and Potassium Phosphate, Monobasic.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.61 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.3 ± 0.5

Available Package Sizes

1L 10L 50L

M571 - Murashige & Skoog Modified Basal Salt Mixture (Without NH_4NO_3)

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) with the following exception: Without Ammonium Nitrate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.68 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

Tissue Culture Kits



*Phyto*Technology Laboratories® offers a selection of plant tissue culture kits for educational use. For more information please see pages 175 to 182.

Kits for:
– African Violet,
– Carrot,
– Carnivorous Plants,
– Fern,
– Hosta,
– Lily,
– Orchids, and
– Potato.

©2014 PhytoTechnology Laboratories®

M516 - Murashige & Skoog Modified BC Potato Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962). Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA. Also contains Kinetin (Product Number K750) and the vitamins cited below.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Glycine	2.0
myo-Inositol	100
Kinetin	0.04
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

M702 - Murashige & Skoog Modified Medium

Contains the macro- and micronutrients as described by Murashige and Skoog (1962) and the vitamins described by Linsmaier and Skoog (1965). Contains 30 g/L Sucrose. Also contains: 148 mg/L Sodium Phosphate Monobasic, 80 mg/L Adenine Hemisulfate, 30 mg/L 2iP, and 0.3 mg/L IAA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 34.69 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	148
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
6-(γ,γ-Dimethylallylamino)purine; 2iP	30
Indole-3-acetic Acid	0.3
myo-Inositol	100
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.0 ± 0.75

Available Package Sizes

1L 10L 50L

M550 - Murashige & Skoog Modified Medium Arabidopsis Culture Medium

Contains the macro- and micronutrients as described by Murashige and Skoog (1962) and modified vitamins. Contains 20 g/L Sucrose. Also contains: 2.0 mg/L 2,4-D and 0.05 mg/L Kinetin.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 24.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
2,4-Dichlorophenoxyacetic Acid	2.0
myo-Inositol	100
Kinetin	0.05
Nicotinic Acid	1.0
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10.0
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L

M555 - Murashige & Skoog Modified Multiplication Medium

This medium may be sold as Murashige & Skoog (MS) Shoot Multiplication Medium C by some media suppliers. Contains the macro- and micronutrients as described by Murashige and Skoog (1962) and the vitamins described by Linsmaier and Skoog (1965). Contains 30 g/L Sucrose. Also contains: 148 mg/L Sodium Phosphate Monobasic, 80 mg/L Adenine Hemisulfate, 1.0 mg/L Kinetin, 0.1 mg/L NAA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 34.66 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	148
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
myo-Inositol	100
Kinetin	1.0
α-Naphthaleneacetic Acid	0.1
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

M547 - Murashige & Skoog Modified Vitamin Powder (1000x)

Contains the vitamins as described by Murashige & Skoog (1962) modified with additional Thiamine HCl (Product Number T390).
myo-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Soluble in Water
- Use 10.40 grams to make 100 mL
- Use at 1.0 mL per liter of Medium
- Plant Tissue Culture Tested

Components (mg/L)	
Glycine	2000
myo-Inositol	100,000
Nicotinic Acid	500
Pyridoxine•HCl	500
Thiamine•HCl	1000
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

100mL 250mL

Vitamins Mixtures for use in Plant Tissue Culture

See "Vitamin Formulations Table" on page 282 in the Technical Section.

M557 - Murashige & Skoog Modified Vitamin Solution (1000x)

Contains the vitamins as described by Murashige & Skoog (1962) modified with additional Thiamine HCl Product Number T390).
myo-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of Medium
- Plant Tissue Culture Tested



Components (mg/L)	
Glycine	2000
myo-Inositol	100,000
Nicotinic Acid	500
Pyridoxine•HCl	500
Thiamine•HCl	1000
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

100 mL

M553 - Murashige & Skoog Vitamin Solution (1000x)

Contains the vitamins as described by Murashige & Skoog (1962).
myo-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of Medium
- Plant Tissue Culture Tested

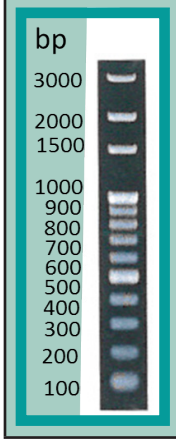


Components (mg/L)	
Glycine	2000
myo-Inositol	100,000
Nicotinic Acid	500
Pyridoxine•HCl	500
Thiamine•HCl	100
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

100 mL

Molecular Biology Kits



*Phyto*Technology Laboratories® offers a variety of kits for molecular biology. Please see the molecular biology section on pages 129 to 148 for more information.

- RNA Extraction Kits
- Genomic DNA Extraction Kits
- Plasmid DNA Extraction Kits
- DNA Ladder Kits

M517 - Murashige Modified African Violet/ Gloxinia Multiplication Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains:
170 mg/L Sodium Phosphate Monobasic, 80 mg/L Adenine Hemisulfate, 2.0 mg/L IAA, 2.0 mg/L Kinetin, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.66 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
Indole-3-acetic Acid	2.0
Kinetin	2.0
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M518 - Murashige Modified African Violet/ Gloxinia Pretransplant Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 1.0 mg/L IAA, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.40 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Indole-3-acetic Acid	1.0
myo-Inositol	100
Thiamine•HCI	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

M507 - Murashige Modified Cattleya Orchid Multiplication Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and modified vitamins. Contains 20 g/L Sucrose. Also contains: 150 mg/L Citric Acid, 0.3 mg/L IAA, 1.75 mg/L IBA, 1.75 mg/L NAA, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 24.57 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Citric Acid, Anhydrous	150
Glycine	2.0
Indole-3-acetic Acid	0.3
Indole-3-butyric Acid	1.75
myo-Inositol	100
α-Naphthaleneacetic Acid	1.75
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	3.25 ± 0.5

Available Package Sizes

1L 10L 50L

Selecting Epiphytic Orchid Media by Genus

See "Figure 24. Epiphytic Orchid Media Selection Guide by Genus" on page 247 in the Technical Section.

M508 - Murashige Modified Fern Multiplication Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 255 mg/L Sodium Phosphate Monobasic, 2.0 mg/L Kinetin, 0.1 mg/L NAA, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.66 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	255
Zinc Sulfate•$7H_2O$	8.6
Kinetin	2.0
myo-Inositol	100
α-Naphthaleneacetic Acid	0.1
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

M509 - Murashige Modified Gerbera Multiplication Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and modified vitamins. Also contains: 85 mg/L Sodium Phosphate Monobasic, 80 mg/L Adenine Hemisulfate, 10.0 mg/L Kinetin, 0.5 mg/L IAA, 100 mg/L L-Tyrosine, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.72 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	85
Zinc Sulfate•7H_2O	8.6
Adenine Hemisulfate•2H_2O	80
Kinetin	10.0
Indole-3-acetic Acid	0.5
myo-Inositol	100
Nicotinic Acid	10.0
Pyridoxine•HCl	1.0
Thiamine•HCl	30
L-Tyrosine	100
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M510 - Murashige Modified Gerbera Pretransplant Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and modified vitamins. Also contains: 85 mg/L Sodium Phosphate Monobasic, 10.0 mg/L IAA, 100 mg/L L-Tyrosine, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.64 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	85
Zinc Sulfate•7H_2O	8.6
myo-Inositol	100
Indole-3-acetic Acid	10
Nicotinic Acid	10
Pyridoxine•HCl	1.0
Thiamine•HCl	30
L-Tyrosine	100
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

M511 - Murashige Modified Kalanchoe Multiplication Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 3.0 mg/L 2iP and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
6-(γ,γ-Dimethylallylamino)purine; 2iP	3.0
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

M512 - Murashige Modified Kalanchoe Pretransplant Basal Medium

This medium may be sold as Murashige Syngonium Pretransplant Medium by some media suppliers.
Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 3.0 mg/L IAA and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	100
Indole-3-acetic Acid	3.0
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

M536 - Murashige Modified Multiplication Basal Medium

Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and modified vitamins. Also contains: 170 mg/L Sodium Phosphate Monobasic and 80 mg/L Adenine Hemisulfate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.68 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	180.7
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•$7H_2O$	8.6
Adenine Hemisulfate•$2H_2O$	80
Glycine	2
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.75 ± 0.5

Available Package Sizes

1L 10L 50L 100L

M527 - Murashige Modified Multiplication Basal Medium

This medium may be sold as Murashige & Skoog (MS) Shoot Tip Rooting Medium by some media suppliers. Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 1.0 mg/L Kinetin, 0.3 mg/L IAA, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Indole-3-acetic Acid	0.3
myo-Inositol	100
Kinetin	1.0
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

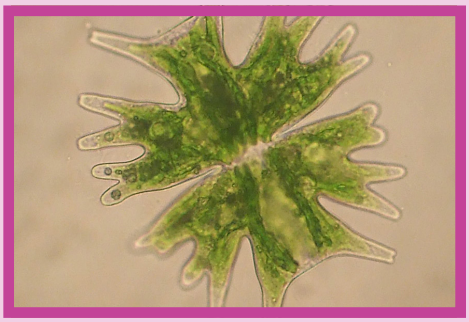
Available Package Sizes

1L 10L 50L

Find Phycology Products on Pages 169 to 174

- *Bold's Basal Medium*
- *Blue-Green Medium*
- *Tris Acetate Phosphate*
- *Seawater*
- *Sueoka's High Salt Medium*





©2014 PhytoTechnology Laboratories®

M491 - Murashige Modified Shoot Multiplication Basal Medium

This medium may be sold as Murashige & Skoog (MS) Shoot Multiplication Medium A by some media suppliers. Contains the macro- and micronutrients as described by Murashige & Skoog (1962) and the vitamins described by Linsmaier & Skoog (1965). Also contains: 170 mg/L Sodium Phosphate Monobasic, 80 mg/L Adenine Hemisulfate, 30.0 mg/L 2iP, 0.3 mg/L IAA, and Ferric Sodium EDTA in place of Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.68 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Sodium Phosphate, Monobasic•H_2O	170
Zinc Sulfate•7H_2O	8.6
Adenine Hemisulfate•2H_2O	80
6-(γ,γ-Dimethylallylamino)purine; 2iP	30.0
Indole-3-acetic Acid	0.3
myo-Inositol	100
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

M462 - Musa (Banana) Multiplication Medium

IITA formulation as described by Vuylsteke (1989) (International Institute for Tropical Agriculture) Contains PGRs, sucrose, and gelling agent.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 36.36 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	332.2
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.25
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	180.74
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
L-Ascorbic Acid	20
6-Benzylaminopurine	4.5
Gellan Gum – Biotech Grade	2000
Glycine	2.0
Indole-3-acetic Acid	0.175
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Sucrose	30,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

N492 - NB Basal Medium

Modified Chu/Gamborg Basal Medium
Contains the macronutrients as described by Chu (1975) and the micronutrients as described by Gamborg *et al.* (1968).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.10 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	463
Boric Acid	3.0
Calcium Chloride, Anhydrous	125.33
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2 EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	90.37
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.75
Potassium Nitrate	2830
Potassium Phosphate, Monobasic, Anhydrous	400
Zinc Sulfate•$7H_2O$	2.0
myo-Inositol	100
Nicotinic Acid	1.0
Pyridoxine•HCI	1.0
Thiamine•HCI	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 4L 10L 50L

N616 - Nitsch & Nitsch Basal Medium with Vitamins

Contains the macro- and micronutrients and vitamins as described by Nitsch & Nitsch (1969).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	720
Boric Acid	10
Calcium Chloride, Anhydrous	166
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	90.372
Manganese Sulfate•H_2O	18.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	68
Zinc Sulfate•$7H_2O$	10
D-Biotin	0.05
Folic Acid	0.5
Glycine	2.0
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Thiamine•HCl	0.5
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

N613 - Nitsch & Nitsch Basal Salt Mixture

Contains the macro- and micronutrients as described by Nitsch & Nitsch (1969).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.10 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	720
Boric Acid	10
Calcium Chloride, Anhydrous	166
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	90.372
Manganese Sulfate•H_2O	18.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	68
Zinc Sulfate•7H_2O	10
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L 100L

N608 - Nitsch & Nitsch Vitamin Powder (1000x)

Contains the vitamins as described by Nitsch & Nitsch (1969). *myo*-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Soluble in Water
- Use 10.86 grams to make 100 mL
- Use at 1.0 mL per liter of Medium
- Plant Tissue Culture Tested

Components (mg/L)	
D-Biotin	50
Folic Acid	500
Glycine	2000
myo-Inositol	100,000
Nicotinic Acid	5000
Pyridoxine•HCl	500
Thiamine•HCl	500
Approximate pH at Room Temperature	3.75 ± 0.75

Available Package Sizes

100mL 250mL

N603 - Nitsch & Nitsch Vitamin Solution (1000x)

Contains the vitamins as described by Nitsch & Nitsch (1969). *myo*-Inositol may precipitate out of the solution when cold; warming with occasional agitation will redissolve the precipitated *myo*-Inositol.

- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with Water
- Use at 1.0 mL per liter of medium
- Plant Tissue Culture Tested



Components (mg/L)	
D-Biotin	50
Folic Acid	500
Glycine	2000
myo-Inositol	100,000
Nicotinic Acid	5000
Pyridoxine•HCl	500
Thiamine•HCl	500
Approximate pH at Room Temperature	8.0 ± 0.75

Available Package Sizes

100mL

Custom Media & Services



*Phyto*Technology Laboratories® offers custom manufacturing and testing services. For more information please see page 12.

- Custom Dry Powder Media
- Custom Liquid Media
- Custom Packaging
- Testing Services

N479 - NLN Basal Medium

Contains the macro- and micronutrients and organic components as described by Lichter (1982).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.77 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	10
Calcium Nitrate	347
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	61
Manganese Sulfate•H_2O	18.95
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Nitrate	125
Potassium Phosphate, Monobasic, Anhydrous	125
Zinc Sulfate•7H_2O	10
D-Biotin	0.05
Folic Acid	0.5
L-Glutamine	800
Glutathione (Reduced)	30
Glycine	2
myo-Inositol	100
Nicotinic Acid	5
Pyridoxine•HCl	0.5
L-Serine	100
Thiamine•HCl	0.5
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

Nutrient Broth & Agar

See Microbiology Section for Complete Listings

O606 - Oat Meal Agar

See Phytopathology Section for Complete Listing

O139 - Orchid Maintenance/Replate Medium

Without Charcoal and Agar

- Store at 2 to 6 °C
- Soluble in Water
- Use at 25.31 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•6H_2O	0.0125
Cupric Sulfate•5H_2O	0.0125
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•2H_2O	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•7H_2O	5.3
myo-Inositol	100
MES•H_2O	1000
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

O156 - Orchid Maintenance/Replate Medium

Contains Banana Powder (Product Number B852) and Charcoal (Product Number C325), Without Agar

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 57.31 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
Na_2EDTA•$2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•$7H_2O$	5.3
Activated Charcoal	2000
Banana Powder	30,000
myo-Inositol	100
MES•H_2O	1000
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

P748 - Orchid Maintenance/Replate Medium

Contains Banana Powder (Product Number B852) and Charcoal (Product Number C325), and Agar (Product Number A111)

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 64.31 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
Na_2EDTA•$2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•$7H_2O$	5.3
Activated Charcoal	2000
Agar	7000
Banana Powder	30,000
myo-Inositol	100
MES•H_2O	1000
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

P658 - Orchid Maintenance Medium

Contains Charcoal (Product Number C325) and Agar (Product Number A111)

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 35.31 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•6H_2O	0.0125
Cupric Sulfate•5H_2O	0.0125
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•2H_2O	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•7H_2O	5.3
Activated Charcoal	2000
Agar	8000
myo-Inositol	100
MES•H_2O	1000
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L 100L

P668 - Orchid Maintenance Medium

Contains Charcoal (Product Number C325), Without Agar

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 27.31 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•6H_2O	0.0125
Cupric Sulfate•5H_2O	0.0125
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•2H_2O	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•7H_2O	5.3
Activated Charcoal	2000
myo-Inositol	100
MES•H_2O	1000
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L 100L

Selecting Terrestrial Orchid Media by Genus

See "Figure 23. Terrestrial Orchid Media Selection Guide by Genus" on page 246 in the Technical Section.

Find Phytopathology Media on Pages 157 to 160

- *Oat Meal Agar*
- *Czapex & Dox Agar & Broth*
- *Bacterial Screening Media*
- *Potato Dextrose Agar & Broth*
- *Corn Meal Agar*





©2014 PhytoTechnology Laboratories®

O753 - Orchid Multiplication Medium

Contains Agar (Product Number A111), Without Charcoal

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 32.30 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
$Na_2EDTA•2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•$7H_2O$	5.3
Agar	7000
6-Benzylaminopurine	2.0
myo-Inositol	100
MES•H_2O	1000
α-Naphthaleneacetic Acid	0.5
Nicotinic Acid	0.5
Peptone from Meat	2000
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	1.0
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

P793 - Orchid Multiplication Medium

Without Charcoal and Agar

- Store at 2 to 6 °C
- Soluble in Water
- Use at 25.30 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
$Na_2EDTA•2H_2O$	37.3
Ferrous Sulfate•$7H_2O$	27.85
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Zinc Sulfate•$7H_2O$	5.3
6-Benzylaminopurine	2.0
myo-Inositol	100
MES•H_2O	1000
α-Naphthaleneacetic Acid	0.5
Nicotinic Acid	0.5
Peptone from Meat	2000
Pyridoxine•HCl	0.5
Sucrose	20,000
Thiamine•HCl	1.0
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

P723 - Orchid Seed Sowing Medium

Contains Charcoal (Product Number C325) and Agar (Product Number A111)

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 32.74 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	412.5
Boric Acid	1.65
Calcium Chloride, Anhydrous	83
Cobalt Chloride•$6H_2O$	0.00625
Cupric Sulfate•$5H_2O$	0.00625
Na_2EDTA•$2H_2O$	18.65
Ferrous Sulfate•$7H_2O$	13.93
Magnesium Sulfate, Anhydrous	75.18
Manganese Sulfate•H_2O	4.23
Molybdic Acid, Disodium Salt•$2H_2O$	0.0625
Potassium Iodide	0.2075
Potassium Nitrate	475
Potassium Phosphate, Monobasic, Anhydrous	42.5
Zinc Sulfate•$7H_2O$	2.65
Activated Charcoal	1000
Agar	8000
myo-Inositol	100
MES•H_2O	500
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

P727 - Orchid Seed Sowing Medium II

Contains Agar (Product Number A111), Without Charcoal

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 31.74 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	412.5
Boric Acid	1.65
Calcium Chloride, Anhydrous	83
Cobalt Chloride•$6H_2O$	0.0063
Cupric Sulfate•$5H_2O$	0.0063
Na_2EDTA•$2H_2O$	18.65
Ferrous Sulfate•$7H_2O$	13.93
Magnesium Sulfate, Anhydrous	75.18
Manganese Sulfate•H_2O	4.23
Molybdic Acid, Disodium Salt•$2H_2O$	0.0625
Potassium Iodide	0.2075
Potassium Nitrate	475
Potassium Phosphate, Monobasic, Anhydrous	42.5
Zinc Sulfate•$7H_2O$	2.65
Agar	8000
myo-Inositol	100
MES•H_2O	500
Nicotinic Acid	1.0
Peptone from Meat	2000
Pyridoxine•HCl	1.0
Sucrose	20,000
Thiamine•HCl	10
Approximate pH at Room Temperature	5.5 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

P713 - Parker Thompson Fern Basal Salt Mixture

Contains the macro- and micronutrients as described by Hickok *et al.* (1995).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.77 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Molybdate(VI)•4H_2O	0.037
Ammonium Nitrate	125
Boric Acid	1.86
Calcium Chloride, Anhydrous	19.628
Cupric Sulfate•5H_2O	0.37
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	58.565
Manganese Sulfate•H_2O	0.25
Potassium Phosphate, Monobasic, Anhydrous	500
Zinc Sulfate•7H_2O	0.52
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

Peptone Waters

See Microbiology Section for Complete Listings

P6800 - *Phyto*Select Basal Medium

See Seed Testing Section for Complete Listing

P781 - *Phyto*Tech™ Orchid Replate Medium

Proprietary Formulation
Contains Sucrose
Does not contain Banana Powder, Activated Charcoal, or a Gelling Agent
An orchid replate and seed sowing medium.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 35.81 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

P782 - *Phyto*Tech™ Orchid Replate Medium

Proprietary Formulation
Contains Sucrose and a Gelling Agent
Does not contain Banana Powder or Activated Charcoal
An orchid replate and seed sowing medium.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 43.81 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	5.0 ± 0.5

Available Package Sizes

1L 10L 50L

Epiphytic Orchid Media Selection Guide

See "Figure 22. Epiphytic Orchid Media Selection Guide" on page 245 in the Technical Section.

P785 - *Phyto*Tech™ Orchid Replate Medium II

Proprietary Formulation
Contains Sucrose, Banana Powder, and a Gelling Agent
Does not contain Activated Charcoal
A complete orchid replate and seed sowing medium.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 65.79 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

P656 - *Phyto*Tech™ *Phalaenopsis* Replate Medium

Proprietary Formulation
Contains Sucrose, Banana Powder, Potato Powder, Activated Charcoal, and a gelling agent.
A complete orchid replate medium.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 61.31 grams per liter
- Plant Tissue Culture Tested

Approximate pH at Room Temperature	5.5 ± 0.5

Available Package Sizes

1L 10L 50L

New Product

P6647 - *Phyto*Tech™ *Spathiphyllum* Multiplication Medium

A complete medium for the micropropagation of *Spathiphyllum*. Contains gelling agent, carbohydrates, and plant growth regulators.
*Phyto*Tech™ *Spathiphyllum* Multiplication Medium is a proprietary plant cell culture medium that was originally developed for the culture of foliage plants such as *Spathiphyllum*.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 33.85 grams per liter
- Plant Tissue Culture Tested

Available Package Sizes

1L 10L 50L

Potato Dextrose Broth & Agar

See Phytopathology Section for Complete Listings

Q673 - Quoirin & Lepoivre Basal Salt Mixture

Contains the macro- and micronutrients as described by Quoirin & Lepoivre (1977) and Quoirin *et al.* (1977).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.56 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	400
Boric Acid	6.2
Calcium Nitrate	833.77
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Na_2EDTA•2H_2O	37.3
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	175.79
Manganese Sulfate•H_2O	0.76
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.08
Potassium Nitrate	1800
Potassium Phosphate, Monobasic, Anhydrous	270
Zinc Sulfate•7H_2O	8.6
Approximate pH at Room Temperature	4.0 ± 0.5

Available Package Sizes

1L 10L 50L

R756 - Rose Modified Initiation Basal Medium

Stage I
Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.51 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
L-Ascorbic Acid	50
6-Benzylaminopurine	2.0
Citric Acid, Anhydrous	50
Glycine	2.0
Indole-3-acetic Acid	0.3
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.5 ± 0.5

Available Package Sizes

1L 10L 50L

For Find Media for the Various Stages of Tissue Culture Plant Growth

See "Figure 5. Examples of Media Designed for a Specific Stage of Growth" on page 227 in the Technical Section.

©2014 *Phyto*Technology Laboratories®

R757 - Rose Modified Multiplication Basal Medium

Stage II
Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.51 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
L-Ascorbic Acid	50
6-Benzylaminopurine	3.0
Citric Acid, Anhydrous	50
Glycine	2.0
Indole-3-acetic Acid	0.30
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	3.5 ± 0.5

Available Package Sizes

1L 10L 50L

R758 - Rose Modified Rooting Basal Medium

Stage III
Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.18 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	412.5
Boric Acid	1.55
Calcium Chloride, Anhydrous	83.25
Cobalt Chloride•$6H_2O$	0.00625
Cupric Sulfate•$5H_2O$	0.00625
Ferric Sodium EDTA	9.175
Magnesium Sulfate, Anhydrous	45.25
Manganese Sulfate•H_2O	4.725
Molybdic Acid, Disodium Salt•$2H_2O$	0.0625
Potassium Iodide	0.2075
Potassium Nitrate	475
Potassium Phosphate, Monobasic, Anhydrous	42.5
Zinc Sulfate•$7H_2O$	2.15
Glycine	2.0
myo-Inositol	100
α-Naphthaleneacetic Acid	0.03
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.0 ± 0.5

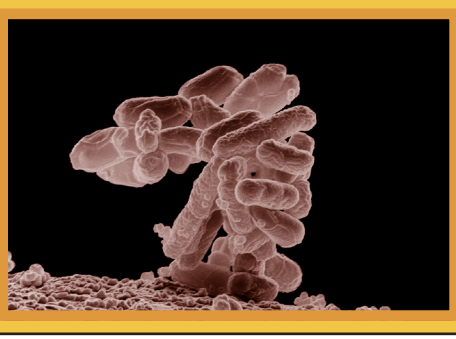
Available Package Sizes

1L 10L 50L

Find Microbiology Media on Pages 149 to 156

- *LB Agars and Broths*
- *Tryptic Soy Broth*
- *YEP Media*
- *Hanahan's Broth*
- *Peptone Waters*





New Product

R7100 - Rugini Olive Medium

Contains the Macronutrients, Micronutrients, and Vitamins as described by Rugini (1984).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.05 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	412
Boric Acid	12.4
Calcium Chloride, Anhydrous	332.16
Calcium Nitrate, anhydrous	416.9
Cobalt Chloride, hexahydrate	0.025
Cupric Sulfate, pentahydrate	0.25
Disodium EDTA dihydrate	37.5
Ferrous Sulfate, heptahydrate	27.8
Magnesium Sulfate, anhydrous	732.5
Manganese Sulfate, monohydrate	16.9
Molybdic Acid, sodium salt dihydrate	0.25
Potassium Chloride	500
Potassium Iodide	0.83
Potassium Nitrate	1100
Potassium Phosphate, monobasic	340
Zinc Sulfate, heptahydrate	14.3
D-Biotin	0.05
Folic Acid	0.5
Glycine	2
myo-Inositol	100
Nicotinic Acid	5
Pyridoxine HCl	0.5
Thiamine HCl	0.5
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

S7536 - Sabouraud Dextrose Broth

See Microbiology Section for Complete Listing

S813 - Schenk & Hildebrandt Basal Medium

Contains 10 g/L Sucrose (Product Number S391)
Contains the macro- and micronutrients and vitamins as described by Schenk & Hildebrandt (1972).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 14.21 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	300
Boric Acid	5
Calcium Chloride, Anhydrous	151
Cobalt Chloride•6H_2O	0.1
Cupric Sulfate•5H_2O	0.2
Na2 EDTA•2H_2O	20
Ferrous Sulfate•7H_2O	15
Magnesium Sulfate, Anhydrous	195.4
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•2H_2O	0.1
Potassium Iodide	1
Potassium Nitrate	2500
Zinc Sulfate•7H_2O	1
myo-Inositol	1000
Nicotinic Acid	5
Pyridoxine•HCl	0.5
Sucrose	10,000
Thiamine•HCl	5
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

S826 - Schenk & Hildebrandt Vitamin Powder (100x)

Contains the vitamins as described by Schenk & Hildebrandt (1972).

- Store at 2 to 6 °C
- Soluble in Water
- Use 10.11 grams to make 100 mL
- Use at 10.0 mL per liter of Medium
- Plant Tissue Culture Tested

Components (mg/L)	
myo-Inositol	100,000
Nicotinic Acid	500
Pyridoxine•HCl	50
Thiamine•HCl	500
Approximate pH at Room Temperature	4.0 ± 0.75

Available Package Sizes

100mL 1L

©2014 PhytoTechnology Laboratories®

S808 - Schenk & Hildebrandt Modified Basal Medium (½x)

Contains 10 g/L Sucrose
Contains ½ the macro- and micronutrients and ½ the vitamins as described by Schenk & Hildebrandt (1972).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 12.10 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	150
Boric Acid	2.5
Calcium Chloride, Anhydrous	75.5
Cobalt Chloride•$6H_2O$	0.05
Cupric Sulfate•$5H_2O$	0.1
Na_2 EDTA•$2H_2O$	10
Ferrous Sulfate•$7H_2O$	7.5
Magnesium Sulfate, Anhydrous	97.7
Manganese Sulfate•H_2O	5.0
Molybdic Acid, Disodium Salt•$2H_2O$	0.05
Potassium Iodide	0.5
Potassium Nitrate	1250
Zinc Sulfate•$7H_2O$	0.5
myo-Inositol	500
Nicotinic Acid	2.5
Pyridoxine•HCl	0.25
Sucrose	10,000
Thiamine•HCl	2.5
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

S811 - Schenk & Hildebrandt Modified Basal Medium

Contains 10 g/L Sucrose (Product Number S391)
Contains the macro- and micronutrients as described by Schenk & Hildebrandt (1972); without vitamins.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 13.20 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	300
Boric Acid	5.0
Calcium Chloride, Anhydrous	151
Cobalt Chloride•$6H_2O$	0.1
Cupric Sulfate•$5H_2O$	0.2
Na_2 EDTA•$2H_2O$	20
Ferrous Sulfate•$7H_2O$	15
Magnesium Sulfate, Anhydrous	195.4
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•$2H_2O$	0.1
Potassium Iodide	1.0
Potassium Nitrate	2500
Zinc Sulfate•$7H_2O$	1.0
Sucrose	10,000
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

Find Biochemicals on Pages 15 to 54

- *Gelling Agents*
- *Plant Growth Regulators*
- *Media Components*
- *Stains and Dyes*
- *Carbohydrates*





S806 - Schenk & Hildebrandt Modified Basal Salt Mixture Without Calcium

Contains the macro- and micronutrients as described by Schenk & Hildebrandt (1972); without Calcium Chloride.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.05 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	300
Boric Acid	5.0
Cobalt Chloride•6H_2O	0.1
Cupric Sulfate•5H_2O	0.2
Na_2 EDTA•2H_2O	20
Ferrous Sulfate•7H_2O	15
Magnesium Sulfate, Anhydrous	195.4
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•2H_2O	0.1
Potassium Iodide	1.0
Potassium Nitrate	2500
Zinc Sulfate•7H_2O	1.0
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

S816 - Schenk & Hildebrandt Basal Salt Mixture

Contains the macro- and micronutrients as described by Schenk & Hildebrandt (1972).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.20 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Phosphate, Monobasic	300
Boric Acid	5.0
Calcium Chloride, Anhydrous	151
Cobalt Chloride•6H_2O	0.1
Cupric Sulfate•5H_2O	0.2
Na_2 EDTA•2H_2O	20
Ferrous Sulfate•7H_2O	15
Magnesium Sulfate, Anhydrous	195.4
Manganese Sulfate•H_2O	10
Molybdic Acid, Disodium Salt•2H_2O	0.1
Potassium Iodide	1.0
Potassium Nitrate	2500
Zinc Sulfate•7H_2O	1.0
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 10LFB 50L 100L

S657 - SOC Medium Solution

See Microbiology Section for Complete Listing

S7478 - Sodaria Crossing Agar

See Microbiology Section for Complete Listing

S743 - Staba Modified Vitamin Solution (100x)

Contains a modification of the Staba (1969) vitamins as described by Skirvin & Chu (1979). This modification differs from the original Staba formulation in that *myo*-Inositol was reduced from 2000 mg/L to 100 mg/L.

- Store at -20 to 0 °C
- Sterile Filtered
- Miscible with Water
- Use at 10.0 mL per liter of Medium
- Plant Tissue Culture Tested



Components (mg/L)	
p-Aminobenzoic Acid	50
D-Biotin	100
Calcium Pantothenate	100
Choline Chloride	100
Cyanocobalamin	0.15
Folic Acid	50
myo-Inositol	10,000
Niacinamide	200
Pyridoxine•HCl	200
Riboflavin	50
Thiamine•HCl	100
Approximate pH at Room Temperature	6.0 ± 0.5

Available Package Sizes

100mL 500mL

S7668 - Sueoka's High-Salt Medium (HSM)

See Phycology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

T839 - Terrestrial (Cypripedium) Orchid Medium

Contains 400 mg/L Calcium Nitrate (Product Number C180) and 400 mg/L Casein (Product Number C184)
Without Ammonium Nitrate
Contains a modification of the macro- and micronutrients, Glucose, and Agar as described by Steele (1996).

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 27.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Citrate, Dibasic	19
Boric Acid	0.5
Calcium Nitrate	400
Cupric Sulfate•5H_2O	0.025
Ferric Ammonium Citrate	25
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Molybdic Acid, Diodium Salt•2H_2O	0.02
Potassium Chloride	100
Potassium Iodide	0.1
Potassium Nitrate	200
Potassium Phosphate, Monobasic, Anhydrous	200
Zinc Sulfate•7H_2O	0.5
Agar	6000
Casein, Enzymatic Hydrolysate	400
D-Glucose, Anhydrous	20,000
Approximate pH at Room Temperature	5.5 ± 0.5

Available Package Sizes

1L 10L 50L

T849 - Terrestrial (Cypripedium) Orchid Medium

Contains 400 mg/L Calcium Nitrate (Product Number C180)
Without Casein
Mother Flasking Medium V
Contains the macro- and micronutrients, Glucose, and Agar as described by Steele (1996).

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 28.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Citrate, Dibasic	19
Ammonium Nitrate	1400
Boric Acid	0.5
Calcium Nitrate	400
Cupric Sulfate•5H_2O	0.025
Ferric Ammonium Citrate	25
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Molybdic Acid, Disodium Salt•2H_2O	0.02
Potassium Chloride	100
Potassium Iodide	0.1
Potassium Nitrate	200
Potassium Phosphate, Monobasic, Anhydrous	200
Zinc Sulfate•7H_2O	0.5
Agar	6000
D-Glucose, Anhydrous	20,000
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

Tissue Culture Kits



*Phyto*Technology Laboratories® offers a selection of plant tissue culture kits for educational use. For more information please see pages 175 to 182.

Kits for:
– African Violet,
– Carrot,
– Carnivorous Plants,
– Fern,
– Hosta,
– Lily,
– Orchids, and
– Potato.

T842 - Terrestrial (Cypripedium) Orchid Medium

Contains 600 mg/L Calcium Nitrate (Product Number C180) and 200 mg/L Casein (Product Number C184)
Without Ammonium Nitrate
Contains a modification of the macro- and micronutrients, Glucose, and Agar as described by Steele (1996).

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 27.44 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Citrate, Dibasic	19
Boric Acid	0.5
Calcium Nitrate	600
Cupric Sulfate•$5H_2O$	0.025
Ferric Ammonium Citrate	25
Magnesium Sulfate, Anhydrous	97.69
Manganese Sulfate•H_2O	1.54
Molybdic Acid, Disodium Salt•$2H_2O$	0.02
Potassium Chloride	100
Potassium Iodide	0.1
Potassium Nitrate	200
Potassium Phosphate, Monobasic, Anhydrous	200
Zinc Sulfate•$7H_2O$	0.5
Agar	6000
Casein, Enzymatic Hydrolysate	200
D-Glucose, Anhydrous	20,000
Approximate pH at Room Temperature	5.25 ± 0.5

Available Package Sizes

1L 10L 50L

Terrific Broths

See Microbiology Section for Complete Listings

New Product

T7954 - TM4 Basal Medium

Contains the Macro- and Micronutrients and Vitamins as described by Shahin (1984).
Originally developed for work with tomato protoplasts.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.99 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	320
Ammonium Phosphate, Monobasic	230
Ammonium Sulfate	134
Boric Acid	6.2
Calcium Chloride, Anhydrous	113.25
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Na_2 EDTA•$2H_2O$	18.5
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	122.12
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Zinc Sulfate•$7H_2O$	8.6
D-Biotin	0.05
Choline Chloride	0.10
Folic Acid	0.5
Glycine (Free Base)	2.5
myo-Inositol	100
Nicotinic Acid	5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.5
Approximate pH at Room Temperature	4.5 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

New Product

T8024 - TM4 Basal Salt Mixture

Contains the Macro- and Micronutrients and Vitamins as described by Shahin (1984).
Originally developed for work with tomato protoplasts.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.88 grams per liter of medium
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	320
Ammonium Phosphate, Monobasic	230
Ammonium Sulfate	134
Boric Acid	6.2
Calcium Chloride, Anhydrous	113.25
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	18.5
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	122.12
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Zinc Sulfate•$7H_2O$	8.6
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

T868 - TM4G Basal Medium

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.99 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	320
Ammonium Phosphate, Monobasic	230
Ammonium Sulfate	130
Boric Acid	6.2
Calcium Chloride, Anhydrous	113.25
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	18.65
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	122.12
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Zinc Sulfate•$7H_2O$	9.2
D-Biotin	0.05
Folic Acid	0.5
Glycine	2.5
myo-Inositol	100
Nicotinic Acid	5.0
Pyridoxine•HCl	0.5
Thiamine•HCl	0.5
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

T853 - TM4G Basal Salt Mixture

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.88 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	320
Ammonium Phosphate, Monobasic	230
Ammonium Sulfate	130
Boric Acid	6.2
Calcium Chloride, Anhydrous	113.25
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
$Na_2EDTA•2H_2O$	18.65
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	122.12
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Zinc Sulfate•$7H_2O$	9.2
Approximate pH at Room Temperature	4.25 ± 0.5

Available Package Sizes

1L 10L 50L

T856 - Tobacco Modified Callus Initiation Basal Medium

Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Casein, Enzymatic Hydrolysate	1000
Glycine	2.0
Indole-3-acetic Acid	2.0
myo-Inositol	100
Kinetin	0.2
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.5 ± 1.0

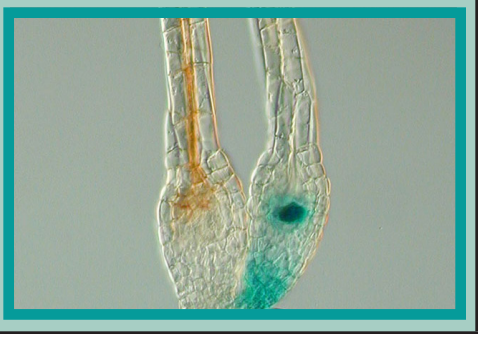
Available Package Sizes

1L 10L 50L

Find Molecular Biology Products on Pages 129 to 148

- *Antibiotics*
- *Buffers*
- *DNA Extraction Kits*
- *Sterile Solutions*
- *IPTG, X-Gal & X-Gluc*





©2014 PhytoTechnology Laboratories®

T867 - Tobacco Modified Shoot & Root Basal Medium

Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Casein, Enzymatic Hydrolysate	1000
Glycine	2.0
Indole-3-acetic Acid	0.03
myo-Inositol	100
Kinetin	1.0
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.5 ± 1.0

Available Package Sizes

1L 10L 50L

T864 - Tobacco Modified Shoot Multiplication Basal Medium

Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•$7H_2O$	8.6
Casein, Enzymatic Hydrolysate	1000
Glycine	2.0
myo-Inositol	100
Kinetin	1.0
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.5 ± 1.0

Available Package Sizes

1L 10L 50L

T861 - Tobacco Modified Root Initiation Basal Medium

Contains Ferric Sodium EDTA in place of both Ferrous Sulfate and Disodium EDTA.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.41 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	1650
Boric Acid	6.2
Calcium Chloride, Anhydrous	333
Cobalt Chloride•6H_2O	0.025
Cupric Sulfate•5H_2O	0.025
Ferric Sodium EDTA	36.7
Magnesium Sulfate, Anhydrous	181
Manganese Sulfate•H_2O	16.9
Molybdic Acid, Disodium Salt•2H_2O	0.25
Potassium Iodide	0.83
Potassium Nitrate	1900
Potassium Phosphate, Monobasic, Anhydrous	170
Zinc Sulfate•7H_2O	8.6
Casein, Enzymatic Hydrolysate	1000
Glycine	2.0
Indole-3-acetic Acid	3.0
myo-Inositol	100
Nicotinic Acid	0.5
Pyridoxine•HCl	0.5
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.5 ± 1.0

Available Package Sizes

1L 10L 50L

Tryptic Soy Broths

See Microbiology Section for Complete Listings

T8050 - Tris-Acetate-Phosphate (TAP) 1x Solution

See Phycology Section for Complete Listing

T8224 - Tris-Acetate-Phosphate (TAP)

See Phycology Section for Complete Listing

V505 - Vacin & Went Modified Orchid Basal Salt Mixture

Contains the macro- and micronutrients as described by Vacin & Went (1949) modified with an equivalent Iron molar concentration of Ferrous Sulfate in place of Ferric Tartrate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.67 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	500
Calcium Phosphate, Tribasic	200
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	122.1
Manganese Sulfate•H_2O	5.6
Potassium Nitrate	525
Potassium Phosphate, Monobasic, Anhydrous	250
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

Selecting Epiphytic Orchid Media by Genus

See "Figure 24. Epiphytic Orchid Media Selection Guide by Genus" on page 247 in the Technical Section.

V882 - Vacin & Went Modified Orchid Basal Medium

Without Sucrose
Contains the macro- and micronutrients as described by Vacin & Went (1949) modified with an equivalent Iron molar concentration of Ferrous Sulfate in place of Ferric Tartrate. Also contains (mg/L): 0.4 Thiamine.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.67 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	500
Calcium Phosphate, Tribasic	200
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•7H_2O	27.8
Magnesium Sulfate, Anhydrous	122.1
Manganese Sulfate•H_2O	5.6
Potassium Nitrate	525
Potassium Phosphate, Monobasic, Anhydrous	250
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

©2014 PhytoTechnology Laboratories®

V895 - Vacin & Went Modified Orchid Medium

Contains Agar (Product Number A111) & Sucrose (Product Number S391)
Contains the macro- and micronutrients as described by Vacin & Went (1949) modified with an equivalent Iron molar concentration of Ferrous Sulfate in place of Ferric Tartrate. Also contains: 0.4 mg/L Thiamine.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 28.67 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	500
Calcium Phosphate, Tribasic	200
$Na_2EDTA•2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	122.1
Manganese Sulfate•H_2O	5.6
Potassium Nitrate	525
Potassium Phosphate, Monobasic, Anhydrous	250
Agar	7000
Sucrose	20,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

V891 - Vacin & Went Modified Orchid Medium

Contains Sucrose (Product Number S391)
Contains the macro- and micronutrients as described by Vacin and Went (1949) modified with an equivalent Iron molar concentration of Ferrous Sulfate in place of Ferric Tartrate. Also contains (mg/L): 0.4 Thiamine.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 21.67 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Sulfate	500
Calcium Phosphate, Tribasic	200
Na_2 EDTA•$2H_2O$	37.26
Ferrous Sulfate•$7H_2O$	27.8
Magnesium Sulfate, Anhydrous	122.1
Manganese Sulfate•H_2O	5.6
Potassium Nitrate	525
Potassium Phosphate, Monobasic, Anhydrous	250
Sucrose	20,000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	5.75 ± 0.5

Available Package Sizes

1L 10L 50L

W863 - Westvaco WV3 Basal Medium

Contains the macro- and micronutrients and vitamins as described by Coke (1996).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 4.29 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	31
Calcium Chloride, Anhydrous	452.88
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.25
Ferric Sodium EDTA	36.71
Magnesium Sulfate, Anhydrous	903.79
Manganese Sulfate•H_2O	15.16
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Chloride	656.79
Potassium Iodide	0.83
Potassium Nitrate	910.06
Potassium Phosphate, Monobasic, Anhydrous	270
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	1000
Thiamine•HCI	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

W865 - Westvaco WV5 Basal Medium

Contains the macro- and micronutrients and vitamins as described by Coke (1996).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 5.22 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	700
Boric Acid	31
Calcium Chloride, Anhydrous	452.88
Cobalt Chloride•$6H_2O$	0.025
Cupric Sulfate•$5H_2O$	0.25
Ferric Sodium EDTA	36.71
Magnesium Sulfate, Anhydrous	903.79
Manganese Sulfate•H_2O	15.16
Molybdic Acid, Disodium Salt•$2H_2O$	0.25
Potassium Chloride	718.67
Potassium Iodide	0.83
Potassium Nitrate	1084.06
Potassium Phosphate, Monobasic, Anhydrous	270
Zinc Sulfate•$7H_2O$	8.6
myo-Inositol	1000
Thiamine•HCl	0.4
Approximate pH at Room Temperature	4.75 ± 0.5

Available Package Sizes

1L 10L 50L

W887 - Wilkins-Chalgren Agar

See Microbiology Section for Complete Listing

W898 - White Basal Salt Mixture

Contains the macro- and micronutrients and vitamins as described by White (1963).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.93 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Boric Acid	1.5
Calcium Nitrate	208.5
Cupric Sulfate•$5H_2O$	0.001
Ferric Sulfate•xH_2O	2.5
Magnesium Sulfate, Anhydrous	351.62
Manganese Sulfate•H_2O	5.31
Molybdenum Trioxide	0.0001
Potassium Chloride	65
Potassium Iodide	0.75
Potassium Nitrate	80
Sodium Phosphate, Monobasic•H_2O	16.5
Sodium Sulfate, Anhydrous	200
Zinc Sulfate•$7H_2O$	3.0
Approximate pH at Room Temperature	4.75 ± 0.75

Available Package Sizes

1L 10L 50L

X8454 - XTS Medium

See Seed Testing Section for Complete Listing

YEP Media

See Microbiology Section for Complete Listings

Y893 - YMB Medium

See Microbiology Section for Complete Listing

Y8488 - Yeast Malt Broth

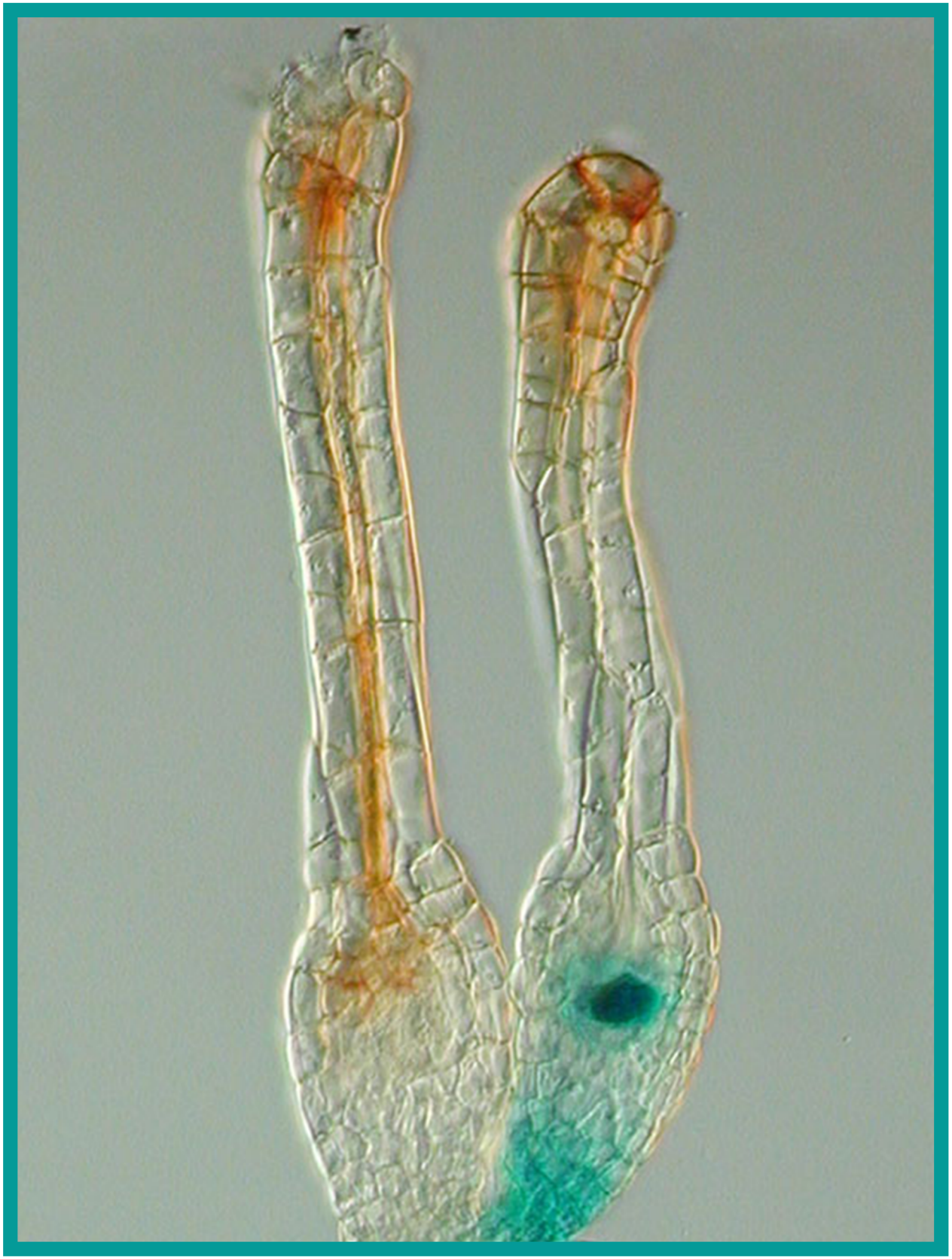
See Microbiology Section for Complete Listing

Y8565 - YEP Broth

See Microbiology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

MOLECULAR BIOLOGY









Molecular Biology

*Phyto*Technology Laboratories® offers a wide variety of products for use in plant molecular biology. The products listed in this section are those that are most commonly used in various molecular biology applications. For bacteria growth media please refer to the Microbiology section on page 149 and the Phytopathology section on page 157.

If you have trouble finding a product please consult the indices at the back of this catalogue. Be sure to check back at **www.phytotechlab.com** for new products!



Sterile Antibiotic Solutions

*Phyto*Technology Laboratories® offers a line of ready-to-use, sterile-filtered antibiotic solutions for use in molecular biology. Each solution is manufactured in-house and then sterile-filtered at the main campus of *Phyto*Technology Laboratories®. All sterile filtered liquids are confirmed sterile according to USP<71> protocols.



Many of our sterile antibiotic solutions are offered, for your convenience, in packages of ten 1mL aliquots. Sterile antibiotic solutions are not only convenient and easy-to-use, but also allow the use of antibiotics without the need for a full body respirator. For more information about antibiotics, see "Antibiotic Selection, Preparation, & Storage" on page 252.





Featured in this section

- Antibiotics
- Antibiotic Solutions
- Buffers
- Transformation
- Stains & Dyes
- Reagents
- And more...

©2014 PhytoTechnology Laboratories®

A104 - Acetosyringone

4-Hydroxy-3',5'-dimethoxyacetophenone
Plant Tissue Culture Tested

This material is sensitive to temperature and should not be autoclaved.

- Powder
- CAS Number: 2478-38-8
- Formula: $C_{10}H_{12}O_4$
- Molecular Weight: 196.20
- Soluble in DMSO
- Store at Room Temperature

Available Package Sizes

1g 5g 25g

New Product

A1104 - Acetosyringone 100 mM Solution

4-Hydroxy-3',5'-dimethoxyacetophenone in DMSO
Plant Tissue Culture Tested
This material is sensitive to temperature and should not be autoclaved.

- Liquid
- CAS Number: 2478-38-8
- Formula: $C_{10}H_{12}O_4$
- Molecular Weight: 196.20
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL 10mL 25mL

A1315 - Agarose, Low Gelling Temp, SeaPlaque®

See Biochemicals Section for Complete Listing

New Product

A1050 - LE Agarose

For gel electrophoresis of nucleic acids.
Gelling Temperature: >33°C for 1.5% gels
Gelling Strength (1% is > 1200 g/cm2)

- Powder
- CAS Number: 9012-36-6
- Formula: $(C_{12}H_{14}O_5(OH)_4)_n$
- Low EEO
- Melting Temperature: 87.0 ± 1.5°C for 1.5% gels
- Molecular Weight: Variable
- Soluble in Hot Water
- Store at Room Temperature

Available Package Sizes

10g 100g 500g 1Kg

A116 - Ampicillin, Sodium Salt

USP Grade, D(-)-α-Aminobenzylpenicillin, Sodium Salt

- Powder
- CAS Number: 69-52-3
- Formula: $C_{16}H_{18}N_3NaO_4S$
- Molecular Weight: 371.4
- Soluble in Water, DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 591

Available Package Sizes

5g 25g

New Product

A1116 - Ampicillin Solution (100 mg/mL)

D(-)-α-Aminobenzylpenicillin, Sodium Salt in DMSO

- Liquid
- CAS Number: 69-52-3
- Formula: $C_{16}H_{18}N_3NaO_4S$
- Molecular Weight: 371.4
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL 10mL 25mL 100mL

A119 - Amphotericin B

- Powder
- CAS Number: 1397-89-3
- Formula: $C_{47}H_{73}NO_{17}$
- Molecular Weight: 924.09
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 590

Available Package Sizes

500mg 1g 5g

A122 - Amoxicillin Trihydrate

(2*S*,5*R*,6*R*)-6-[[(2*R*)-Amino(4-hydroxyphenyl)acetyl]amino] -3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic Acid Trihydrate

- Powder
- CAS Number: 61336-70-7
- Formula: $C_{16}H_{19}N_3O_5S \cdot 3H_2O$
- Molecular Weight: 419.5
- Forms Suspension with Water
- Store at 2 to 6 °C
- *Merck* **13**, 582

Available Package Sizes

1g 5g 25g

B129 - Bacteria Screening Medium 523

See Phytopathology Section for Complete Listing

B132 - Bacitracin Zinc

- Powder
- CAS Number: 1405-89-6
- Formula: $C_{66}H_{101}N_{17}O_{16}SZn$
- Molecular Weight: 1486.07
- Soluble in Water at 5.1 mg/mL (28 °C) Merck
- Store at 2 to 6 °C
- *Merck* **13**, 938



Available Package Sizes

1g	5g	25g

B131 - Bialaphos

A tripeptide herbicidal antibiotic that can be used as a selection agent with the *bar* and *pat* genes for transformation research.

- Powder
- CAS Number: 71048-99-2
- Formula: $C_{11}H_{21}N_3NaO_6P$
- Molecular Weight: 345.27
- Soluble in Water
- Store at -20 to 0 °C

Available Package Sizes

100mg	500mg	1g

New Product

B1730 - Bialaphos Solution (1mg/mL)

A tripeptide herbicidal antibiotic that can be used as a selection agent with the *bar* and *pat* genes.
Sterile Filtered

- Liquid
- CAS Number: 71048-99-2
- Formula: $C_{11}H_{21}N_3NaO_6P$
- Molecular Weight: 345.27
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

10x1mL	25mL	100mL

B162 - BIS-TRIS

2,2-Bis-(hydroxymethyl)-2,2',2"-nitrilotriethanol
Plant Tissue Culture Tested
Useful pH range: 5.8-7.2
pKa @ 25°C = 6.5

- Powder
- CAS Number: 6976-37-0
- Formula: $C_8H_{19}NO_5$
- Molecular Weight: 209.2
- Soluble in Water
- Store at Room Temperature



Available Package Sizes

100g	500g	1Kg

X884 - Blue-Gal

5-Bromo-3-indolyl-β-D-galactopyranoside

- Powder
- CAS Number: 97753-82-7
- Formula: $C_{14}H_{16}BrNO_6$
- Molecular Weight: 374.2
- Soluble in DMSO or KOH
- Store at -20 to 0 °C

Available Package Sizes

100mg	500mg	1g

B441 - Bradford Reagent

Used to determine concentration of proteins in solution based on the formation of a Brilliant Blue G - protein complex. Useful in determining the protein content of samples and for gel electrophoresis.

- Liquid
- Store at 2 to 6 °C



Available Package Sizes

10mL	100mL

New Product

C1888 - Carbendazim

BCM, Methyl benzimidazol-2-ylcarbamate, methyl-1H-benzimidazol-2-yl carbamate
Plant Tissue Culture Tested

- Powder
- CAS Number: 10605-21-7
- Formula: $C_9H_9N_3O_2$
- Molecular Weight: 191.19
- Soluble in HCl at 10 mg/mL
- Store at 2 to 6 °C

Available Package Sizes

1g	5g	25g

C346 - Carbenicillin, Disodium Salt

α-Carboxybenzylpenicillin, Disodium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 4800-94-6
- Formula: $C_{17}H_{16}N_2O_6SNa_2$
- Molecular Weight: 422.41
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 1801



Available Package Sizes

5g	10g	25g	100g

©2014 PhytoTechnology Laboratories®

C540 - Carbenicillin Solution (100 mg/mL)

α-Carboxybenzylpenicillin, Disodium Salt
Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 4800-94-6
- Formula: $C_{17}H_{16}N_2O_6SNa_2$
- Molecular Weight: 422.41
- Miscible with Water
- Store at -20 to 0 °C
- Ship on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

New Product

C2046 - Carbenicillin Solution (250 mg/mL)

α-Carboxybenzylpenicillin, Disodium Salt
Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 4800-94-6
- Formula: $C_{17}H_{16}N_2O_6SNa_2$
- Molecular Weight: 422.41
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

For More Information about Antibiotics

See "Figure 29. Antibiotics/Antimycotics/Selection Agent Guide" on page 253 in the Technical Section.

C380 - Cefotaxime, Sodium Salt

(6*R*,7*R*)-3-[(Acetyloxy)methyl]-7-[[(2*Z*)-(2-amino-4-thiazolyl)(methoxyimino)acetyl]amino]-8-oxo-5-thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylic Acid, Sodium Salt
Plant Tissue Culture Tested

- Powder
- CAS Number: 64485-93-4
- Formula: $C_{16}H_{16}N_5O_7S_2Na$
- Molecular Weight: 477.4
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 1946



Available Package Sizes

1g	5g	25g	100g

C537 - Cefotaxime Solution (100 mg/mL)

Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 64485-93-4
- Formula: $C_{16}H_{16}N_5O_7S_2Na$
- Molecular Weight: 477.4
- Miscible with Water
- Store at -20 to 0 °C
- Ship on dry ice



Available Package Sizes

10x1mL	10mL	100mL

New Product

C1880 - Cefotaxime Solution (250 mg/mL)

Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 64485-93-4
- Formula: $C_{16}H_{16}N_5O_7S_2Na$
- Molecular Weight: 477.4
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

C526 - CHAPS

3-[(3-Cholamidopropyl)dimethylammonio]-1-propanesulfonate

CHAPS is a nondenaturing zwitterionic detergent that is typically used to solubilize membrane proteins.

- Powder
- CAS Number: 75621-03-3
- Formula: $C_{32}H_{58}N_2O_7S$
- Molecular Weight: 614.89
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 2052

Available Package Sizes

1g	5g	10g

C252 - Chloramphenicol

2,2-Dichloro-*N*-[(1*R*,2*R*)2-hydroxy-1-(hydroxymethyl)-2-(4-nitrophenyl)ethyl]acetamide
Plant Tissue Culture Tested

- Powder
- CAS Number: 56-75-7
- Formula: $C_{11}H_{12}Cl_2N_2O_5$
- Molecular Weight: 323.13
- Soluble in Water at 2.5 mg/mL per tje Merck Index.
- Store at Room Temperature
- *Merck* **13**, 2087



Available Package Sizes

100mg	5g	25g	100g

New Product

C2010 - Chloramphenicol Solution (10 mg/mL)

2,2-Dichloro-*N*-[(1*R*,2*R*)2-hydroxy-1-(hydroxymethyl)-2-(4-nitrophenyl)ethyl]acetamide
Sterile Filtered solution in 95% Ethanol
Plant Tissue Culture Tested

- Liquid
- CAS Number: 56-75-7
- Formula: $C_{11}H_{12}Cl_2N_2O_5$
- Molecular Weight: 323.13
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

C375 - Cupric Sulfate

See Biochemicals Section for Complete Listing

C466 - Copper(II) Sulfate Solution (4%)

Copper(II) Sulfate Pentahydrate
Typically used with Bicinchoninic Acid Solution (B496) in the determination of protein concentration.

- Liquid
- CAS Number: 7758-99-8
- Formula: $CuSO_4 \cdot 5H_2O$
- Molecular Weight: 249.68
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 2682



Available Package Sizes

100mL	500mL	1L

H276 - CTAB

Hexadecyltrimethylammonium Bromide, HTAB, Centimide, Cetrimide, Cetrimonium bromide,
N,N,N-trimethyl-1-hexadecanaminium bromide
Molecular Biology Grade

- Powder
- CAS Number: 59-09-0
- Formula: $CH_3(CH_2)_{15}N(Br)(CH_3)_3$
- Molecular Weight: 364.45
- Soluble in Water
- Store at Room Temperature



Available Package Sizes

100g	500g

New Product

H3818 - CTAB Solution (100 mg/mL)

Hexadecyltrimethylammonium Bromide, HTAB, Centimide, Cetrimide, Cetrimonium bromide,
N,N,N-trimethyl-1-hexadecanaminium bromide.
An aqueous solution of CTAB (H276) at 100 milligrams per milliliter. A cationic detergent with bactericidal activity against both gram-positive and gram-negative organisms.

- Liquid
- Sterile Filtered
- CAS Number: 57-09-0
- Formula: $C_{19}H_{42}NBr$
- Molecular Weight: 364.45
- Miscible withWater
- Store at Room Temperature



Available Package Sizes

10mL	100mL

New Product

C1989 - Cycloheximide

Actidione, Naramycin A
3-[2-(3,5-Dimethyl-2-oxocyclohexyl)-2-hydroxyethyl] glutarimide
An antimycotic derived from *Streptomyces griseus,* which is active against many fungi, molds and yeasts; can be used as a plant growth regulator, since it induces ethylene production in plants.

- Powder
- CAS Number: 66-81-9
- Formula: $C_{15}H_{23}NO_4$
- Molecular Weight: 281.4
- Soluble in Water, DMSO, Ethanol
- Store at 2 to 6 °C



Available Package Sizes

1g	5g	25g

©2014 PhytoTechnology Laboratories®

New Product

C1796 - Cycloheximide Solution (100 mg/mL)

A solution of Cycloheximide at 100 milligrams per milliliter. Cycloheximide is also known as Actidione, Naramycin A
3-[2-(3,5-Dimethyl-2-oxocyclohexyl)-2-hydroxyethyl] glutarimide
An antimycotic derived from *Streptomyces griseus,* which is active against many fungi, molds and yeasts; can be used as a plant growth regulator, since it induces ethylene production in plants.

- Liquid
- CAS Number: 66-81-9
- Formula: $C_{15}H_{23}NO_4$
- Molecular Weight: 281.4
- Miscible with Water
- Store at 2 to 6 °C

Available Package Sizes

10x1mL	10mL	25mL

P679 - DL-Phosphinothricin, Monoammonium Salt

PPT; 2-Amino-4-(hydroxymethylphosphinyl)butanoic Acid, Monoammonium Salt; Glufosinate Ammonium



- Powder
- CAS Number: 77182-82-2
- Formula: $C_5H_{15}N_2O_4P$
- Molecular Weight: 198.19
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7425

Available Package Sizes

250mg	1g

G523 - DL-Phosphinothricin Solution (1 mg/mL)

PPT; 2-Amino-4-(hydroxymethylphosphinyl)butanoic Acid, Monoammonium Salt; Glufosinate Ammonium

Aqueous Solution
Sterile Filtered



- Liquid
- CAS Number: 77182-82-2
- Formula: $C_5H_{15}N_2O_4P$
- Molecular Weight: 198.19
- Miscible with Water
- Store at 2 to 6 °C

Available Package Sizes

10mL	100mL

D241 - Dimethyl Sulfoxide

DMSO; Methyl Sulfoxide
Plant Tissue Culture Tested

Solidifies below and melts above 18.5°C.



- Liquid
- CAS Number: 67-68-5
- Formula: $(CH_3)_2SO$
- Molecular Weight: 78.13
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 3285

Available Package Sizes

500mL	1L	4L

D548 - DNA Denaturing Solution

Contains 1.5 M Sodium Chloride (87.66 g/L) and 0.5 M Sodium Hydroxide (20.0 g/L)





- Sterile Filtered
- Liquid
- Miscible with Water
- Store at Room Temperature

Available Package Sizes

100mL	500mL	1L

New Product

DNA Extraction System for Plant Genomic DNA

- Viogene® Plant Genomic DNA Extraction System
- Isolation of up to 50kb of Plant Genomic Material with predominant fragments of 20-30 kb, final yield dependant on kit type.
- Tissue is ground with liquid N_2, Incubated with RNAse, lysate is sheared, gDNA is captured on silica-gel membrane.
- Isolation of gDNA (viral, mitochondial, and chloroplast) from 1g of plant tissue (Maxi*Prep*) or 0.1g of plant tissue (Mini*Prep*).
- Purities typically range from A_{260}/A_{280} = 1.7-1.9
- D2251 (Mini*Prep* Kit), D2275 (Maxi*Prep* Kit, Pictured Below)



Product Number	Isolation Capacity	Available Package Sizes
D2251	Up to 40µg	50 Preps 250 Preps
D2275	Up to 1000µg	20 Preps

New Product

DNA Extraction System for Plasmid DNA

Great kit for cloning plasmid pieces that will be cut-out and ligated into vectors.
Downstream applications: Automated or Manual Sequencing, Restriction analysis, Cloning, and Transfection of most cell lines.

- Viogene® Plasmid DNA Extraction System
- DNA able to be processed at capacity dependant on kit type, which generally corresponds to 1-5 mL of E. Coli culture (OD_{600}=0.9-1.5).
- Silica-gel membrane technology that binds up to 40µg of Plasmid DNA in the presence of chaotropic salts (Mini*Plus* Kit).
- Elution into low-salt buffer so that it doesn't impact sequencing, transfection, etc. (Mini*Plus* Kit).
- Diethylaminoethyl (DEAE) ligands bound to macropus silica resin for anion exchange in gravity flow. (Midi*Plus* and Maxi*Plus* kits)
- D2126 (Mini*Plus* Kit), D2179 (Midi*Plus* Kit), D2231 (Maxi*Plus* Kit, Pictured Below)



Product Number	Processing Capacity	Available Package Sizes
D2126	> 0.04mg	50 Preps 250 Preps
D2179	> 0.1mg	25 Preps 50 Preps
D2231	> 0.5mg	10 Preps 25 Preps

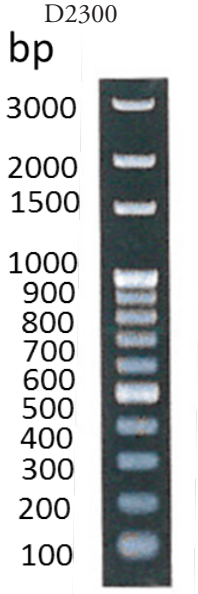
©2014 PhytoTechnology Laboratories®

New Product

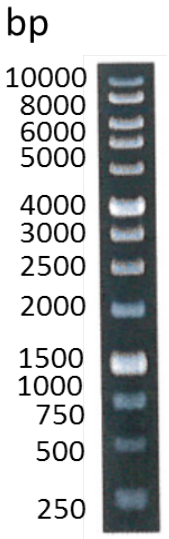
DNA Ladders

- Viogene® VioEasy™ DNA Ladders
- Linear dsDNA with blunt-ends.
- Pictured below are both DNA ladders in 2% LE Agarose (Product Number A1050).
- Preps per kit 166 preps in D2300, 167 preps in D2450.

D2300



D2450



Product Number	Ladder Size	Lane Amount	Package Sizes
D2300	100 bp	300 ng	50µg/0.5mL
D2450	1 kb	400 ng	67µg/0.5mL

D544 - DNA Neutralizing Solution, pH 7.4

Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (g/L)	
Tris HCl (0.84 M)	132.20
Tris Base (0.16 M)	19.40
Sodium Chloride (1.5 M)	87.66
Contains sufficient HCl to adjust pH to 7.4	

Available Package Sizes

500mL 1L

E316 - Ethylenediaminetetraacetic Acid, Free Acid

EDTA; Edetic Acid
Plant Tissue Culture Tested

- Powder
- CAS Number: 60-00-4
- Formula: $C_{10}H_{16}N_2O_8$
- Molecular Weight: 292.24
- Soluble in KOH
- Store at Room Temperature
- *Merck* **13**, 3546

Available Package Sizes

100g 500g 1Kg

E582 - EDTA Solution 0.5 M, pH 8.0

Sterile Filtered
DNAse/RNAse Free

- Liquid
- CAS Number: 6381-92-6
- Formula: $C_{10}H_{14}N_2O_8Na_2 \cdot 2H_2O$
- Molecular Weight: 372.24
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 3543

Components (g/L)	
$Na_2EDTA \cdot 2H_2O$ (0.5 M)	186.12
Contains sufficient NaOH to adjust pH to 8.0	

Available Package Sizes

500mL 1L

E344 - Erythromycin

USP Grade
Erythromycin A

- Powder
- CAS Number: 114-07-8
- Formula: $C_{37}H_{67}NO_{13}$
- Molecular Weight: 733.92
- Soluble in EtOH at 2mg/mL per the Merck Index
- Store at Room Temperature
- *Merck* **13**, 3714

Available Package Sizes

5g 25g

G810 - G418 Sulfate

Geneticin®
Geneticin is a registered trademark of Invitrogen Corporation.

- Powder
- CAS Number: 108321-42-2
- Formula: $C_{20}H_{40}N_4O_{10} \cdot 2H_2SO_4$
- Molecular Weight: 692.7
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1g	5g	10g

G570 - Gentamicin Sulfate

Gentamycin Sulfate



- Powder
- CAS Number: 1405-41-0
- Formula: $C_{21}H_{43}N_5O_7 \cdot H_2SO_4$
- Molecular Weight: 575.67
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 4403

Available Package Sizes

5g	10g	25g

New Product

G3410 - Gentamicin Solution (100 mg/mL)

Gentamycin Sulfate
Aqueous Solution
Sterile Filtered



- Liquid
- CAS Number: 1405-41-0
- Formula: $C_{21}H_{43}N_5O_7 \cdot H_2SO_4$
- Molecular Weight: 575.67
- Miscible with Water
- Store at 2 to 6 °C

Available Package Sizes

10mL	25mL	100mL

New Product

G3350 - Gentamicin Solution (50 mg/mL)

Gentamycin Sulfate
Aqueous Solution
Sterile Filtered



- Liquid
- CAS Number: 1405-41-0
- Formula: $C_{21}H_{43}N_5O_7 \cdot H_2SO_4$
- Molecular Weight: 575.67
- Miscible with Water
- Store at 2 to 6 °C

Available Package Sizes

10mL	25mL	100mL

G3574 - Guaiacol

See Seed Testing Section for Complete Listing

New Product

G3300 - Guanidine Thiocyanate

Guanidinium rhodanide or Guanidinium thiocyanate.
A denaturing and chaotropic agent often used in buffers for nucleic acid extractions.

- Powder
- CAS Number: 593-84-0
- Formula: $CH_5N_3 \cdot HSCN$
- Molecular Weight: 118.16
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g	500g	1kg

H289 Hanahan's Broth

See Microbiology Section for Complete Listing

H326 - HEPES, Free Acid

N-(2-Hydroxyethyl)Piperazine-*N*'-(2-Ethanesulfonic Acid);
4-(2-Hydroxyethyl)-1-Piperazineethanesulfonic Acid
Molecular Biology Grade
DNAse/RNAse Free
pKa 7.5 (25 °C)
Effective Buffering Range: pH 6.8 to 8.2

- Powder
- CAS Number: 7365-45-9
- Formula: $C_8H_{18}N_2O_4S$
- Molecular Weight: 238.3
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g	500g	1Kg

H245 - Hydrochloric Acid Solution 1.0 N

Hydrogen Chloride Solution 1.0 N; Muriatic Acid
Plant Tissue Culture Tested
Contains about 3.06% (w/v) concentrated Hydrochloric Acid per liter



- Liquid
- CAS Number: 7647-01-0
- Formula: HCl
- Molecular Weight: 36.46
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 4801

Available Package Sizes

500mL	1L	4L

©2014 PhytoTechnology Laboratories®

H397 - Hygromycin B

O-6-Amino-6-deoxy-L-glycero-D-galacto-heptopyranosylidene-(1→2-3)-*O*-β-D-talopyranosyl-(1→5)-2-deoxy-*N*^{3}-methyl-D-Streptamine
From *Streptomyces hygroscopicus*

- Powder
- CAS Number: 31282-04-9
- Formula: $C_{20}H_{37}N_3O_{13}$
- Molecular Weight: 527.5
- Soluble in Water or PBS Buffer
- Store at 2 to 6 °C
- *Merck* **13**, 4878



Available Package Sizes

1g 5g

H385 - Hygromycin B Solution, 100 mg/mL in Distilled Water

O-6-Amino-6-deoxy-L-glycero-D-galacto-heptopyranosylidene-(1→2-3)-*O*-β-D-talopyranosyl-(1→5)-2-deoxy-*N*^{3}-methyl-D-Streptamine
Sterile Filtered
From *Streptomyces hygroscopicus*

- Liquid
- CAS Number: 31282-04-9
- Formula: $C_{20}H_{37}N_3O_{13}$
- Molecular Weight: 527.5
- Miscible with Water or PBS Buffer
- Store at 2 to 6 °C; Do Not Freeze





Available Package Sizes

10x1mL 10mL

H370 - Hygromycin B Solution, 50 mg/mL in PBS Buffer

O-6-Amino-6-deoxy-L-glycero-D-galacto-heptopyranosylidene-(1→2-3)-*O*-β-D-talopyranosyl-(1→5)-2-deoxy-*N*^{3}-methyl-D-Streptamine
Sterile Filtered
From *Streptomyces hygroscopicus*

- Liquid
- CAS Number: 31282-04-9
- Formula: $C_{20}H_{37}N_3O_{13}$
- Molecular Weight: 527.5
- Miscible with Water or PBS Buffer
- Store at 2 to 6 °C; Do Not Freeze





Available Package Sizes

10x1mL 20mL

I373 - Isopropyl-β-D-thiogalactopyranoside

IPTG

- Powder
- CAS Number: 367-93-1
- Formula: $C_9H_{18}O_5S$
- Molecular Weight: 238.3
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1g 5g 25g

K378 - Kanamycin Monosulfate

O-3-Amino-3-deoxy-α-D-glucopyranosyl-(1→6)-*O*-[6-amino-6-deoxy-α-D-glucopyranosyl-(1→4)]-2-deoxy-D-Streptamine Monosulfate
Plant Tissue Culture Tested

- Powder
- CAS Number: 25389-94-0
- Formula: $C_{18}H_{36}N_4O_{11} \cdot H_2SO_4$
- Molecular Weight: 582.6
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5299

Available Package Sizes

5g 10g 25g

New Product

K4751 - Kanamycin Monosulfate Solution (100 mg/mL)

Sterile Filtered
Aqueous Solution
Plant Tissue Culture Tested

- Liquid
- CAS Number: 25389-94-0
- Formula: $C_{18}H_{16}N_4O_{11} \cdot H_2SO_4$
- Molecular Weight: 582.6
- Miscible with Water
- Store at 2 to 6 °C
- Ship on Blue Ice



Available Package Sizes

10mL 25mL 100mL

K586 - Kanamycin Monosulfate Solution (50 mg/mL)

Sterile Filtered
Aqueous Solution
Plant Tissue Culture Tested

- Liquid
- CAS Number: 25389-94-0
- Formula: $C_{18}H_{16}N_4O_{11}$
- Molecular Weight: 582.6
- Miscible with Water
- Store at 2 to 6 °C
- Ship on Blue Ice



Available Package Sizes			
10x1mL	10mL	25mL	100mL

K559 - Kasugamycin Hydrochloride Monohydrate

3-*O*-[2-amino-4-[(carboxyiminomethyl)amino]-2,3,4,6-tetradeoxy-α-D-arabino-hexopyranosyl]-D-chiro-inositol Hydrochloride Monohydrate
Plant Tissue Culture Tested

- Powder
- CAS Number: 6980-18-3
- Formula: $C_{14}H_{25}N_3O_9 \cdot HCl \cdot H_2O$
- Molecular Weight: 433.8
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes		
1g	5g	25g

LB Broths & Agars

See Microbiology Section for Complete Listing

Malt Extract Broth & Agar

See Microbiology Section for Complete Listing

M649 - ß-Mercaptoethanol

2-Mercaptoethanol, 2-Me, 2-Thioethanol, Thioglycol, 2-Hydroxyethylmercaptan
Molecular Biology Grade
DNase/RNase Free

- Liquid
- CAS Number: 60-24-2
- Formula: $HSCH_2CH_2OH$
- Molecular Weight: 78.13
- Miscible with Water
- Concentration: 14.3 M
- Density: 1.114 g/mL at 20 °C
- Store at Room Temperature



Available Package Sizes
Inquire about Package Size, Pricing, and more Information

M825 - MES, Monohydrate

2-(*N*-Morpholino)ethanesulfonic Acid, Free Acid
Plant Tissue Culture Tested
Useful pH range: 5.5 - 6.7
pKa @ 25°C = 6.1

- Powder
- CAS Number: 145224-94-8
- Formula: $C_6H_{13}NO_4S \cdot H_2O$
- Molecular Weight: 213.3
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 5929

Available Package Sizes		
100g	500g	1Kg

M5781 - Methylene Blue

See Seed Testing Section for Complete Listing

M572 - MOPS-EDTA-Sodium Acetate Buffer Solution (10x)

MESA Buffer
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (g/L)	
MOPS (0.4 M)	83.71
Sodium Acetate (0.1 M)	8.20
$Na_2EDTA \cdot 2H_2O$ (0.01 M)	7.4

Available Package Sizes		
100mL	500mL	1L

M631 - MOPS, Free Acid

3-[*N*-Morpholino]propanesulfonic acid, Free Acid
Useful pH range: 6.5-7.9
DNAse/RNAse Tested
pKa @ 25° C = 7.15

- Powder
- CAS Number: 1132-61-2
- Formula: $C_7H_{15}NO_4S$
- Molecular Weight: 209.3
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 6288

Available Package Sizes	
500g	1Kg

©2014 PhytoTechnology Laboratories®

M565 - MTT

3-[4,5-Dimethylthiazol-2-yl]-2,5-diphenyltetrazolium Bromide; Thiazolyl Blue Tetrazolium Bromide

- Powder
- CAS Number: 298-93-1
- Formula: $C_{18}H_{16}N_5SBr$
- Molecular Weight: 414.32
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

1g 5g 10g

M569 - MUG

4-Methylumbelliferyl-β-D-glucuronide Trihydrate

- Powder
- CAS Number: 6160-80-1
- Formula: $C_{16}H_{16}O_9 \cdot 3H_2O$
- Molecular Weight: 406.4
- Soluble in DMSO
- Store at -20 to 0 °C

Available Package Sizes

100mg 1g

N584 - Neomycin Sulfate



- Powder
- CAS Number: 1405-10-3
- Formula: $C_{23}H_{46}N_6O_{13} \cdot 3H_2SO_4$
- Molecular Weight: 908.9
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 6482

Available Package Sizes

25g 100g

New Product

N5967 - Neomycin Solution (50 mg/mL)

Sterile Filtered
Aqueous Solution



- Liquid
- CAS Number: 1405-10-3
- Formula: $C_{23}H_{46}N_6O_{13} \cdot 3H_2SO_4$
- Molecular Weight: 908.9
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice

Available Package Sizes

10mL 25mL 100mL

N618 - 4-Nitrophenyl-β-D-glucuronide

PNPG

- Powder
- CAS Number: 10344-94-2
- Formula: $C_{12}H_{13}NO_9$
- Molecular Weight: 315.2
- Soluble in DMSO
- Store at -20 to 0 °C

Available Package Sizes

250mg 1g

N604 - 2-Nitrophenyl-β-D-galactopyranoside

ONPG

- Powder
- CAS Number: 369-07-3
- Formula: $C_{12}H_{15}NO_8$
- Molecular Weight: 301.3
- Soluble in DMSO
- Store at -20 to 0 °C

Available Package Sizes

1g 5g 25g

N581 - Nystatin

USP Grade

- Powder
- CAS Number: 1400-61-9
- Formula: $C_{47}H_{75}NO_{17}$
- Molecular Weight: 926.12
- Soluble in DMSO
- Store at 2 to 6 °C
- *Merck* **13**, 6770

Available Package Sizes

5g 10g 25g

O606 - Oatmeal Agar

See Phytopathology Section for Complete Listing

P710 - Paromomycin Sulfate

O-2-Amino-2-deoxy-α-D-glucopyranosyl-(1→4)-*O*-[*O*-2,6-diamino-2,6-dideoxy-β-L-idopyranosyl-(1→3)-β-D-ribofuranosyl-(1→5)]-2-deoxy-D-streptamine sulfate
Plant Tissue Culture Tested

- Powder
- CAS Number: 1263-89-4
- Formula: $C_{23}H_{45}N_5O_{14} \cdot H_2SO_4$
- Molecular Weight: 713.7
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7113

Available Package Sizes

5g 25g 100g

P621 - Percoll®

Percoll®, Sterile
23% (w/w) aqueous solution of 15-30nm diameter colloidal silica particles coated with polyvinylpyrrolidone (PVP).
Percoll® is a registered trademark of GE Healthcare.

- Liquid
- Density: 1.130 ± 0.005 g/mL
- pH: 9.0 ± 0.5 @ 20°C
- Miscible with Water
- Store at 2 to 6 °C
- Non-toxic

Available Package Sizes

25mL	100mL

P777 - Penicillin

See Seed Testing Section for Complete Listing

P6767 - Penicillin G Solution

See Seed Testing Section for Complete Listing

Peptone Waters

See Microbiology Section for Complete Listing

P711 - PIPES

Piperazine-*N,N'*-bis(2-ethanesulfonic Acid), Sesquisodium Salt
Plant Tissue Culture Tested
Useful pH range: 6.1-7.5
pKa @ 25° C = 6.8

- Powder
- CAS Number: 100037-69-2
- Formula: $C_8H_{16.5}N_2O_6S_2 \cdot Na_{1.5}$
- Molecular Weight: 335.3
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7561

Available Package Sizes

100g	500g	1Kg

P671 - Potassium Acetate Solution 3.0 M, pH 5.0

Sterile Filtered

- Liquid
- CAS Number: 127-08-2
- Formula: $KC_2H_3O_2$
- Molecular Weight: 98.14
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 7687

Components (mg/L)	
Potassium Acetate	294,420
Contains sufficient HCl to adjust pH to 5.0	

Available Package Sizes

100mL	500mL	1L

P730 - Potassium Chloride Solution 3.0 M

Electrode Filling/ Soaking Solution

- Liquid
- CAS Number: 7447-40-7
- Formula: KCl
- Molecular Weight: 74.55
- Miscible with Water
- Store at Room Temperature
- *Merck* **13**, 7704

Available Package Sizes

100mL	500mL

How to Make a GUS Gene Staining Solution

See "Figure 30. GUS Gene Staining Solution Formulation" on page 255 in the Technical Section.

New Product

P6626 - Potassium Ferricyanide

Also known as Potassium hexacyanoferrate(III), Iron Potassium Cyanide, or Prussian Red

- Powder
- CAS Number: 13746-66-2
- Formula: $K_3Fe(CN)_6$
- Molecular Weight: 329.25
- Soluble in Water
- Store at Room Temperature, Protect from light
- *Merck*, **13**, 7712

Available Package Sizes

25g	100g	500g

New Product

P6826 - Potassium Ferrocyanide

Also known as Potassium Hexacyanoferrate(II) Trihydrate or Yellow Prussiate.

- Powder
- CAS Number: 14459-95-1
- Formula: $K_4Fe(CN)_6 \cdot 3H_2O$
- Molecular Weight: 422.41
- Soluble in Water
- Store at Room Temperature
- *Merck* **13,** *7713*

Available Package Sizes

25g	100g	500g

P6780 - Potassium Sodium Tartrate

See Biochemicals Section for Complete Listing

©2014 PhytoTechnology Laboratories®

R501 - Rifampicin

3-[[(4-Methyl-1-piperazinyl)imino]methyl]rifamycin; Rifampin
Plant Tissue Culture Tested

- Powder
- CAS Number: 13292-46-1
- Formula: $C_{43}H_{58}N_4O_{12}$
- Molecular Weight: 822.94
- Soluble in DMSO
- Store at -20 to 0 °C
- *Merck* **13**, 8300

Available Package Sizes

5g	10g	25g

New Product

R7153 - Plant RNA Extraction System

- Viogene® VioTotal™ Plant RNA Mini
- Isolates RNA greater than 200nt (excluding 5.8S rRNA, 5S rRNA, and tRNA) from 50mg of plant tissue or $1x10^4$ - $5x10^6$ cells.
- Downstream applications include: Northern Blotting, RT-PCR, cDNA synthesis.
- The System accomodates secondary metabolites that have been known to gum/clog membranes.
- Purities typically range from A_{260}/A_{280} = 1.9-2.1



Available Package Sizes

50 preps	250 preps

S657 - SOC Medium Solution

See Microbiology Section for Complete Listing

S844 - Sodium Dodecyl Sulfate

SDS; Sodium Lauryl Sulfate

- Powder
- CAS Number: 151-21-3
- Formula: $C_{12}H_{25}NaO_4S$
- Molecular Weight: 288.38
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 8710

Available Package Sizes

25g	100g	500g

S742 - Spectinomycin Dihydrochloride

Togamycin; Trobicin

- Powder
- CAS Number: 22189-32-8
- Formula: $C_{14}H_{24}N_2O_7 \cdot 2HCl \cdot 5H_2O$
- Molecular Weight: 495.35
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 8813

Available Package Sizes

5g	25g

S716 - SSC Buffer Solution (20x), pH 7.0

Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (mg/L)	
Sodium Chloride (3 M)	175,320
Sodium Citrate•$2H_2O$ (0.3 M)	88,230
Contains sufficient HCl to adjust pH to 7.0	

Available Package Sizes

500mL	1L

S677 - SSPE Buffer Solution (20x)

Saline - Sodium Phosphate EDTA Buffer Solution
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (g/L)	
Sodium Chloride	175.32
Sodium Phosphate Monobasic	27.6
$Na_2EDTA \cdot 2H_2O$	7.4
Contains sufficient amount of NaOH to adjust pH to 7.4 ± 0.2	

Available Package Sizes

100mL	500mL	1L

S739 - Streptomycin Sulfate

USP Grade
O-2-Deoxy-2-(methylamino)-α-L-glucopyranosyl-(1→2)-*O*-5-deoxy-3-*C*-formyl-α-L-lyxofuranosyl-(1→4)-*N,N'*-bis(aminoiminomethyl)-D-streptamine Sulfate

- Powder
- CAS Number: 3810-74-0
- Formula: $(C_{21}H_{39}N_7O_{12})_2 \cdot 3H_2SO_4$
- Molecular Weight: 1457.4
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 8905



Available Package Sizes

25g 100g

New Product

S7739 - Streptomycin Sulfate Solution (250 mg/mL)

O-2-Deoxy-2-(methylamino)-α-L-glucopyranosyl-(1→2)-*O*-5-deoxy-3-*C*-formyl-α-L-lyxofuranosyl-(1→4)-*N,N'*-bis(aminoiminomethyl)-D-streptamine Sulfate
Aqueous Solution
Sterile Filtered

- Liquid
- CAS Number: 3810-74-0
- Formula: $(C_{21}H_{39}N_7O_{12})_2 \cdot 3H_2SO_4$
- Molecular Weight: 1457.4
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

10mL 25mL 100mL

Terrific Broths

See Microbiology Section for Complete Listing

T859 - Tetracycline Hydrochloride

[4*S*-(4α,4aα,5aα,6β,12aα)]-4-(Dimethylamino)-1,4,4a,5,5a,6-11,12a-octahydro-3,6,10,12,12a-pentahydroxy-6-methyl-1,11-dioxo-2-napthacenecarboxamide Hydrochloride

- Powder
- CAS Number: 64-75-5
- Formula: $C_{22}H_{24}N_2O_8 \cdot HCl$
- Molecular Weight: 480.94
- Soluble in Water
- Store at -20 to 0 °C
- *Merck* **13**, 9271

Available Package Sizes

5g 25g 100g

New Product

T7859 - Tetracycline Hydrochloride Solution (10 mg/mL)

[4*S*-(4α,4aα,5aα,6β,12aα)]-4-(Dimethylamino)-1,4,4a,5,5a,6-11,12a-octahydro-3,6,10,12,12a-pentahydroxy-6-methyl-1,11-dioxo-2-napthacenecarboxamide Hydrochloride in DMSO

- Liquid
- CAS Number: 64-75-5
- Formula: $C_{22}H_{24}N_2O_8 \cdot HCl$
- Molecular Weight: 480.94
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10mL 25mL 100mL

For More Information about Antibiotics

See "Figure 29. Antibiotics/Antimycotics/Selection Agent Guide" on page 253 in the Technical Section.

T869 - Timentin

Ticarcillin Disodium Salt/ Potassium Clavulanate mixture (15:1)
Plant Tissue Culture Tested

- Powder
- CAS Number: 4697-14-7 / 61177-45-5
- Formula: $C_{15}H_{14}N_2Na_2O_6S_2$ / $C_8H_8KNO_5$
- Molecular Weight: 428.4 / 237.3
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

2g 5g 10g 25g 100g

T767 - Timentin Solution (100 mg/mL)

Ticarcillin Disodium Salt/ Potassium Clavulanate Mixture (15:1)
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 4697-14-7 / 61177-45-5
- Formula: $C_{15}H_{14}N_2Na_2O_6S_2$ / $C_8H_8KNO_5$
- Molecular Weight: 428.4 / 237.3
- Miscible with Water
- Store at -20 to 0 °C
- Ship on dry ice



Available Package Sizes

10x1mL 10mL 25mL 100mL

©2014 PhytoTechnology Laboratories®

New Product

T7869 - Timentin Solution (50 mg/mL)

Ticarcillin Disodium Salt/ Potassium Clavulanate Mixture (15:1)
Sterile Filtered
Aqueous Solution
Plant Tissue Culture Tested

- Liquid
- CAS Number: 4697-14-7 / 61177-45-5
- Formula: $C_{15}H_{14}N_2Na_2O_6S_2$ / $C_8H_8KNO_5$
- Molecular Weight: 428.4 / 237.3
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

T834 - Tobramycin Sulfate

USP Grade
O-3-Amino-3-deoxy-α-D-glucopyranosyl-(1→6)-*O*-[2,6-diamino-2,3,6-trideoxy-α-D-*ribo*-hexopyranosyl-(1→4)]-2-deoxy-D-Streptamine Sulfate

- Powder
- CAS Number: 79645-27-5
- Formula: $(C_{18}H_{37}N_5O_9)_2 \cdot 5H_2SO_4$
- Molecular Weight: 1425.4
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 9567

Available Package Sizes

1g	5g	25g

T769 - Tris Acetate EDTA Buffer Solution (50x), pH 8.1 ± 0.1

TAE Buffer used for DNA electrophoresis
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (g/L)	
Tris Base	242.28
EDTA, Free Acid	14.61
Glacial Acetic Acid	57.1 mL

Available Package Sizes

500mL	1L

For More Information on Preparing Tris Buffers

See "Figure 39. Tris Buffer Preparation Guide" on page 262 in the Technical Section.

T838 - Tris Base

2-Amino-2-hydroxymethyl-1,3-propanediol

- Powder
- CAS Number: 77-86-1
- Formula: $C_4H_{11}NO_3$
- Molecular Weight: 121.13
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 9842

Available Package Sizes

100g	500g	1Kg	5Kg

T831 - Tris Borate EDTA Buffer

TBE Buffer
Use 17.02 grams to make 1 liter of 1x buffer solution

- Powder
- Soluble in Water when pH = 8.5
- Store at Room Temperature

Components (g/L)	
Tris Base	10.78
Boric Acid	5.5
$Na_2EDTA \cdot 2H_2O$	0.74

Available Package Sizes

100g	500g

T774 - Tris Borate EDTA Buffer Solution (10x)

TBE Buffer
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature

Components (g/L)	
Tris Base	107.8
Boric Acid	55.0
$Na_2EDTA \cdot 2H_2O$	7.4

Available Package Sizes

500mL	1L

T773 - Tris Borate EDTA Buffer Solution (5x)

TBE Buffer
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature



Components (g/L)	
Tris Base	53.9
Boric Acid	27.5
$Na_2EDTA•2H_2O$	3.7

Available Package Sizes

500mL 1L

T855 - Tris-EDTA Buffer

TE Buffer
Use 1.58 grams to make 1 liter of 1x buffer solution

- Powder
- Soluble in Water
- Store at Room Temperature

Components (g/L)	
Tris Base	1.21
$Na_2EDTA•2H_2O$	0.37

Available Package Sizes

100g 500g

T752 - Tris EDTA Buffer Solution (10X), pH 8.0

TE Buffer
Sterile Filtered
DNAse/RNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature



Components (g/L)	
Tris Base	1.21
$Na_2EDTA•2H_2O$	0.37
Contains sufficient HCl to adjust pH to 8.0	

Available Package Sizes

500mL 1L

T814 - Tris-Glycine Buffer

TG Buffer
Use 17.44 grams to make 1 liter of 1x buffer solution

- Powder
- Soluble in Water
- Store at Room Temperature

Components (g/L)	
Tris Base	3.03
Glycine	14.41

Available Package Sizes

100g 500g

T821 - Tris Glycine SDS Buffer

TG-SDS Buffer / TGS Buffer
Use 18.44 grams to make 1 liter of 1x buffer solution

- Powder
- Soluble in Water
- Store at Room Temperature

Components (g/L)	
Tris Base	3.03
Glycine	14.41
Sodium Dodecyl Sulfate	1.00

Available Package Sizes

100g 500g

T749 - Tris-Glycine-SDS Buffer Solution (10x)

Protein Running Buffer; TG-SDS Buffer
Sterile Filtered
DNAse Free

- Liquid
- Miscible with Water
- Store at Room Temperature



Components (g/L)	
Tris Base	30.28
Glycine	144.14
Sodium Dodecyl Sulfate	10.0

Available Package Sizes

500mL 1L

T764 - Tris HCl Solution 1.0 M, pH 7.5

Sterile Filtered

- Liquid
- Miscible with Water
- Store at Room Temperature



Components (g/L)	
Tris Base	121.14
Contains sufficient HCl to adjust pH to 7.5	

Available Package Sizes

500mL 1L

©2014 PhytoTechnology Laboratories®

T858 - Tris Hydrochloride

2-Amino-2-hydroxymethyl-1,3-propanediol Hydrochloride

- Powder
- CAS Number: 1185-53-1
- Formula: $C_4H_{11}NO_3$•HCl
- Molecular Weight: 157.6
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g	500g	1Kg

T8100 - Triton X-100

Octoxynol; X-100; 4-(1,1,3,3-Tetramethylbutyl)phenyl-polyethylene glycol; t-Octylphenoxypolyethoxyethanol; Polyethylene glycol tert-octylphenyl ether
Triton X-100 is a nonionic surfactant. It's often used to solubilized proteins in molecular biology applications.

- Liquid
- CAS Number: 9002-93-1
- Formula: $C_{14}H_{22}O(C_2H_4O)_n$ (n = 9 to 10)
- Molecular Weight: Average 625
- Miscible with Water
- Store at Room Temperature



Available Package Sizes

10mL	25mL	100mL

V870 - Vancomycin Hydrochloride

Plant Tissue Culture Tested

- Powder
- CAS Number: 1404-93-9
- Formula: $C_{66}H_{75}Cl_2N_9O_{24}$•HCl
- Molecular Weight: 1485.73
- Soluble in Water
- Store at 2 to 6 °C
- *Merck* **13**, 9995



Available Package Sizes

1g	5g	10g	25g

New Product

V8370 - Vancomycin Hydrochloride Solution (100 mg/mL)

Aqueous Solution
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 1404-93-9
- Formula: $C_{66}H_{75}Cl_2N_9O_{24}$•HCl
- Molecular Weight: 1485.73
- Miscible with Water
- Store at -20 to 0 °C
- Ships on dry ice



Available Package Sizes

10x1mL	10mL	25mL	100mL

W783 - Water, Plant Tissue Culture Grade

Sterile Filtered
Plant Tissue Culture Tested
DNAse/RNAse Free

- Liquid
- CAS Number: 7732-18-5
- Formula: H_2O
- Molecular Weight: 18.02
- Store at Room Temperature
- *Merck* **13**, 10098



Available Package Sizes

1L	3.9L

W887 - Wilikins-Chalgren Agar

See Microbiology Section for Complete Listing

X874 - X-Gal

5-Bromo-4-chloro-3-indolyl-β-D-galactopyranoside

- Powder
- CAS Number: 7240-90-6
- Formula: $C_{14}H_{15}BrClNO_6$
- Molecular Weight: 408.63
- Soluble in DMSO or KOH
- Store at -20 to 0 °C

Available Package Sizes

100mg	500mg	1g

How to Make a GUS Gene Staining Solution

See "Figure 30. GUS Gene Staining Solution Formulation" on page 255 in the Technical Section.

X877 - X-Gluc, Monocyclohexyl Ammonium Salt

X-GlcA; 5-Bromo-4-chloro-3-indolyl-β-D-glucuronic Acid, Monocyclohexyl Ammonium Salt

- Powder
- CAS Number: 114162-64-0
- Formula: $C_{20}H_{26}BrClN_2O_7$
- Molecular Weight: 521.8
- Soluble in DMSO or KOH
- Store at -20 to 0 °C

Available Package Sizes

100mg	500mg	1g	5g

X871 - X-Gluc, Sodium Salt

5-Bromo-4-chloro-3-indolyl-β-D-glucuronic Acid, Sodium Salt

- Powder
- CAS Number: 129541-41-9
- Formula: $C_{14}H_{12}BrClNaNO_7$
- Molecular Weight: 444.6
- Soluble in DMSO or KOH
- Store at -20 to 0 °C

Available Package Sizes

100mg	500mg	1g	5g

New Product

X8451 - X-Gluc Stock Solution (20 mg/mL)

A solution of X-Gluc (X877) at 20 milligrams per milliliter in DMSO (D241).
5-bromo-4-chloro-3-indolyl-ß-D-glucuronic Acid Monocyclohexyl Ammonium Salt

- Liquid
- CAS Number: 114162-64-0
- Formula: $C_{20}H_{26}BrClN_2O_7$
- Molecular Weight: 521.8
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes

10mL	10x1mL	25mL	100mL

Y889 - YEP Medium

See Microbiology Section for Complete Listing

Y893 - YMB Medium

See Microbiology Section for Complete Listing

Custom Media & Services

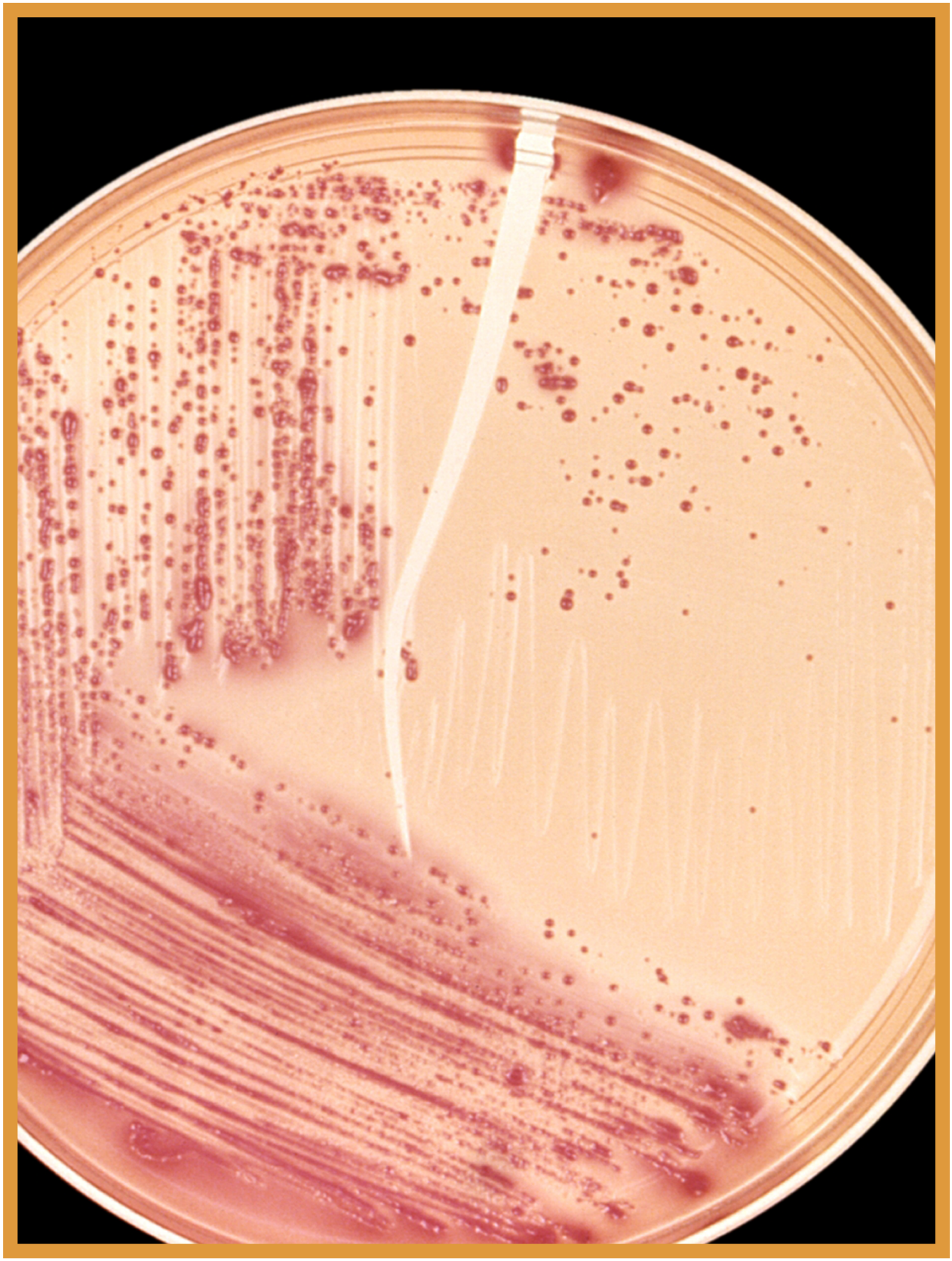


*Phyto*Technology Laboratories® offers custom manufacturing and testing services. For more information please see page 12.

- Custom Dry Powder Media
- Custom Liquid Media
- Custom Packaging
- Testing Services

©2014 PhytoTechnology Laboratories®

MICROBIOLOGY









Microbiology

*Phyto*Technology Laboratories® offers a line of media for the growth of bacteria and fungi. These media are manufactured with the same dedication and standards of quality that has made the *Phyto*Technology Laboratories® plant tissue culture media so popular.

Most components used in the formulation of Microbiology Media are available as individual components. Check the Biochemicals Section on Page 15 for component product listings and more information.

Be sure to check **www.phytotechlab.com** frequently as we continue to expand this product line.

For More Information on Microbiology Media

See "Phytopathology & Microbiology Media" on page 256 in the Technical Section.

A1272 - Aniline Blue

See Seed Testing Section for Complete Listing

B129 - Bacteria Screening Medium 523

See Phytopathology Section for Complete Listing

B1714 - Bromothymol Blue

See Seed Testing Section for Complete Listing

C184 - Casein, Enzymatic Hydrolysate

See Biochemicals Section for Complete Listing

C1842 - Cellobiose

See Seed Testing Section for Complete Listing

C1970 - Cephalexin Monohydrate

See Seed Testing Section for Complete Listing

C2112 - Cephalexin Solution (100 mg/mL)

See Seed Testing Section for Complete Listing

C442 - Corn Meal Agar

See Phytopathology Section for Complete Listing

C1830 - Crystal Violet

See Seed Testing Section for Complete Listing

H276 - CTAB

See Molecular Biology Section for Complete Listing

H3818 - CTAB Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

Czapex-Dox Broth & Agar

See Phytopathology Section for Complete Listing

H289 - Hanahan's Broth

SOB Medium was developed by Hanahan (1983) for the cultivation of competent *E. coli* cells prior to transformation. This is a nutritionally rich medium to which 22 mM (0.4%) D-glucose is added for the final stage of transformation; this allows the *E. coli* cells to mend from transformation and replicate.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 28.09 grams per liter

Components (mg/L)	
Tryptone	20,000
Yeast Extract	5000
Magnesium Sulfate, Anhydrous	2400
Sodium Chloride	500
Potassium Chloride	186
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 100g 500g

K5013 - King's B Medium

See Seed Testing Section for Complete Listing

L5128 - LB Agar, Lennox L Modification

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Lennox L (1955).
Also known as Lysogeny Agar or Luria-Bertani Agar

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 32.00 grams per liter

Components (mg/L)	
Sodium Chloride	5,000
Agar	12,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	6.9 ± 0.5

Available Package Sizes

1L 500g 5Kg

©2014 PhytoTechnology Laboratories®

L465 - LB Agar, Miller Modification

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Miller (1972).
This is the most widely-used formulation of LB Broth, Stambrook (1989).
Also known as Lysogeny Agar or Luria-Bertani Agar

- Store at 2 to 6 °C
- Soluble in Water
- Use at 37.00 grams per liter

Components (mg/L)	
Agar	12,000
Sodium Chloride	10,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 500g 5Kg

L5138 - LB Broth, Lennox L Modification

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Lennox L (1955).
Also known as Lysogeny Broth or Luria-Bertani Broth

- Store at 2 to 6 °C
- Soluble in Water
- Use at 20.00 grams per liter

Components (mg/L)	
Sodium Chloride	5,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	6.75 ± 0.75

Available Package Sizes

1L 500g 5Kg

L5190 - LB Broth, Lennox L Modification (ADP Free)

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Lennox L (1955). Also known as Lysogeny Broth or Luria-Bertani Broth

- Store at 2 to 6 °C
- Soluble in Water
- Free of Animal Derived Products (ADP)
- Use at 24.0 grams per liter

Components (mg/L)	
Peptone, from Soy	14,000
Yeast Extract	5000
Sodium Chloride	5000
Approximate pH at Room Temperature	6.75 ± 0.75

Available Package Sizes

1L 500g

L475 - LB Broth, Miller Modification

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Miller (1972).
This is the most widely-used formulation of LB Broth, Stambrook (1989).
Also known as Lysogeny Broth or Luria-Bertani Broth

- Store at 2 to 6 °C
- Soluble in Water
- Use at 25.00 grams per liter

Components (mg/L)	
Sodium Chloride	10,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 500g 5Kg

L585 - LB Broth Solution, Lennox L Modification (1x)

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Lennox L (1955).
Also known as Lysogeny Broth or Luria-Bertani Broth

- Liquid
- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with water



Components (mg/L)	
Sodium Chloride	5,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	6.9 ± 0.5

Available Package Sizes

100mL 500mL 1L

L301 - LB Broth Solution, Miller Modification (1x)

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Miller (1972).
This is the most widely-used formulation of LB Broth, Stambrook (1989).
Also known as Lysogeny Broth or Luria-Bertani Broth

- Liquid
- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with water



Components (mg/L)	
Tryptone	10,000
Yeast Extract	5000
Sodium Chloride	10,000

Available Package Sizes

100mL 500mL 1L

L591 - LB Broth Solution with Glycerol

Contains the nutrients as described by Bertani (1951), and Luria & Burrows (1955). Formulation modified by Lennox L (1955).
Also known as Lysogeny Broth or Luria-Bertani Broth

- Liquid
- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with water



Components (mg/L)	
Glycerol	4.0 mL
Sodium Chloride	5,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	6.9 ± 0.5

Available Package Sizes

100mL 500mL 1L

L476 - Leifert & Waites Sterility Test Medium

See Phytopathology Section for Complete Listing

M474 - Malt Extract

See Biochemicals Section for Complete Listing

M498 - Malt Extract Agar

- Store at Room Temperature
- Soluble in Water (Partially)
- Use at 48.00 grams per liter

Components (mg/L)	
Agar	15,000
Malt Extract	30,000
Peptone from Meat	3,000
Approximate pH at Room Temperature	6.4 ± 0.5

Available Package Sizes

500g 1Kg

New Product

M5506 - Malt Extract Agar with Glucose and Maltose

Malt Extract Agar is a nutrient medium used for the isolation, detection, transformation and growth of yeasts and fungi in microbiology applications. Formulation as published by Thom & Church (1926).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 30.0 grams per liter of medium

Components (mg/L)	
Agar	15,000
D-Glucose, anhydrous	6000
Malt Extract	6000
Maltose	1800
Yeast Extract	1200

Available Package Sizes

1L 100g 500g

M484 - Malt Extract Broth

- Store at Room Temperature
- Soluble in Water
- Use at 20.00 grams per liter

Components (mg/L)	
Malt Extract	17,000
Peptone from Meat	3,000
Approximate pH at Room Temperature	6.5 ± 0.5

Available Package Sizes

1L 500g 1Kg

M5516 - mD5A Medium

See Seed Testing Section for Complete Listing

M567 - Meat Extract

See Biochemicals Section for Complete Listing

M5781 - Methylene Blue

See Seed Testing Section for Complete Listing

©2014 PhytoTechnology Laboratories®

M580 - Modified Melin-Norkrans Medium

Used for the isolation of Fungi from mixed microbiological samples.
- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 20.82 grams per liter

Components (mg/L)	
Ammonium Phosphate, Monobasic	184.7
Calcium Chloride, Anhydrous	50
FeNaEDTA	20
Magnesium Sulfate	35.8
Potassium Phosphate, Monobasic, Anhydrous	500
Sodium Chloride	25
Agar	7,000
Malt Extract	3,000
Sucrose	10,000
Thiamine•HCl	0.1
Approximate pH at Room Temperature	6.5 ± 0.5

Available Package Sizes

1L 10L

Indexing with Microbiology Media

See "Figure 20. Media Used in Indexing Explants" on page 244 in the Technical Section.

N601 - Nutrient Agar

- Store at Room Temperature
- Soluble in Water (Partially)
- Use at 23.00 grams per liter

Components (mg/L)	
Agar	15,000
Meat Extract	3,000
Peptone from Meat	5,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 100g 500g

N611 - Nutrient Broth

- Store at Room Temperature
- Soluble in Water
- Use at 8.00 grams per liter

Components (mg/L)	
Meat Extract	3,000
Peptone from Meat	5,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 500g

O606 - Oat Meal Agar

See Phytopathology Section for Complete Listing

P6737 - PCNB

See Seed Testing Section for Complete Listing

P777 - Penicillin G

See Biochemical Section for Complete Listing

P6767 - Penicillin G Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

P721 - Peptone, from Soymeal

See Biochemicals Section for Complete Listing

P780 - Peptone, Glysate

See Biochemicals Section for Complete Listing

P775 - Peptone, Type I

See Biochemicals Section for Complete Listing

P632 - Peptone Water

- Liquid
- Store at 2 to 6 °C
- Miscible in Water
- Use at 15 grams per liter



Components (mg/L)	
Peptone from Meat	10,000
Sodium Chloride	5,000
Approximate pH at Room Temperature	7.2 ± 0.5

Available Package Sizes

100mL 500mL

P732 - Peptone Water, Buffered (1x)

- Liquid
- Store at 2 to 6 °C
- Miscible in Water
- Use at 20 grams per liter



Components (mg/L)	
Peptone from Meat	10,000
Sodium Chloride	5000
Sodium Phosphate, Dibasic	3500
Potassium Phosphate, Monobasic	1500
Approximate pH at Room Temperature	7.2 ± 0.5

Available Package Sizes

100mL 500mL 1L

P6800 - PhytoSelect Basal Medium

See Seed Testing Section for Complete Listing

P6809 - Polymyxin B Sulfate

See Seed Testing Section for Complete Listing

P6719 - Polymyxin B Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

Potato Dextrose Broth & Agar

See Phytopathology Section for Complete Listing

P692 - Potato Powder

See Biochemicals Section for Complete Listing

R7171 - Rose Bengal

See Seed Testing Section for Complete Listing

New Product

S7536 - Sabouraud Dextrose Broth

Used in the isolation and cultivation of yeasts, fungi.

- Store at Room Temperature
- Soluble in Water
- Use at 50.0 grams per liter

Components (mg/L)	
D-(+) Glucose, Anhydrous	40,000
Peptone from Meat	10,000

Available Package Sizes

1L 100g 500g

S7775 - Saline Solution (0.85%)

See Seed Testing Section for Complete Listing

S657 - SOC Medium Solution

Typically used in the recovery step of *Escherichia coli* competent cell transformations. Formulation as described by Hanahan (1983).

- Liquid
- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with water



Components (mg/L)	
Glucose, Anhydrous	3,600
Magnesium Sulfate, Anhydrous	2,400
Potassium Chloride	186
Sodium Chloride	500
Tryptone	20,000
Yeast Extract	5,000
Approximate pH at Room Temperature	7.2 ± 0.5

Available Package Sizes

100mL 500mL 1L

New Product

S7478 - Sordaria Crossing Agar

Used as medium for genetic crossover culture of the fungus *Sordaria fimicola*.

- Store at 2 to 6 °C
- Soluble in Boiling Water
- Use at 35.1 grams per liter

Components (mg/L)	
Agar	15,000
Corn Meal	2000
D-Glucose, Anhydrous	7000
Potassium Phosphate, Monobasic	100
Sucrose	10,000
Yeast Extract	1000

Available Package Sizes

1L 100g 500g 5Kg

T8199 - Tetrazolium Blue

See Biochemicals Section for Complete Listing

T760 - Terrific Broth

Terrific Broth is a nutrient media for use with the culture *Escherichia coli* for microbiology applications.
Requires the addition of 4.0 mL of Glycerol (Product Number G381) per liter of broth.

- Powder
- Store at 2 to 6 °C
- Soluble in Water
- Use at 47.00 grams per liter

Components (mg/L)	
Tryptone	11,800
Potassium Phosphate, Dibasic, Anhydrous	9,400
Potassium Phosphate, Monobasic, Anhydrous	2,200
Yeast Extract	23,600
Approximate pH at Room Temperature	7.3 ± 0.5

Available Package Sizes

1L 500g 5kg

©2014 PhytoTechnology Laboratories®

T754 - Terrific Broth Solution with Glycerol (1x)

Terrific Broth is a nutrient media for use with the culture *Escherichia coli* for microbiology applications.

- Liquid
- Store at 2 to 6 °C
- Sterile Filtered
- Miscible with water



Components (mg/L)	
Glycerol	4.0 mL
Tryptone	11,800
Potassium Phosphate, Dibasic, Anhydrous	9400
Potassium Phosphate, Monobasic, Anhydrous	2200
Yeast Extract	23,600
Approximate pH at Room Temperature	7.3 ± 0.5

Available Package Sizes

100mL 500mL 1L

T7968 - Trehalose Dihydrate

See Seed Testing Section for Complete Listing

T752 - TRIS EDTA Buffer Solution, pH 8.0

See Molecular Biology Section for Complete Listing

New Product

T7900 - Tryptic Soy Broth

Tryptic Soy Broth, Type I

- Store at Room Temperature
- Soluble in Water
- Use at 25.0 grams per liter of medium

Components (mg/L)	
Tryptone	15,000
Peptone from Soymeal	5000
Sodium Chloride	5000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 500g 1Kg

New Product

T8000 - Tryptic Soy Broth, Type II

- Store at Room Temperature
- Soluble in Water
- Use at 30.0 grams per liter of medium

Components (mg/L)	
Tryptone	17,000
Peptone from Soymeal	3000
Sodium Chloride	5000
Potassium Phosphate, Dibasic	2500
D- Glucose	2500

Available Package Sizes

1L 500g 1Kg

T832 - Tryptone

See Biochemicals Section for Complete Listing

T848 - Tryptose

See Biochemicals Section for Complete Listing

T8110 - Tyrothricin

See Seed Testing Section for Complete Listing

T8020 - Tyrothricin (10 mg/mL)

See Seed Testing Section for Complete Listing

W783 - Water, Plant Tissue Culture Grade

See Molecular Biology Section for Complete Listing

W887 - Wilkins-Chalgren Agar

This medium is typically used to isolate and culture anaerobic bacteria. Formulation as described by Wilkens & Chalgren (1976).

- Store at 2 to 6 °C
- Prepared medium should be stored at 2 to 6 °C in the dark.
- Soluble in Water (Partially)
- Use at 43.00 grams per liter

Components (mg/L)	
Agar	10,000
L-Arginine (Free Base)	1,000
D-Glucose	1,000
Haemin	5.0
Menadione	0.5
Peptone, Glysate	10,000
Pyruvic Acid	1,000
Sodium Chloride	5,000
Tryptone	10,000
Yeast Extract	5,000
Approximate pH at Room Temperature	6.9 ± 0.5

Available Package Sizes

500g

X8454 - XTS Medium

See Seed Testing Section for Complete Listing

Y892 - Yeast Extract

See Biochemicals Section for Complete Listing

New Product

Y8488 - Yeast Malt Broth

Also known as Yeast Mold Broth.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 21.0 grams per liter

Components (mg/L)	
Peptone from Meat	5000
Yeast Extract	3000
D- Glucose, Anhydrous	10,000
Malt Extract	3000

Available Package Sizes

1L 500g

New Product

Y8565 - YEP Broth

Also known as Yeast Extract Peptone Broth. This has been used to culture *Agrobacterium* as well as yeasts.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 25.0 grams per liter

Components (mg/L)	
Peptone from Meat	10,000
Yeast Extract	10,000
Sodium Chloride	5000

Available Package Sizes

1L 10L 500g

Y889 - YEP Medium

Also known as Yeast Extract Peptone Medium. This has been used to culture *Agrobacterium* as well as yeasts.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 40.00 grams per liter

Components (mg/L)	
Agar	15,000
Peptone from Meat	10,000
Sodium Chloride	5,000
Yeast Extract	10,000
Approximate pH at Room Temperature	6.6 ± 0.5

Available Package Sizes

1L 500g

New Product

Y8480 - YEP Medium (ADP Free)

Also known as Yeast Extract Peptone Medium. This has been used to culture *Agrobacterium* as well as yeasts.

- Store at 2 to 6 °C
- Soluble in Boiling Water
- Free of Animal Derived Products (ADP)
- Use at 45.0 grams per liter

Components (mg/L)	
Peptone from Soy	15,000
Yeast Extract	10,000
Sodium Chloride	5,000
Agar	15,000

Available Package Sizes

1L 500g

Y893 - YMB Medium

Also known as Yeast Mannitol Broth Medium. Used for the cultivation of *Rhizobium spp.* and vairous fungi.

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 26.20 grams per liter

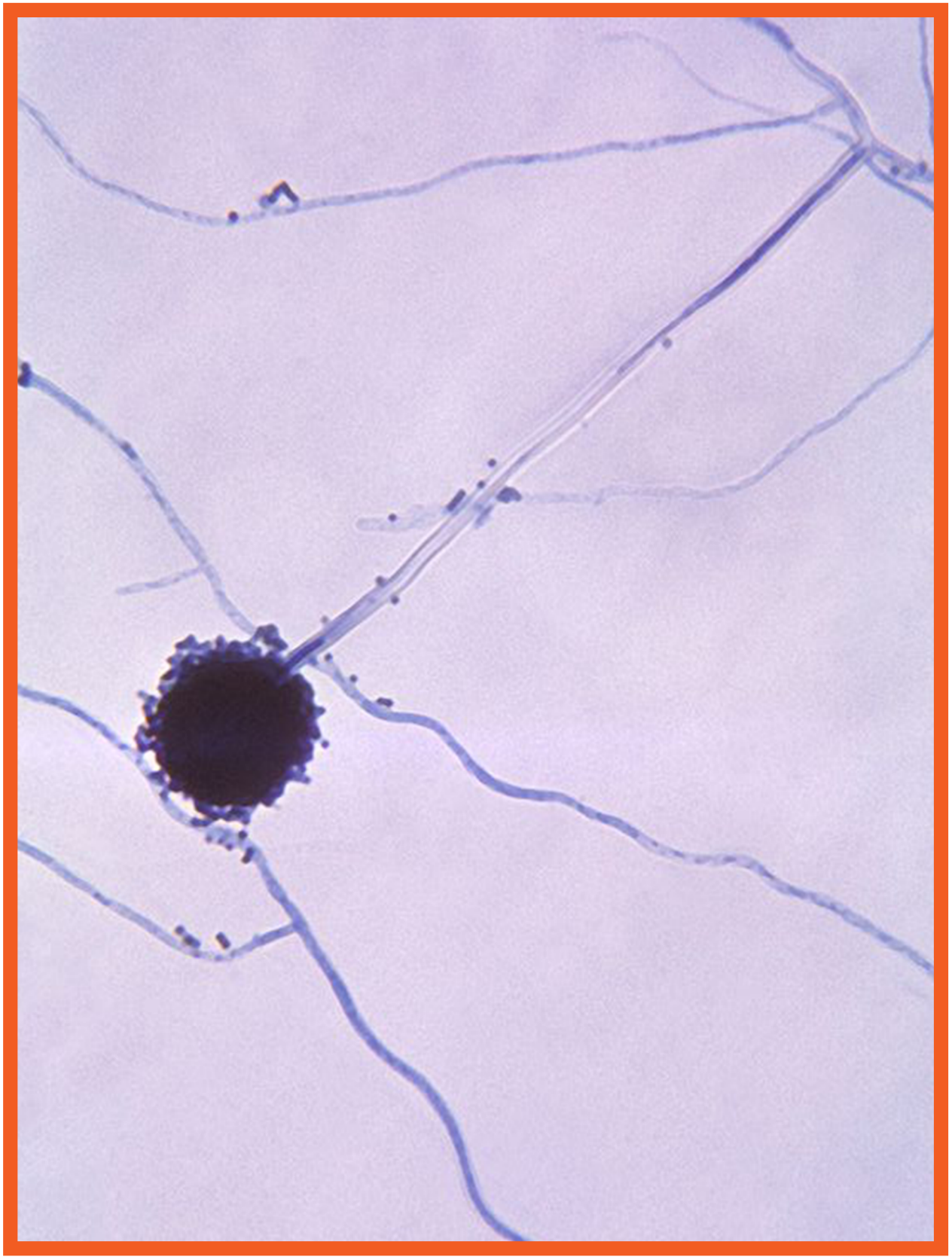
Components (mg/L)	
Magnesium Sulfate, Anhydrous	200
Potassium Phosphate, Dibasic, Anhydrous	500
Agar	15,000
D-Mannitol	10,000
Sodium Chloride	100
Yeast Extract	400
Approximate pH at Room Temperature	7.4 ± 0.5

Available Package Sizes

1L 500g

©2014 PhytoTechnology Laboratories®

PHYTOPATHOLOGY









Phytopathology

*Phyto*Technology Laboratories® offers a line of media and products for use in phytopathology research. Phytopathology media are manufactured with the same dedication and standards of quality that has made *Phyto*Technology Laboratories® plant tissue culture media so popular.

Most components used in the formulation of Phytopathology Media are available as individual components. Check the Biochemicals Section on Page 15 for component product listings and more information.

Be sure to check **www.phytotechlab.com** frequently as we continue to expand this product line.

For More Information on Phytopathology Media

See "Phytopathology & Microbiology Media" on page 256 in the Technical Section.

A1286 - Alcian Blue

See Seed Testing Section for Complete Listing

A1272 - Aniline Blue

See Seed Testing Section for Complete Listing

B129 - Bacteria Screening Medium 523

Used to identify pathogen-free explants. Does not promote explant growth. Formulation as described by Viss & Driver (1991).

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 32.15 grams per liter
- Plant Tissue Culture Tested

Components (mg/L)	
Magnesium Sulfate•7H_2O	150
Potassium Phosphate, Monobasic, Anhydrous	2,000
Agar	8,000
Casein, Enzymatic Hydrolysate	8,000
Sucrose	10,000
Yeast Extract	4,000
Approximate pH at Room Temperature	6.0 ± 0.5

Available Package Sizes

1L 100g 500g 1Kg

B1714 - Bromothymol Blue

See Seed Testing Section for Complete Listing

C184 - Casein, Enzymatic Hydrolysate

See Biochemicals Section for Complete Listing

C1842 - Cellobiose

See Seed Testing Section for Complete Listing

C1970 - Cephalexin Monohydrate

See Seed Testing Section for Complete Listing

C2112 - Cephalexin Solution (100 mg/mL)

See Seed Testing Section for Complete Listing

C442 - Corn Meal Agar

- Store at Room Temperature
- Soluble in Water (Partially)
- Use at 22.00 grams per liter

Components (mg/L)	
Agar	7,000
Corn Meal	15,000
Approximate pH at Room Temperature	7.2 ± 0.5

Available Package Sizes

1L 100g 500g

C1830 - Crystal Violet

See Seed Testing Section for Complete Listing

H276 - CTAB

See Molecular Biology Section for Complete Listing

H3818 - CTAB Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

C506 - Czapek–Dox Agar

Czapek-Dox broth is a semi-synthetic broth used for the cultivation of fungi. This medium is prepared according to the formula developed by Thom and Church (1926).

- Store at 2 to 6 °C
- Soluble in Water (Partially)
- Use at 50.01 grams per liter

Components (mg/L)	
Agar	15,000
Ferrous Sulfate•7H_2O	10
Magnesium Sulfate, Anhydrous	500
Potassium Chloride	500
Potassium Phosphate, Dibasic, Anhydrous	1,000
Sodium Nitrate	3,000
Sucrose	30,000
Approximate pH at Room Temperature	7.9 ± 0.5

Available Package Sizes

1L 500g

©2014 PhytoTechnology Laboratories®

C443 - Czapek–Dox Broth

Czapek-Dox broth is a semi-synthetic broth used for the cultivation of fungi. This medium is prepared according to the formula developed by Thom and Church (1926).

- Store at 2 to 6 °C
- Soluble in Water
- Use at 35.01 grams per liter

Components (mg/L)	
Ferrous Sulfate•$7H_2O$	10
Magnesium Sulfate, Anhydrous	500
Potassium Chloride	500
Potassium Phosphate, Dibasic, Anhydrous	1,000
Sodium Nitrate	3,000
Sucrose	30,000
Approximate pH at Room Temperature	8.3 ± 0.5

Available Package Sizes

1L 500g

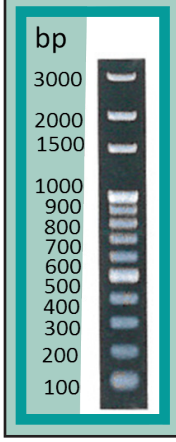
G3574 - Guaiacol

See Seed Testing Section for Complete Listing

Indexing with Phytopathology Media

See "Figure 20. Media Used in Indexing Explants" on page 244 in the Technical Section.

Molecular Biology Kits



*Phyto*Technology Laboratories® offers a variety of kits for molecular biology. Please see the molecular biology section on pages 129 to 148 for more information.

- RNA Extraction Kits
- Genomic DNA Extraction Kits
- Plasmid DNA Extraction Kits
- DNA Ladder Kits

L476 - Leifert & Waites Sterility Test Medium

This medium was developed to determine and identify potential pathogens in explants. Formulation as described by Leifert, C & WM Waites (1992).

Store at 2 to 6 °C
Soluble in Water
Use at 45.22 grams per liter
Plant Tissue Culture Tested

Components (mg/L)	
Ammonium Nitrate	825
Boric Acid	3.1
Calcium Chloride, Anhydrous	166.1
Cobalt Chloride•$6H_2O$	0.0125
Cupric Sulfate•$5H_2O$	0.0125
$Na_2EDTA•2H_2O$	18.63
Ferrous Sulfate•$7H_2O$	13.9
Magnesium Sulfate, Anhydrous	90.35
Manganese Sulfate•H_2O	8.45
Molybdic Acid, Disodium Salt•$2H_2O$	0.125
Potassium Iodide	0.415
Potassium Nitrate	950
Potassium Phosphate, Monobasic, Anhydrous	85
Sodium Chloride	2,000
Zinc Sulfate•$7H_2O$	4.3
D-Glucose, Anhydrous	5,000
Glycine	1.0
myo-Inositol	50
Meat Extract	7,000
Nicotinic Acid	0.25
Peptone from Meat	4,000
Pyridoxine•HCl	0.25
Sucrose	15,000
Thiamine•HCl	0.05
Yeast Extract	10,000
Approximate pH at Room Temperature	6.8 ± 0.5

Available Package Sizes

500g 1Kg

M474 - Malt Extract

See Biochemicals Section for Complete Listing

M567 - Meat Extract

See Biochemicals Section for Complete Listing

M5781 - Methylene Blue

See Seed Testing Section for Complete Listing

O606 - Oat Meal Agar

- Store at Room Temperature
- Soluble in Water (Partially)
- Use at 10.50 grams per liter

Components (mg/L)	
Agar	7,000
Rolled Oats	3,500
Approximate pH at Room Temperature	6.9 ± 0.5

Available Package Sizes

1L 100g 500g

P6737 - PCNB

See Seed Testing Section for Complete Listing

P777 - Penicillin G

See Seed Testing Section for Complete Listing

P6767 - Penicillin G Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

Peptone From Meat -or- Peptone From Soy

See Biochemicals Section for Complete Listings

P6809 - Polymyxin B Sulfate

See Seed Testing Section for Complete Listing

P6719 - Polymyxin B Solution (10 mg/mL)

See Seed Testing Section for Complete Listing

P772 - Potato Dextrose Agar

- Store at Room Temperature
- Soluble in Water (Partially)
- Use at 39.00 grams per liter

Components (mg/L)	
Agar	15,000
D-Glucose, Anhydrous	20,000
Potato Powder	4,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 100g 500g 2.5Kg

P762 - Potato Dextrose Broth

- Store at Room Temperature
- Soluble in Water
- Use at 24.00 grams per liter

Components (mg/L)	
D-Glucose, Anhydrous	20,000
Potato Powder	4,000
Approximate pH at Room Temperature	7.0 ± 0.5

Available Package Sizes

1L 100g 500g

P692 - Potato Powder

See Biochemicals Section for Complete Listing

R7171 - Rose Bengal

See Seed Testing Section for Complete Listing

S7775 - Saline Solution (0.85%)

See Seed Testing Section for Complete Listing

T8199 - Tetrazolium Blue

See Biochemicals Section for Complete Listing

T7968 - Trehalose Dihydrate

See Seed Testing Section for Complete Listing

T8092 - Toluidine Blue O

See Seed Testing Section for Complete Listing

T8110 - Tyrothricin

See Seed Testing Section for Complete Listing

T8020 - Tyrothricin (10 mg/mL)

See Seed Testing Section for Complete Listing

T752 - TRIS EDTA Buffer Solution, pH 8.0

See Molecular Biology Section for Complete Listing

T832 - Tryptone

See Biochemicals Section for Complete Listing

T848 - Tryptose

See Biochemicals Section for Complete Listing

W783 - Water, Plant Tissue Culture Grade

See Molecular Biology Section for Complete Listing

W887 - Wilkins-Chalgren Agar

See Microbiology Section for Complete Listing

X8454 - XTS Medium

See Seed Testing Section for Complete Listing

Y892 - Yeast Extract

See Biochemicals Section for Complete Listing

Y8488 - Yeast Malt Broth

See Microbiology Section for Complete Listing

YEP Broths & Medium

See Microbiology Section for Complete Listings

Y893 - YMB Medium

See Microbiology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

SEED TESTING









Seed Testing

*Phyto*Technology Laboratories® introduced the Seed Testing product line in late 2012.

Most components used in the formulation of Seed Testing Media are available as individual components. Check the Biochemicals Section on Page 15 for component product listings and more information.

Be sure to check **www.phytotechlab.com** frequently as we continue to expand this product line in 2013-2014.

For More Information on Stains & Dyes

See "Figure 34. Stains & Dyes Usage Table" on page 259 in the Technical Section.

New Product

A1286 - Alcian Blue

Alcian Blue 8GX
A biological stain useful for staining pectins in plant cell walls.

- Powder
- CAS Number: 75881-23-1
- Formula: $C_{56}H_{68}Cl_4CuN_{16}S_4$
- Molecular Weight: 1298.86
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

10g	25g	100g

New Product

A1272 - Aniline Blue

A histological stain used to detect fungal contaminants during seed testing. Sometimes used with Lactic Acid during seed testing.

- Powder
- CAS Number: 28631-66-5
- Formula: $C_{32}H_{25}N_3O_9S_3Na_2$
- Molecular Weight: 737.72
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1g	5g	25g	50g

A116 - Ampicillin

See Molecular Biology Section for Complete Listing

A1116 - Ampicillin Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

B132 - Bacitracin Zinc

See Molecular Biology Section for Complete Listing

New Product

B1714 - Bromothymol Blue

Bromothymol Blue Sodium Salt, BTB,
4,4'-(1,1-dioxido-3H-2,1-benzoxathiole-3,3-diyl)bis(2-bromo-6-isopropyl-3-methylphenol)
A biological (histological) stain and pH indicator.
Yellow at pH 6.0, green at pH 6.7, and blue at pH 7.6.

- Powder
- CAS Number: 34722-90-2
- Formula: $C_{27}H_{27}Br_2O_5SNa$
- Molecular Weight: 646.37
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

10g	25g

C1933 - Calcofluor White M2R

See Biochemicals Section for Complete Listing

New Product

C1842 - Cellobiose

A general carbon source. Can be used as a carbon source in mD5A medium for the selection of *Xanthomonas hortorum*.

- Powder
- CAS Number: 528-50-7
- Formula: $C_{12}H_{22}O_{11}$
- Molecular Weight: 342.30
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

10g	25g	100g

For More Information about Antibiotics

See "Figure 29. Antibiotics/Antimycotics/Selection Agent Guide" on page 253 in the Technical Section.

New Product

C1970 - Cephalexin Monohydrate

An antibiotic used with XTS Medium (X8454) and *Phyto*Select Medium (P6800) for the isolation of *Xanthomonas translucens* from Barley and Wheat seeds, *Xanthomonas camperstris* from *Brassicas*, and other plant pathogens.

- Powder
- CAS Number: 23325-78-2
- Formula: $C_{16}H_{17}N_3O_4S \cdot H_2O$
- Molecular Weight: 365.4
- Soluble in Water, DMSO
- Store at Room Temperature

Available Package Sizes

5g	10g	25g

©2014 PhytoTechnology Laboratories®

New Product

C2112 - Cephalexin Solution (100 mg/mL)

A solution of Cephalexin Monohydrate (C1970) at 100 milligrams per milliliter of DMSO. An antibiotic used with XTS Medium (X8454) and *Phyto*Select Medium (P6800) for the isolation of *Xanthomonas translucens* from Barley and Wheat seeds, *Xanthomonas campestris* from *Brassicas*, and other plant pathogens.



- Liquid
- CAS Number: 23325-78-2
- Formula: $C_{16}H_{17}N_3O_4S•H_2O$
- Molecular Weight: 365.4
- Miscible withWater
- Store at -20 to 0 °C

Available Package Sizes

10mL 100mL

C252 - Chloramphenicol

See Molecular Biology Section for Complete Listing

C2010 - Chloramphenicol Solution (10 mg/mL)

See Molecular Biology Section for Complete Listing

New Product

C1830 - Crystal Violet

Hexamethylpararosaniline Chloride, Gentian Violet, Basic Violet 3
A biological stain used in *Phyto*Select Medium (P6800) for plant pathogen selection; also used in gram staining, usually with Safranin O (Product Number S7400).

- Powder
- CAS Number: 548-62-9
- Formula: $C_{25}H_{30}ClN_3$
- Molecular Weight: 407.98
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g 100g

H276 - CTAB

See Molecular Biology Section for Complete Listing

H3818 - CTAB Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

C375 - Cupric Sulfate

See Biochemicals Section for Complete Listing

C1989 - Cycloheximide

See Molecular Biology Section for Complete Listing

C1796 - Cycloheximide Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

D2362 - DAPI

See Biochemicals Section for Complete Listing

E2799 - Evans Blue

See Biochemicals Section for Complete Listing

New Product

F3178 - Fast Green (FCF)

ethyl-[4-[[4-[ethyl-[(3-sulfophenyl)methyl]amino]phenyl]-(4-hydroxy-2-sulfophenyl)methylidene]-1-cyclohexa-2,5-dienylidene]-[(3-sulfophenyl)methyl]azanium, C.I. 42053

- Powder
- CAS Number: 2353-45-9
- Formula: $C_{37}H_{34}N_2O_{10}S_3Na_2$
- Molecular Weight: 808.85
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

5g 10g 25g 100g

F2950 - Fluorescein Diacetate

See Biochemicals Section for Complete Listing

G570 - Gentamicin Sulfate

See Molecular Biology Section for Complete Listing

G3350 - Gentamicin Solution (50 mg/mL)

See Molecular Biology Section for Complete Listing

G3410 - Gentamicin Solution (100 mg/mL)

See Molecular Biology Section for Complete Listing

G399 - L-Glutamic Acid

See Biochemicals Section for Complete Listing

G381 - Glycerol

See Biochemicals Section for Complete Listing

G503 - Glycine

See Biochemicals Section for Complete Listing

New Product

G3574 - Guaiacol

2-methoxyphenol
Used in peroxidase assays as a colorimetric agent; used in cultivar separation of soybeans, and alternatively to detect *H. oryzae* in rice seeds.
The melting point of this product can be as low as 26.1°C, so it can be either a fine powder or a liquid at room temperature.

- Liquid or Powder
- CAS Number: 90-05-1
- Formula: $C_7H_8O_2$
- Molecular Weight: 124.14
- Miscible with and Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g	50g	100g	250g

New Product

I4068 - Indigo Carmine

5,5'-Indigodisulfonic Acid Sodium Salt, Indigotine, Acid Blue 74, CI#: 73015
Used in viability tests to stain seeds to detect dead tissues; stain will penetrate dead cells, but will not stain living cells.
Can also be used as a pH indicator: it is blue at pH 11.4 and yellow at 13.0.

- Powder
- CAS Number: 860-22-0
- Formula: $C_{16}H_8N_2Na_2O_8S_2$
- Molecular Weight: 466.35
- Soluble in Water, Ethanol
- Store at Room Temperature

Available Package Sizes

25g	100g

New Product

K5013 - King's B Medium

Also known as King's B Agar or KB.
A non-selective medium for the subculture of suspected isolates. Glycerol (G381) is often added as a carbon source.

- Store at Room Temperature
- Soluble in Boiling Water
- Use at 37.23 grams per liter of medium

Components (mg/L)	
Peptone	20,000
Potassium Phosphate, Dibasic	1500
Magnesium Sulfate	730
Agar	15,000

Available Package Sizes

1L	500g

M562 - D-Mannitol

See Biochemicals Section for Complete Listing

M573 - Malachite Green Oxalate

See Biochemicals Section for Complete Listing

New Product

M5516 - mD5A Medium

Modified D-5 Agar Medium.
Used for detecting seedborne *Xanthamonas campestris pv. carotae* on carrot seeds. Recommended in ISTA method 7-020.

- Store at Room Temperature
- Soluble in Boiling Water
- Use at 20.45 grams per liter of medium

Components (mg/L)	
Magnesium Sulfate, Heptahydrate	300
Sodium Phosphate, Monohydrate	1150
Ammonium Chloride	1000
Potassium Phosphate, Dibasic	3000
Agar	15,000

Available Package Sizes

1L	10L

M539 - L-Methionine

See Biochemicals Section for Complete Listing

New Product

M5781 - Methylene Blue

3,7-bis(Dimethylamino)-phenothiazin-5-ium chloride, Basic Blue 9, Tetramethylthionine chloride.
A biological stain, redox indicator and cationic dye.

- Powder
- CAS Number: 7220-79-3
- Formula: $C_{16}H_{18}ClN_3S \bullet 3H2O$
- Molecular Weight: 373.9
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g	100g

N6179 - 1-Naphthol

See Biochemicals Section for Complete Listing

N581 - Nystatin

See Molecular Biology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

New Product

P6737 - Pentachloronitrobenzene (PCNB)

Quintozene
An antimycotic used in seed testing, specifically for the detection of *Fusarium circinatum*.

- Powder
- CAS Number: 82-68-8
- Formula: $C_6Cl_5NO_2$
- Molecular Weight: 295.33
- Soluble in DMSO
- Store at Room Temperature

Available Package Sizes

25g 100g

P777 - Penicillin G, Sodium Salt

(2*S*,5*R*,6*R*)-3,3-Dimethyl-7-oxo-6-[(phenylacetyl)amino]-4-thia-1-azabicyclo-[3.2.0]heptane-2-carboxylic Acid, Sodium Salt



- Powder
- CAS Number: 69-57-8
- Formula: $C_{16}H_{17}N_2O_4SNa$
- Molecular Weight: 356.4
- Soluble in Water
- Store at Room Temperature
- *Merck* **13**, 7165

Available Package Sizes

25g 100g

New Product

P6767 - Penicillin G Solution (10 mg/mL)

(*2S,5R,6R*)-3,3-Dimethyl-7-oxo-6-[(phenylacetyl)amino]-4-thia-1-azabicyclo-[3.2.0]heptane-2-carboxylic Acid, Sodium Salt
An aqueous solution of Penicillin G Sodium Salt (P777) at 10 milligrams per milliliter. Used with *Phyto*Select Basal Medium (P6800) for the selection of *Xanthomonas campestris*.







- Liquid
- CAS Number: 69-57-8
- Formula: $C_{16}H_{17}N_2O_4SNa$
- Molecular Weight: 356.4
- Miscible with Water
- Store at -20 to 0 °C
- Sterile Filtered
- Ships on Dry Ice

Available Package Sizes

10mL 100mL

For More Information on the *Phyto*Select Basal Medium

See "Seed Testing – P6800 *Phyto*Select Basal Medium & SMART Media" on page 258 in the Technical Section.

New Product

P6800 - *Phyto*Select Basal Medium

*Phyto*Select Basal Medium is formulated based on the SMART media system developed by Kawanishi *et al.* (2011)
It requires the addition of antibiotics and a specific carbon source to be a complete selection medium. See the Product Information Sheet available online for more information.

- Store at Room Temperature
- Soluble in Boiling Water
- Use at 24.93 grams per liter of medium

Components (mg/L)	
Sodium Phosphate, Monohydrate	5665
Potassium Phosphate, Monobasic, Anhydrous	3000
Ammonium Chloride	1000
Magnesium Sulfate, Heptahydrate	250
Ferrous Sulfate, Heptahydrate	9
Agar	15,000
Crystal Violet	3

Available Package Sizes

1L 5L 10L 50L

New Product

P6809 - Polymyxin B Sulfate

An antibiotic used with *Phyto*Select Medium (P6800) for the selection of plant pathogens.

- Powder
- CAS Number: 1405-20-5
- Formula: $C_{55}H_{96}N_{16}O_{13} \cdot 2H_2SO_4$
- Molecular Weight: 1385.61
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

100mg 500mg 1g

New Product

P6719 - Polymyxin B Solution (10 mg/mL)

An aqueous solution of Polymyxin B Sulfate (P6809)at 10 milligrams per milliliter. An antibiotic used with *Phyto*Select Medium (P6800) for the selection of plant pathogens.

- Liquid
- Sterile Filtered
- CAS Number: 1405-20-5
- Formula: $C_{55}H_{96}N_{16}O_{13} \cdot 2H_2SO_4$
- Molecular Weight: 1385.61
- Miscible with Water
- Store at -20 to 0 °C



Available Package Sizes	
10mL	100mL

P672 - Potassium Hydroxide

See Biochemicals Section for Complete Listing

P682 - Potassium Hydroxide Solution 1.0 N

See Biochemicals Section for Complete Listing

P846 - Potassium Phosphate, Monobasic Anhydrous

See Biochemicals Section for Complete Listing

New Product

P6780 - Potassium Sodium Tartrate

Rochelle Salt, Seignette Salt, L(+)-Tartaric acid Potassium Sodium salt

A component of Fehling's solution, used to differentiate between water-soluble carbohydrate and ketone functional groups, and as a test for monosaccharides. Fehling's solution can be used to determine whether a carbonyl-containing compound is an aldehyde or a ketone.

- Powder
- CAS Number: 6381-59-5
- Formula: $C_4H_4KNaO_6 \cdot 4H_2O$
- Molecular Weight: 282.22
- Soluble in Water
- Store at Room Temperature

Available Package Sizes		
100g	500g	1kg

New Product

R7171 - Rose Bengal

4,5,6,7-tetrachloro-2',4',5',7'-tetraiodofluorescein disodium salt, Acid Red 94, Bengal Rose B sodium salt, Rose Bengal sodium salt

- Powder
- CAS Number: 632-69-9
- Formula: $C_{20}H_2Cl_4I_4Na_2O_5$
- Molecular Weight: 1017.64
- Soluble in Water
- Store at Room Temperature

Available Package Sizes	
5g	25g

New Product

R7278 - Ruthenium Red

Ammoniated Ruthenium Oxychloride, CI# 77800

Ruthenium Red is used to stain pectins, mucilages and gums within plant material. Can be used to stain seed mucilage when using a concentration of 0.01% solution.

- Powder
- CAS Number: 11103-72-3
- Formula: $H_{42}Cl_6N_{14}O_2Ru_3$
- Molecular Weight: 786.35
- Soluble in Water
- Store at Room Temperature

Available Package Sizes			
100mg	1g	5g	25g

New Product

S7775 - Saline Solution (0.85%)

Used for the extraction of plant pathogens from tissue; can be diluted and plated for pathogen identification.

Recommended for ISTA methods 7-019, 7-020, and 7-021.

- Store at Room Temperature
- Sterile Filtered
- Miscible with Water

Components (mg/L)	
Sodium Chloride	8500
Tween 20®	0.2 mL

Available Package Sizes		
100mL	500mL	1L

S7400 - Safranin O

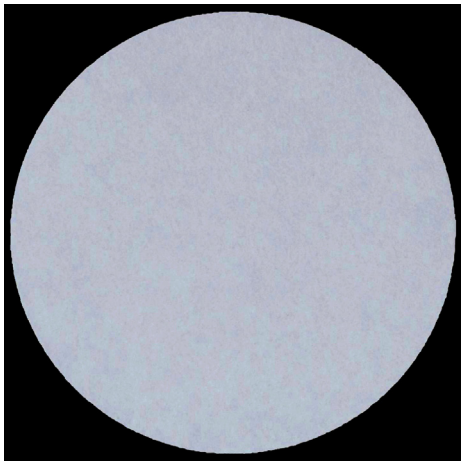
See Biochemicals Section for Complete Listing

©2014 PhytoTechnology Laboratories®

New Product

Seed Testing Papers, Round

Whatman® Seed Germination Papers.
100 per pack.
- Pore Size: 4-7 µm
- Average Width: 180 µm



Product Number	Paper Size	Available Package Sizes
P6635	70 mm	1 Each
P6645	90 mm	1 Each

S515 - Sodium Phosphate, Monobasic Monohydrate

See Biochemicals Section for Complete Listing

S744 - D-Sorbitol

See Biochemicals Section for Complete Listing

S804 - Sulfuric Acid Solution 1.0 N

See Biochemicals Section for Complete Listing

T8199 - Tetrazolium Blue

See Biochemicals Section for Complete Listing

New Product

T7982 - Thiourea

Thiocarbamide, Sulfourea
Thiourea is commonly used to increase the stress tolerance in plants, and also to increase germination rate or to break dormancy in seeds. It has been used as a substitute for stratification in a number of tree species.

- Powder
- CAS Number: 62-56-6
- Formula: CH_4N_2S
- Molecular Weight: 76.12
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

25g 100g 500g

For More Information on Stains & Dyes

See "Figure 34. Stains & Dyes Usage Table" on page 259 in the Technical Section.

New Product

T8092 - Toluidine Blue O

Tolonium Chloride, C.I. 52040
A biological stain.

- Powder
- CAS Number: 92-31-9
- Formula: $C_{15}H_{16}ClN_3S$
- Molecular Weight: 305.83
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

1g 5g 25g 100g

New Product

T7968 - Trehalose Dihydrate

α-D-Glucopyranosyl-α-D-glucopyranoside
Used as a carbon source in the *Phyto*Select Basal Media (P6800) to select for *Xanthomonas hortorum*.

- Powder
- CAS Number: 6138-23-4
- Formula: $C_{12}H_{22}O_{11}•2H_2O$
- Molecular Weight: 378.33
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

5g 25g 100g

New Product

T8164 - Triphenyl Tetrazolium Chloride (TTC)

2,3,5-Triphenyl-tetrazolium chloride, Tetrazolium chloride

- Powder
- CAS Number: 298-96-4
- Formula: $C_{19}H_{15}ClN_4$
- Molecular Weight: 334.8
- Soluble in Water
- Store at 2 to 6 °C

Available Package Sizes

5g 10g 25g 100g

New Product

T8110 - Tyrothricin

Also known as Tyrothicinum.
An antibiotic used with *Phyto*Select Basal Medium (P6800); a combination of about 20% Gramicidin and 80% Tyrocidine.

- Powder
- CAS Number: 1404-88-2
- Formula: $C_{65}H_{85}N_{11}O_{13}$
- Molecular Weight: 1228.44
- Soluble in Ethanol
- Store at Room Temperature

Available Package Sizes

1g	5g	25g

New Product

T8020 - Tyrothricin Solution (10 mg/mL)

A solution of Tyrothricin (T8110) - also known as Tyrothicinum - at 10 milligrams per milliliter of Ethanol. An antibiotic used with *Phyto*Select Basal Medium (P6800); a combination of about 20% Gramicidin and 80% Tyrocidine.

- Liquid
- CAS Number: 1404-88-2
- Formula: $C_{65}H_{85}N_{11}O_{13}$
- Molecular Weight: 1228.44
- Miscible with Water
- Store at -20 to 0°C



Available Package Sizes

10mL	100mL

New Product

X8454 - XTS Medium

A semi-selective medium for the isolation of *Xanthomonas translucens* from barley and wheat seeds as described by Schaad and Forster (1985).

- Store at Room Temperature
- Soluble in Water
- Use at 28.0 grams per liter of medium

Components (mg/L)	
Meat Extract	3000
Peptone	5000
Agar	15,000
D-Glucose, Anhydrous	5000

Available Package Sizes

1L	500g

Find Plant Tissue Culture Media on Pages 55 to 128

- *MS Media*
- *Crop Specific Media*
- *Vitamin Solutions*
- *Orchid Media*
- *Stock Solutions*



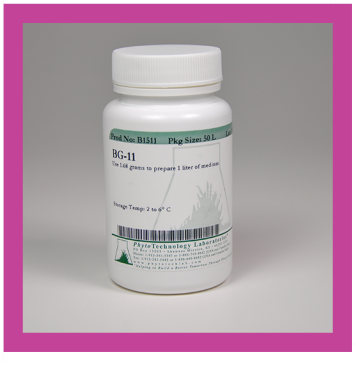


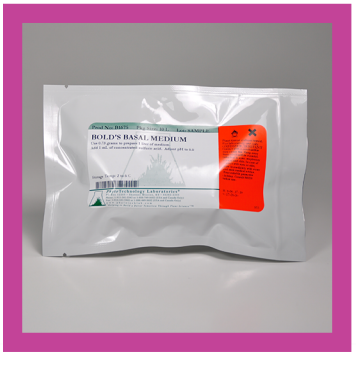
©2014 PhytoTechnology Laboratories®

PHYCOLOGY


Prod No: S7650
Pkg Size: 1 L
Lot: 12E7650001A
SEAWATER
Sterile Filtered
USP 30 Compliant
Storage Temp: Room Temperature
Formula: N/A
FW: N/A
PhytoTechnology Laboratories
Prod No: B1411
Pkg Size: 500 mL
Prod No: B1511
Pkg Size: 50 L
BG-11
Use 1.68 grams to prepare 1 liter of medium.
Storage Temp: 2 to 6° C
Product No: F3222
Storage Temp: 2 to 6° C
f/2 GUILLARD'S MARIN
ENRICHED SEAWATER
Dissolve 0.10 grams in 1 liter of Seawater (S7650)
Product No: G3454
Storage Temp: 2 to 6° C
f/2 GUILLARD'S MARIN
ENRICHED SEAWATER
WITHOUT SILICATE
Dissolve 0.09 grams in 1 liter of Seawater







Phycology

*Phyto*Technology Laboratories® has recently introduced a series of products for phycology research. With media and reagents for freshwater and marine algae and cyanobacteria, all manufactured to the same levels of quality as our plant tissue culture media.

Most components used in the formulation of Phycology Media are available as individual components. Check the Biochemicals Section on Page 15 for component product listings and more information.

Check **www.phytotechlab.com** frequently as we continue to expand this product line.

A256 - Acetic Acid, Glacial

See Biochemicals Section for Complete Listing

New Product

B1511 - Blue-Green Medium (BG-11)

A growth medium for freshwater cyanobacteria as described by Stanier *et al.* (1971).
This medium can be buffered with HEPES (H326), and is biologically tested with 20mM of HEPES per liter of medium.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 1.68 grams per liter of medium
- Adjust to pH 8.0 ± 0.1
- Algal Culture Tested

Components (mg/L)	
Boric Acid	2.86
Calcium Chloride, Anhydrous	27.18
Citric Acid	6.0
Cobalt Nitrate Hexahydrate	0.049
Cupric Sulfate Pentahydrate	0.079
Ferric Ammonium Citrate	6.0
Magnesium Sulfate, Anhydrous	75.0
Manganese Chloride Tetrahydrate	1.81
Disodium Magnesium EDTA	1.0
Potassium Phosphate, Dibasic	40.0
Sodium Carbonate, Anhydrous	20.0
Sodium Molybdate Dihydrate	0.39
Sodium Nitrate	1500.0
Zinc Sulfate Heptahydrate	0.222
Approximate pH at Room Temperature	8.0 ± 1.0

Available Package Sizes

1L 10L 50L

New Product

B1411 - Blue-Green Medium (BG-11) 50x Concentrate Solution

A growth medium for freshwater cyanobacteria as described by Stanier *et al.* (1971).
This medium can be buffered with HEPES (H326), and is biologically tested with 20mM of HEPES per liter of medium.

- Store at 2 to 6 °C
- Miscible with Water
- Use at 20 milliliters per liter of medium
- Adjust to pH 8.0 ± 0.1
- Algal Culture Tested



Components (mg/L)	
Boric Acid	143
Calcium Chloride, Anhydrous	1359
Citric Acid	300
Cobalt Nitrate Hexahydrate	2.45
Cupric Sulfate Pentahydrate	3.95
Ferric Ammonium Citrate	300
Magnesium Sulfate, Anhydrous	3750
Manganese Chloride Tetrahydrate	90.5
Disodium Magnesium EDTA	50
Potassium Phosphate, Dibasic	2000
Sodium Carbonate, Anhydrous	1000
Sodium Molybdate Dihydrate	19.5
Sodium Nitrate	75000
Zinc Sulfate Heptahydrate	11.1
Approximate pH at Room Temperature	4.2 ± 0.5

Available Package Sizes

1L 2L

New Product

©2014 PhytoTechnology Laboratories®

B1675 - Bold's Basal Medium (BBM)

A traditional freshwater algal medium for axenic maintenance as described by Nichols & Bold (1965).
1.0 mL of 0.1% Sulfuric Acid Solution (S7664) to be added per liter of media at 1x concentration.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 0.705 grams per liter of medium
- Adjust to pH 6.6 ± 0.1
- Algal Culture Tested

Components (mg/L)	
Boric Acid	11.42
Calcium Chloride, Anhydrous	18.87
Cobalt Nitrate Hexahydrate	0.49
Cupric Sulfate Pentahydrate	1.57
EDTA, Disodium Salt	63.69
Ferrous Sulfate Heptahydrate	4.98
Magnesium Sulfate, Anhydrous	36.63
Manganese Chloride Tetrahydrate	1.44
Potassium Hydroxide	31.0
Potassium Phosphate, Dibasic	75.0
Potassium Phosphate, Monobasic	175.0
Sodium Chloride	25.0
Sodium Molybdate	1.19
Sodium Nitrate	250.0
Zinc Sulfate Heptahydrate	8.82
Approximate pH at Room Temperature	8.0 ± 2.0

Available Package Sizes

1L 10L 50L

New Product

B1650 - Bold's Basal Medium (BBM) 50x Concentrate Solution

A freshwater algal standard medium as described by Nichols & Bold (1965).

- Store at 2 to 6 °C
- Miscible with Water
- Use at 20.0 mL per liter of medium
- Adjust to pH 6.6 ± 0.1
- Algal Culture Tested



Components (mg/L)	
Boric Acid	571
Calcium Chloride, Anhydrous	944
Cobalt Nitrate Hexahydrate	24.5
Cupric Sulfate Pentahydrate	78.5
EDTA, Disodium Salt	3181
Ferrous Sulfate Heptahydrate	249
Magnesium Sulfate, Anhydrous	3750
Manganese Chloride Tetrahydrate	72
Potassium Hydroxide	2984
Potassium Phosphate, Dibasic	1550
Potassium Phosphate, Monobasic	3750
Sodium Chloride	8750
Sodium Molybdate	1250
Sodium Nitrate	12550
Zinc Sulfate Heptahydrate	441
Approximate pH at Room Temperature	4.2 ± 0.5

Available Package Sizes

500mL 1L 2L

New Product

C2124 - Cobalt Sulfate, Heptahydrate

Plant Tissue Culture Tested

- Powder
- CAS Number: 10026-24-1
- Formula: $CoSO_4 \cdot 7H_2O$
- Molecular Weight: 281.103
- Soluble in Water
- Store at Room Temperature
- *Merck* **13,** 2473

Available Package Sizes

25g 100g

New Product

F3222 - f/2 Guillard's Marine Enriched Seawater

A powder formulation of the vitamins, macro- and trace element solutions as described by Guillard and Ryther (1962). To be dissolved into Seawater . Contains silicate for diatom growth.

- Store at 2 to 6 °C
- Partially Soluble in Seawater
- Use at 0.1 grams per liter of medium
- Adjust to pH 7.5 ± 0.5
- Algal Culture Tested

Components (mg/L)	
Sodium Nitrate	75.0
Cobalt Chloride Hexahydrate	0.01
Cupric Sulfate Pentahydrate	0.01
EDTA, Disodium Salt	4.36
Ferric Chloride, Anhydrous	1.9
Manganese Chloride Tetrahydrate	0.18
Molybdic Acid, Disodium Salt	0.006
Sodium Phosphate, Monobasic	5.0
Sodium Metasilicate, Anhydrous	12.94
Zinc Sulfate, Heptahydrate	0.022
Biotin	0.0005
Cyanocobalamin, Vitamin B12	0.0005
Thiamine Hydrochloride	0.1
Approximate pH at Room Temperature	6.0 ± 2.0

Available Package Sizes

1L 10L 50L

Custom Media & Services



*Phyto*Technology Laboratories® offers custom manufacturing and testing services. For more information please see page 12.

- Custom Dry Powder Media
- Custom Liquid Media
- Custom Packaging
- Testing Services

New Product

G3454 - f/2 Guillard's Marine Enriched Seawater without Silicate

A powder formulation of the vitamins, macro- and trace element solutions as described by Guillard and Ryther (1962). This product does not contain silicate, and can therefore be used for the axenic maintenance of non-diatom marine algae. To be dissolved into Seawater .

- Store at 2 to 6 °C
- Partially Soluble in Seawater
- Use at 0.09 grams per liter of medium
- Adjust to pH 7.5 ± 0.5
- Algal Culture Tested

Components (mg/L)	
Sodium Nitrate	75.0
Cobalt Chloride Hexahydrate	0.01
Cupric Sulfate Pentahydrate	0.01
EDTA, Disodium Salt	4.36
Ferric Chloride, Anhydrous	1.9
Manganese Chloride Tetrahydrate	0.18
Molybdic Acid, Disodium Salt	0.006
Sodium Phosphate, Monobasic	5.0
Zinc Sulfate, Heptahydrate	0.022
Biotin	0.0005
Cyanocobalamin, Vitamin B12	0.0005
Thiamine Hydrochloride	0.1
Approximate pH at Room Temperature	6.0 ± 2.0

Available Package Sizes

10L 50L

New Product

F3138 - Ferric Ammonium Sulfate

Plant Tissue Culture Tested

- Powder
- CAS Number: 7783-83-7
- Formula: $NH_4Fe(SO_4)_2 \cdot 12H_2O$
- Molecular Weight: 482.25
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g

©2014 PhytoTechnology Laboratories®

New Product

F2876 - Ferric Chloride, Anhydrous

Plant Tissue Culture Tested

- Powder
- CAS Number: 7705-08-0
- Formula: $FeCl_3$
- Molecular Weight: 162.2
- Soluble in Water
- Store at Room Temperature
- *Merck* **13,** 4048

Available Package Sizes

25g 100g

H326 - HEPES, Free Acid

See Molecular Biology Section for Complete Listing

M5781 - Methylene Blue

See Seed Testing Section for Complete Listing

P6905 - Potassium Bromide

See Biochemicals Section for Complete Listing

New Product

S7650 - Seawater

Untreated Seawater.

- Liquid
- Sterile Filtered
- Store at Room Temperature



Available Package Sizes

Inquire about Package Size, Pricing, and more Information

New Product

S7550 - Sodium Carbonate

Plant Tissue Culture Tested

- Powder
- CAS Number: 497-19-8
- Formula: $NaCo_3$
- Molecular Weight: 105.99
- Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1Kg

New Product

S7834 - Sodium Metasilicate, Anhydrous

An essential nutrient for diatoms.
Algal Culture Tested

- Powder
- CAS Number: 6834-92-0
- Formula: Na_2SiO_3
- Molecular Weight: 122.06
- Partially Soluble in Water
- Store at Room Temperature

Available Package Sizes

100g 500g 1kg

New Product

S7668 - Sueoka's High Salt Medium (HSM)

A general maintenance medium used for freshwater algae; a high-salt alternative to Tris-Acetate-Phosphate medium (T8224, T8050).
2 g/L Sodium Acetate recommended for heterotrophic growth.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 2.78 grams per liter of medium
- Adjust to pH 6.8 ± 0.1
- Algal Culture Tested

Components (mg/L)	
Ammonium Chloride	500
Ammonium Molybdate, Tetrahydrate	1.1
Boric Acid	11.4
Calcium Chloride, Anhydrous	7.548
Cobalt Chloride, Hexahydrate	1.61
Cupric Sulfate, Pentahydrate	1.57
Sodium EDTA, Dihydrate	50
Ferrous Sulfate, Heptahydrate	4.99
Magnesium Sulfate, Anhydrous	9.77
Manganese Chloride, Tetrahydrate	5.060
Potassium Phosphate, Dibasic	1440
Potassium Phosphate, Monobasic, Anhydrous	720
Zinc Sulfate, Heptahydrate	22
Approximate pH at Room Temperature	7.0 ± 1.0

Available Package Sizes

1L 10L 50L

New Product

S7664 - Sulfuric Acid, 0.1% Solution

Used with Bold's Basal Medium (B1675)
Sterile Filtered
Plant Tissue Culture Tested

- Liquid
- CAS Number: 7664-93-9
- Formula: H_2SO_4
- Molecular Weight: 98.08
- Miscible with Water
- Store at Room Temperature



Available Package Sizes

10x1mL	25mL	100mL

New Product

T8224 - Tris Acetate Phosphate (TAP)

A standard maintenance medium for freshwater algal species, as described by Gorman & Levine (1965).
Add 1 mL Glacial Acetic Acid (Product Number A256) per liter of medium for heterotrophic growth.
Use powder as is for photoautotrophic growth.

- Store at 2 to 6 °C
- Soluble in Water
- Use at 3.17 grams per liter of medium
- Algal Culture Tested

Components (mg/L)	
Ammonium Chloride	400.0
Tris-Base	2420
Ammonium Molybdate Tetrahydrate	1.1
Boric Acid	11.4
Calcium Chloride, Anhydrous	37.74
Cobalt Chloride Hexahydrate	1.61
Cupric Sulfate Pentahydrate	1.57
EDTA, Disodium Salt	50.0
Ferrous Sulfate Heptahydrate	4.9
Magnesium Sulfate, Anhydrous	48.83
Magnesium Chloride Tetrahydrate	5.06
Potassium Phosphate, Dibasic	108.0
Potassium Phosphate, Monobasic	54.0
Zinc Sulfate Heptahydrate	22.0
Approximate pH at Room Temperature	7.0 ± 0.1

Available Package Sizes

1L	10L	50L

New Product

T8050 - Tris Acetate Phosphate (TAP) 1x Solution

A standard maintenance medium for freshwater algal species, as described by Gorman & Levine (1965).
Contains Glacial Acetic Acid (Product Number A256) for use as a heterotrophic growth medium.

- Store at 2 to 6 °C
- Miscible with Water
- Contains 17.4 mM of Acetate
- pH adjusted to 7.0 ± 0.1
- Algal Culture Tested



Components (mg/L)	
Ammonium Chloride	400.0
Tris-Base	2420
Ammonium Molybdate Tetrahydrate	1.1
Boric Acid	11.4
Calcium Chloride, Anhydrous	37.74
Cobalt Chloride Hexahydrate	1.61
Cupric Sulfate Pentahydrate	1.57
EDTA, Disodium Salt	50.0
Ferrous Sulfate Heptahydrate	4.9
Magnesium Sulfate, Anhydrous	48.83
Magnesium Chloride Tetrahydrate	5.06
Potassium Phosphate, Dibasic	108.0
Potassium Phosphate, Monobasic	54.0
Zinc Sulfate Heptahydrate	22.0
Glacial Acetic Acid	1 mL
Approximate pH at Room Temperature	7.0 ± 0.1

Available Package Sizes

500mL	1L	2L

W783 - Water, Plant Tissue Culture Grade

See Molecular Biology Section for Complete Listing

©2014 PhytoTechnology Laboratories®

TISSUE CULTURE KITS









Tissue Culture Kits

*Phyto*Technology Laboratories® provides a series of plant tissue culture kits for educational demonstrations. Each kit comes with a variety of media and equipment appropriate to the plant species featured in the kit.

Basic Kit Components

The Kits outlined in this catalogue follow the same general format, and include the following:

- Plastic Culture Vessels
- Petri Dishes
- Forceps, Scoops, Scalpel Handles and Blades
- Vinegar & Baking Soda for pH adjustment
- Sucrose (if needed by media formulation)
- Gelling Agents (if needed by media formulation)
- Plant Tissue Culture Media
- Instruction Manual

Some kits can be purchased with a live plant (for continental United States customers only).

New Kits in this Catalogue

- C1835 - Cape Sundew & Venus Flytrap Tissue Culture Kit
- C1955 - Carrot Tissue Culture Kit
- P6963 - Potato Tissue Culture Kit

Items You Must Supply

While the tissue culture kits outlined in this catalogue provide significant amount of materials, they do not provide every item you may need. You will be responsible for providing the following:

- 10% Chlorine Bleach or other sterilant to disinfect plant material. Tween 20 (Product Number P720) or other suitable wetting agent.
- Bunsen burner (Product Number B966), alcohol lamp (Product Number B876), glass bead sterilizer (Product Number S7510/S7520) or other method to sterilize instruments.
- Distilled or deionized water, or Sterile Tissue Culture Grade Water (Product No. W783).
- Large 2-liter flask, beaker, or container for mixing the media. Product Number F986 - 2000mL Flask is available for purchase separately.
- A method to sterilize your media, usually a pressure cooker or an autoclave.
- Growth lights: fluorescent lights or other suitable areas for growing plants.
- Any live plant matter needed, unless otherwise specified in Kit description.

A137 - African Violet Multiplication Kit

The purpose of this kit is to demonstrate *in vitro* vegetative propagation. This kit provides the necessary materials to initiate cultures from the leaf blades and petioles of African Violet leaves (not included in kit).

*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Strips, 4.0 - 7.0	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
M401	1L	Murashige & Skoog Modified Medium	3
M508	1L	Murashige Modified Fern Multiplication Basal Medium	3
M517	1L	Murashige African Violet/ Gloxinia Multiplication Medium	3
M518	1L	Murashige African Violet/ Gloxinia Pretransplant Medium	3
S391	500g	D-Sucrose	1
A111/ A296	9g	Agar	12
Instruction Manual			1

Available Package Sizes

1 Kit

©2014 PhytoTechnology Laboratories®

New Product

C1835 - Cape Sundew & Venus Flytrap Tissue Culture Kit

The purpose of this kit is to is to demonstrate the tissue culture of Cape Sundew and Venus Flytrap at multiplication and pretransplant stages.
A Cape Sundew or Venus Flytrap culture can be purchased with this kit.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
C206	1L	Cape Sundew/Venus Flytrap Multiplication Basal Medium	5
C216	1L	Cape Sundew/Venus Flytrap Pretransplant Basal Medium	5
S391	500g	D-Sucrose	1
A111/ A296	9g	Agar	10
Optional - Cape Sundew OR Venus Flytrap Culture (Continental United States Only)			1
Instruction Manual			1

Available Package Sizes

1 Kit
1 Kit with Cape Sundew Culture
1 Kit with Venus Flytrap Culture

New Product

C1955 - Carrot Tissue Culture Kit

The purpose of this kit is to study the somatic embryogenisis through carrot callus. Kit does not include carrot root.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S967	1 Each	Scalpel Handel, No. 7	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Strips, 4.0 - 7.0	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
C212	1L	Carrot Callus Initiation Medium	5
C222	1L	Carrot Shoot Development Medium	5
S391	500g	D-Sucrose	1
G434	2g	Gellan Gum	10
Instruction Manual			1

Available Package Sizes

1 Kit

Find Plant Tissue Culture Media on Pages 55 to 128

- *MS Media*
- *Crop Specific Media*
- *Vitamin Solutions*
- *Orchid Media*
- *Stock Solutions*





F354 - Fern Multiplication Kit

The purpose of this kit is to demonstrate *in vitro* fern shoot multiplication. To shipments within the continental United States, an established fern culture is provided so that it may be subcultured to observe the rapid, *in vitro* production of plants. Cultures can also be generated from runner tips (not included with this kit).

*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
M401	1L	Murashige & Skoog Modified Medium	4
M508	1L	Murashige Modified Fern Multiplication Basal Medium	4
M555	1L	Murashige & Skoog Modified Multiplication Medium	4
S391	500g	D-Sucrose	1
A111/ A296	9g	Agar	12
Optional - Fern Culture (Continental United States Only)			1
Instruction Manual			1

Available Package Sizes

1 Kit

1 Kit with Fern Culture

H411 - Hosta Initiation-Multiplication Kit

The purpose of this kit is to demonstrate *in vitro* vegetative propagation and the effects of the cytokinin BA on shoot multiplication. To shipments within the continental United States, an established Hosta culture is provided.

*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
H435	1L	Hosta Initiation / Multiplication Medium	3
H3959	1L	Hosta Initiation / Multiplication Medium II	3
H436	1L	Hosta Multiplication Medium	3
H437	1L	Hosta Rooting Medium	3
B130	100mL	6-Benzylaminopurine Solution	1
A111/ A296	9g	Agar	12
Optional - Hosta Culture (Continental United States Only)			1
Instruction Manual			1

Available Package Sizes

1 Kit

1 Kit with Hosta Culture

Find Biochemicals on Pages 15 to 54

- *Gelling Agents*
- *Plant Growth Regulators*
- *Media Components*
- *Stains and Dyes*
- *Carbohydrates*





©2014 PhytoTechnology Laboratories®

L577 - Lily Multiplicaton Kit

The purpose of this kit is to demonstrate *in vitro* vegetative propagation from lily scales. To shipments within the continental United States, a Lily Bulb is supplied.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
S088	1 Each	Spatula / Scoop	1
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
M401	1L	Murashige & Skoog Modified Medium	4
M555	1L	Murashige & Skoog Modified Multiplication Medium	4
M508	1L	Murashige Fern Multiplication Medium	4
S391	500g	D-Sucrose	1
A111/ A296	9g	Agar	12
Optional - Lily Bulb (Continental United States Only)			1
Instruction Manual			1

Available Package Sizes

1 Kit

1 Kit with Lily Bulb Culture

O755 - Orchid Stem Propagation Kit

This kit is designed to stimulate the multiplication of shoots from stem cuttings of orchids, particularly *Phalaenopsis* orchids. A *Phalaenopsis* orchid in flower is needed for this kit (not included with the kit).
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
S088	1 Each	Spatula / Scoop	1
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
P748	1L	Orchid Maintenance/Replate Medium	3
B141	1L	BM-1 Terrestrial Orchid Medium	3
B142	1L	BM-2 Terrestrial Orchid Medium	2
O753	1L	Orchid Multiplication Medium	3
Instruction Manual			1

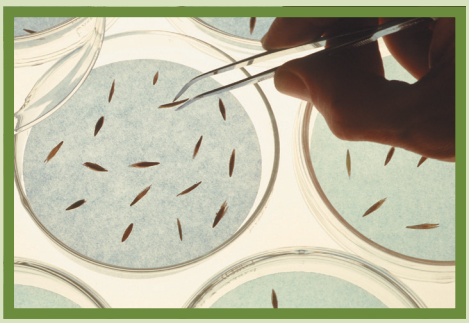
Available Package Sizes

1 Kit

Find Seed Testing Products on Pages 161 to 168

- *PhytoSelect Basal Medium*
- *mD5A Medium*
- *Stains & Dyes*
- *King’s B Medium*
- *Selection Agents*





O788 - Terrestrial Orchid Seed Sowing Kit

The purpose of this kit is to allow for the germination of terrestrial orchid seeds (not included with the kit), and their subsequent replate.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
S088	1 Each	Spatula / Scoop	1
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
T849	1L	Terrestrial (*Cypripedium*) Orchid Medium	2
T839	1L	Terrestrial (*Cypripedium*) Orchid Medium	2
B141	1L	BM-1 Terrestrial Orchid Medium	2
B142	1L	BM-2 Terrestrial Orchid Medium	2
K425	1L	Knudson C Modified Plus Orchid Medium	3
M551	1L	Malmgren Modified Terrestrial Orchid Medium	2
Instruction Manual			1

Available Package Sizes

1 Kit

O799 - Epiphytic Orchid Seed Sowing Kit

The purpose of this kit is to allow for the germination of epiphytic orchid seeds (not included with the kit), and their subsequent replate.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
S088	1 Each	Spatula / Scoop	1
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
P723	1L	Orchid Seed Sowing Medium	3
P785	1L	*Phyto*Tech™ Orchid Replate Medium	2
P748	1L	Orchid Maintenance/Replate Medium	2
K425	1L	Knudson C Modified Plus Orchid Medium	2
V895	1L	Vacin & Went Modified Orchid Medium	3
Instruction Manual			1

Available Package Sizes

1 Kit

For More Information about Orchid Micropropagation

See "Tissue Culture & Orchids" on page 245 in the Technical Section.

Find Media For Orchids in the Pant Tissue Culture Media Section on Pages 55 to 128



©2014 PhytoTechnology Laboratories®

New Product

P6963 - Potato Tissue Culture Kit

For study of micropropagation via nodal segments and formation of microtubers. Kit does not include a potato.
*Individual kit components may be substituted for equivalent products when necessary.

This Kit Contains:

Product Number	Package Size	Product Description	Quantity
C215	10 Each	Culture Container	1
F951	1 Each	Forceps, 8”	2
S963	1 Each	Scalpel Handel, No. 3	1
S971	1 Each	Scalpel Blades	2
P334	1 Each	pH Paper, 4.5 - 7.5	1
D940	20 Each	Petri Dishes	1
V886	15mL	Vinegar	1
S803	25g	Baking Soda	1
P068	1 Each	Pipet, Plastic Transfer	2
M516	1L	Murashige & Skoog Modified BC Potato Basal Medium	5
M404	1L	Murashige & Skoog with Gamborg’s Vitamins	5
S391	500g	D-Sucrose	1
A111/ A296	9g	Agar	10
B130	100mL	6-Benzylaminopurine Solution	1
N605	100mL	NAA Solution	1
Instruction Manual			1

Available Package Sizes

1 Kit

Media Type By Components

Deficient Media
May Contain:
- Macronutrients, or
- Micronutrients.
- Deficient Media are Basal Salts which lack one or more components.

Basal Salts
Contains:
- Macronutrients, and
- Micronutrients.

Media
Contains:
- Macronutrients,
- Micronutrients, and
- Contains at least one of the following:
  - Vitamins,
  - Carbohydrates, or
  - Gelling Agents.

Complete Media
Contains:
- Macronutrients,
- Micronutrients,
- Vitamins,
- Carbohydrates, and
- Plant Growth Regulators.

Media & Gelling Agent
Contains:
- Macronutrients,
- Micronutrients,
- Vitamins,
- Carbohydrates, and
- Gelling Agents.

Molecular Biology Kits

*Phyto*Technology Laboratories® offers several molecular biology kits. These kits are ideally suited for research use and come with most of the biochemicals and small lab supplies you'll need to accomplish the described molecular application. All kits include an instruction manual. These kits are offered at very competitive prices, for more information consult the product listings for these kits in the Molecular Biology section of this catalogue on pages 129 to 148 or visit **www.phytotechlab.com**.



- **Plasmid DNA Extraction System (Pictured Above, Page 136)**
- **Plant Genomic DNA Extraction System (Page 136)**
- **Plant RNA Mini (Page 143)**
- **DNA Ladders (Page 137)**







Check out the Molecular Biology Section for more products...

- ***Acetosyringone***
- ***Agarose***
- ***Antibiotics***
- ***IPTG***
- ***Molecular Biology Grade Water***
- ***MOPS Buffers***
- ***Reagents***
- ***Sterile Antibiotic Solutions***
- ***Tris Buffers***
- ***X-Gluc & X-Gal***

©2014 PhytoTechnology Laboratories®

EQUIPMENT



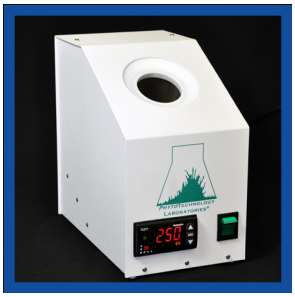






Equipment

*Phyto*Technology Laboratories® offers a wide variety of laboratory equipment for the plant sciences. Everything from clean room supplies and glass bead sterilizers to forceps and scalpels. All of our equipment have been carefully selected both of high quality and intended for research laboratories.



γ-Irradiated Plastics

Eliminating the need for washing or autoclaving your plastics by using γ-irradiated plastics saves time in the lab.

*Phyto*Technology Laboratories® offers a line of proprietary, γ-irradiated culture vessels, the SteriCons™. Offered in 8oz, 16oz, and 32oz sizes, these culture vessels are perfect for growing any type of *in vitro* plant.

- C1958 - SteriCon™-4
- C2118 - SteriCon™-8
- C1932 - SteriCon™-13

We also offer a line of sterile petri dishes.

- D940 - Petri Dish (15mm tall)
- D942 - Petri Dish (20mm tall)
- D943 - Petri Dish (25mm tall)



Reusable Plastics

*Phyto*Technology Laboratories® offers a wide variety of autoclavable, reusable culture vessels, including our popular *Phyto*Con™ and PTCon™.

- C209 - *Phyto*Con™-8
- C1808 - *Phyto*Con™-8, graduated
- C215 - *Phyto*Con™-16
- C221 - *Phyto*Con™-32
- C1755 - PTcon™-7
- C1765 - PTcon™-12
- C1775 - PTcon™-11W





Featured in this section

- Balances
- Books
- Centrifuges
- Clean Room Supplies
- Culture Tubes
- Flasks, Beakers, and Jars
- Forceps
- Glass Bead Sterilizers
- Glass Culture Vessels
- Gloves
- Instrument Rests
- Mixers
- Personal Protective Equipment
- pH Indicators
- Plastic Culture Vessels
- Scalpels and Scalpel Blades
- Scissors
- Scoops
- Spatulas
- Sterile Culture Vessels
- Sterilization Indicators
- Tape
- Trays
- Vented Caps and Closures
- Weigh Boats and Papers

©2014 PhytoTechnology Laboratories®

B999 - Bags, Resealable

Clear, LDPE
Not Autoclavable
Can be used to help control the spread of contamination via insects
- 2 mil
- 8 in x 8 in (20.32 cm x 20.32 cm)



Available Package Sizes

100 Each

B798 - Balance, Electronic, 200 g x 0.01 g

Comes with Draft Shield and 12 V AC adapter
6 x AA batteries can be used in place of adapter
- 200 g Capacity
- 0.01 g Readability
- 13.0 cm Diameter Round Pan



Available Package Sizes

1 Each

B809 - Balance, Electronic, Ohaus, 220 V

Comes with 220 - 240 V adapter
- 200 g Capacity
- 0.01 g Readability
- 11.8 cm Diameter Round Pan



Available Package Sizes

1 Each

B901 - Balance, Electronic, Portable/Economy Model

Powered by both AC power and batteries
- 1000 g Capacity
- 0.1 g Readability
- Round Pan: 14.6 cm



Available Package Sizes

1 Each

B929 - Balance, Electronic, Ohaus

Comes with 110 - 120 V adapter
- 200 g Capacity
- 0.01 g Readability
- Oval Pan: 13 cm x 14 cm



Available Package Sizes

1 Each

B936 - Balance, Electronic, Ohaus

- 400 g Capacity
- 0.1 g Readability
- 12.5 cm x 14.5 cm Rectangular Pan



Available Package Sizes

1 Each

B817 - Balance, Triple Beam with Tare, Salter Brecknell

- 610 g Capacity
- 0.1 g Readability
- 15.2 cm Diameter Round Pan



Available Package Sizes

1 Each

Beakers, Graduated, Polymethyl Pentene

Polymethyl Pentene, Autoclavable
Graduated



Product Number	Capacity	Available Package Sizes
B910	250 mL	1 Each 6 Each
B931	1000 mL	1 Each
B939	2000 mL	1 Each
B960	4000 mL	1 Each

©2014 PhytoTechnology Laboratories®

Beakers, Graduated, Polypropylene

Polypropylene, Autoclavable
Graduated



Product Number	Capacity	Available Package Sizes	
B161	250 mL	1 Each	6 Each
B188	1000 mL	1 Each	
B192	2000 mL	1 Each	
B199	4000 mL	1 Each	

Beakers, Griffin, Polypropylene

Graduated
Flared rim for easy pouring
Autoclavable to 121°C (250°F)



Product Number	Capacity	Available Package Sizes
B265	5 L	1 Each
B310	10 L	1 Each

Beakers, Tri-Pour, Graduated

Graduated, Polypropylene, Autoclavable
Disposable beakers with three no-drip pouring spouts
Can be written on directly



Product Number	Capacity	Available Package Sizes	
B220	250 mL	10 Each	100 Each
B223	800 mL	10 Each	100 Each
B225	1000 mL	10 Each	100 Each

B439 - Beard Cover, 18 in

Non-woven Spunbond polypropylene
Latex-free
Non-linting
Disposable
• 18 inch width
• 50 per box

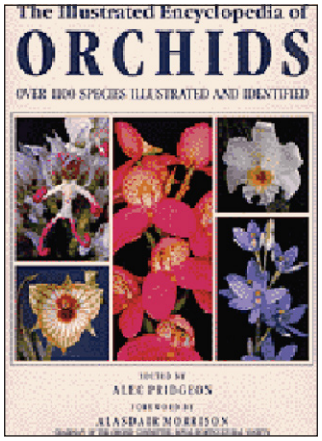


Available Package Sizes

500 Each

B044 - Book, The Illustrated Encyclopedia of Orchids

Publication Year: 1992
Edited By: Alec Pridgeon
Hardcover, 304 pages
ISBN 0-88192-267-6

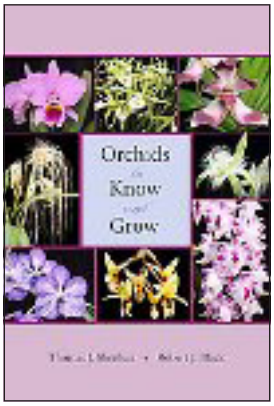


Available Package Sizes

1 Each

B059 - Book, Orchids to Know & Grow

Publication Year: 2007
Authors: Thomas Sheehan & Robert Black
Paperback, 320 pages
ISBN 0-81303-065-X

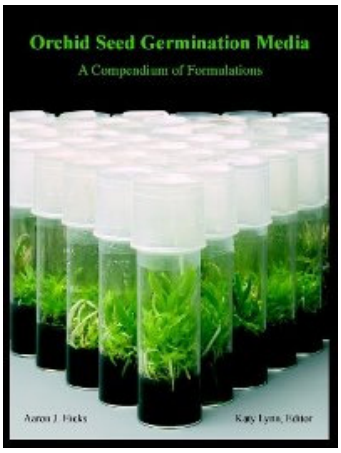


Available Package Sizes

1 Each

B693 - Book, Orchid Seed Germination Media

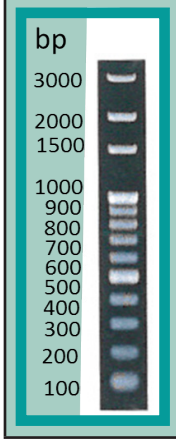
Publication Year: 2007
Author: Aaron Hicks
Paperback, 211 Pages
ISBN 0-9673049-2-X



Available Package Sizes

1 Each

Molecular Biology Kits



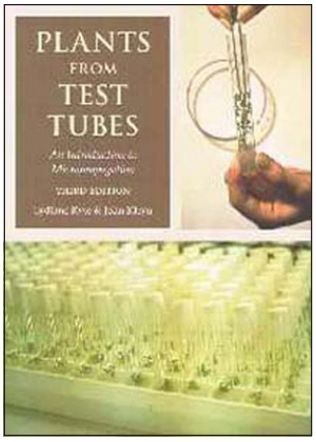
*Phyto*Technology Laboratories® offers a variety of kits for molecular biology. Please see the molecular biology section on pages 129 to 148 for more information.

- RNA Extraction Kits
- Genomic DNA Extraction Kits
- Plasmid DNA Extraction Kits
- DNA Ladder Kits

©2014 PhytoTechnology Laboratories®

B051 - Book, Plants from Test Tubes

Publication Year: 1996
Authors: Lydiane Kyte and John Kleyn
Hardcover, 240 Pages
ISBN 0-88192-361-3

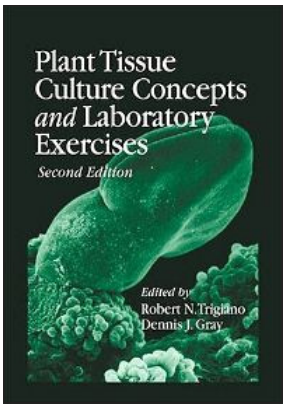


Available Package Sizes

1 Each

B050 - Book, Plant Tissue Culture Concepts & Laboratory Exercises

Publication Year: 2nd Edition, 1999
Edited by: Robert Trigiano & Dennis Gray
472 Pages
ISBN 0-84932-029-1



Available Package Sizes

1 Each

Bottle, Laboratory Wash Solution

Polyethylene, Not Autoclavable
• 500 mL Capacity



Product Number	Use with	Available Package Sizes
B027	Bleach	1 Each
B063	Ethanol	1 Each
B974	Isopropyl Alcohol	1 Each
B987	Distilled Water	1 Each

B235 - Buffer Solution, pH Reference Standard, pH 4.0 ± 0.02 at 25 °C

See Biochemicals Section for Complete Listing

B236 - Buffer Solution, pH Reference Standard, pH 7.0 ± 0.02 at 25 °C

See Biochemicals Section for Complete Listing

B237 - Buffer Solution, pH Reference Standard, pH 10.0 ± 0.02 at 25 °C

See Biochemicals Section for Complete Listing

B876 - Burner, Alcohol

Glass, With an Adjustable Wick



Available Package Sizes

1 Each

B966 - Bunsen Burner

Touch-O-Matic®
Use only with mixed gas



Available Package Sizes

1 Each

C201 - Centrifuge, Micro

Compact, bench-top centrifuge with 4-position switch: Off/ pulse/6,000 rpm/10,000 rpm
- 16-position rotor receives 1.5 or 2.0 mL tubes
- Rapid slow-down, from 10,000 rpm to zero in approximately 20 seconds.
- 110 - 120 VAC



Available Package Sizes

1 Each

C251 - Centrifuge, Micro-Digital

Multiple speed selection up to 10,000 rpm
- 60 minute programmable timer; digital display
- Imbalance detection system
- 16-position rotor receives 1.5 or 2.0 mL tubes
- Safety switch instantly stops rotor if cover is ajar; will not operate without cover in place
- Forced air ventilation system: specimens, rotor, & motor stay cool during extended runs
- 100 - 230 VAC with grounded cord & double insulated construction.



Available Package Sizes

1 Each

C284 - Glassware Cleaner/Detergent

- Liquid detergent for hand-washing glass and plastic labware
- Neutral pH
- Formulated with biodegradable polyglycol ether; will not etch or mar precision glassware
- Rapidly drains off glassware; dries quickly without wiping
- Use at 1% dilution
- Store at Room Temperature



Available Package Sizes

1 L	4 L

©2014 PhytoTechnology Laboratories®

Closures, Culture Tube, Kim-Kap™

Polypropylene, Autoclavable
Fits C930 and C935 Culture Tubes
• 1.02 mm Wall Thickness x 2.78 cm Opening Diameter



C069



C163

Product Number	Color	Available Package Sizes	
C069	Clear	125 Each	500 Each
C163	Green	125 Each	500 Each

C945 - Closures, Culture Tube, Bellco®

Polypropylene
Autoclavable to 121°C (250°F)
Fits C930 and C935 Culture Tubes
• 1.2 mm Wall Thickness x 2.62 cm Opening Diameter



Available Package Sizes	
100 Each	500 Each

Closures, *Phyto*Cap™

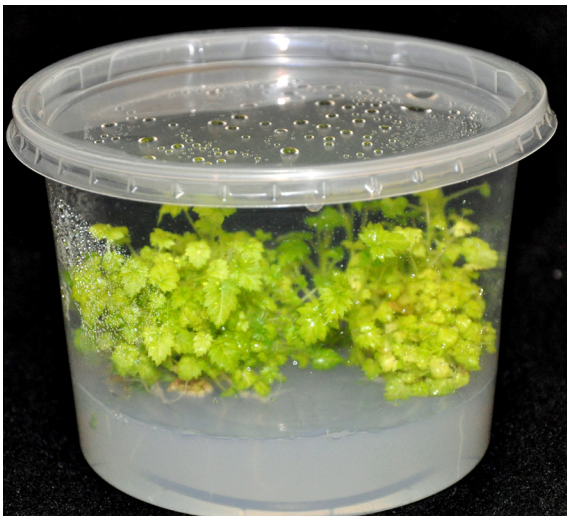
Polypropylene, Autoclavable
Fits standard baby food jar type culture vessels
Sold exclusively by *Phyto*Technology Laboratories®
• Equivalent to Magenta® B-Cap



Product Number	Vented	Available Package Sizes		
C070	No	25 Each	100 Each	1000 Each
C176	Yes	10 Each		25 Each

Closures, *Phyto*Con™-L, Round, Replacement Lid

Polypropylene, Autoclavable
For use with C209, C215 or C221 *Phyto*Con™ Culture Vessels
Recommended use: 1 - 3 times
Can NOT be autoclaved at temperatures higher than 121°C (250°F)
• 115 mm Diameter



Product Number	Vented	Available Package Sizes	
C203	No	100 Each	
C174	Yes	10 Each	25 Each

Closures, Round, 70 mm Screw Cap

Natural Polypropylene
Autoclavable up to 121°C (250°F)
Fits C031, C583, and C590 Culture Vessels
• 70 mm Diameter



Product Number	Vented	Available Package Sizes	
C566	No	12 Each	100 Each
C170	Yes	10 Each	25 Each

New Product

Closures, Round, 89mm Screw Cap

Natural Polypropylene, Autoclavable
Fits C597, C607, C1755, and C1765 Culture Vessels
• 89 mm Diameter



Product Number	Vented	Available Package Sizes	
C579	No	12 Each	100 Each
C2055	Yes	10 Each	25 Each

New Product

C1820 - Closures, Round, 120 mm, Vented

Natural Polypropylene, Autoclavable
Fits C1775 PTcon Culture Vessel
• 120 mm Diameter



Available Package Sizes	
10 Each	25 Each

Closures, Silicone Sponge

• Autoclavable
• C152 fits F934, F938 and F979 Erlenmeyer Flasks, and other 125-300 mL containers
• C164 fits F980 and F985 Erlenmeyer Flasks and other 500-1000 mL containers
• C450 fits C930 and C935 Culture Tubes and other 18-25mm flasks



Product Number	Diameter	Available Package Sizes
C152	28mm	10 Each
C164	38mm	10 Each
C450	18-25 mm	10 Each

©2014 PhytoTechnology Laboratories®

Lab Coats - American Standard

- Spunbond polypropylene
- Non-linting
- 3-snap closure
- No Pockets
- Disposable



Product Number	Coat Sizes	Available Package Sizes	
C459	Medium	1 Each	30 Each
C461	Large	1 Each	30 Each
C463	X-Large	1 Each	30 Each
C243	XX-Large	25 Each	

Coveralls, Disposable

Non-woven spunbond polypropylene
Non-linting
With zipper closure and elastic cuff and ankle
Disposable



Product Number	Coveralls Sizes	Available Package Sizes
C238	Medium	25 Each
C239	Large	25 Each
C240	X-Large	25 Each
C440	XX-Large	25 Each

New Product

C1770 - Culture Vessel, Baby Food Jar

Compatible with C070 *Phyto*Caps™ (sold separately)
Autoclavable
Offered as a 5 each sample pack (Product Number C2099).

Dimensions:
Base Diameter: 5.8 cm
Opening Outer Diameter: 4.8 cm
Opening Inner Diameter: 4.4 cm
Height: 9.0 cm



Available Package Sizes

100 Each

New Product

C2099 - Culture Vessel, Baby Food Jar Sample Pack

Contains 5 culture vessels (Product Number C1770)
Contains 5 lids (Product Number C070)
Autoclavable

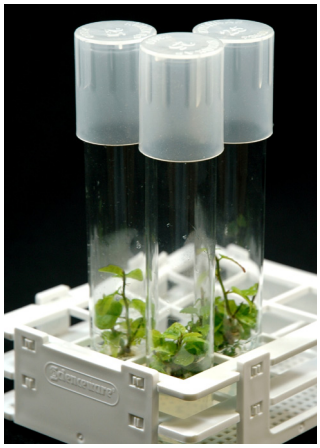


Available Package Sizes

5 Each

Culture Tubes, Borosilicate Glass

- Autoclavable
- 25 mm Diameter
- Uses C069, C163, C450, and C945 Closures



Product Number	Bottom Type	Height	Package Sizes
C930	Round	150 mm	125 Each 500 Each
C935	Flat	95 mm	144 Each 576 Each

New Product

C1898 - Culture Tube, Flip-Cap, Sterile

Polypropylene
Sterilized by gamma-irradiation
Autoclavable to 121 °C (250 °F)
- Base Diameter: 44 mm
- Height: 97 mm
- Top (Cap) Width: 60 mm
- Volume: approximately 145 mL

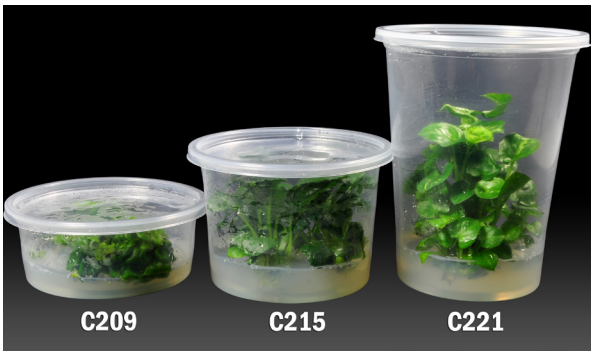


Available Package Sizes

25 Each 250 Each

Culture Vessels, *Phyto*Con™

Round, Non-graduated Vessel
Polypropylene, Autoclavable
Comes with C203 *Phyto*Con™-L Round Replacement Lid
Recommended use: 1 - 3 times
Can NOT be autoclaved at temperatures higher than 121°C (250°F)



Product Number	Capacity	Available Package Sizes
C209	8 oz (237 mL)	10 Each 250 Each
C215	16 oz (473 mL)	10 Each 250 Each
C221	32 oz (946 mL)	10 Each 250 Each

For More Information on Culture Vessels

See "Figure 35. Culture Vessel Selection Guide" on page 261 in the Technical Section.

New Product

Culture Vessels, PTcon™

Round, Graduated Culture Vessel
Clarified Polypropylene
Autoclavable to 121 C (250 F)
Comes with Screw-Cap Lids



Product Number	Capacity	Available Package Sizes
C1755	8 oz (237 mL)	25 Each 100 Each
C1765	20 oz (592 mL)	25 Each 100 Each
C1775	32 oz (947 mL)	25 Each 100 Each

©2014 PhytoTechnology Laboratories®

New Product

C2125 - Culture Vessel, PTCON™ Sample Pack

Contains 5 each of products C1755, C1765, and C1775
Contains lids for each product
Autoclavable to 121 °C (250 °F)



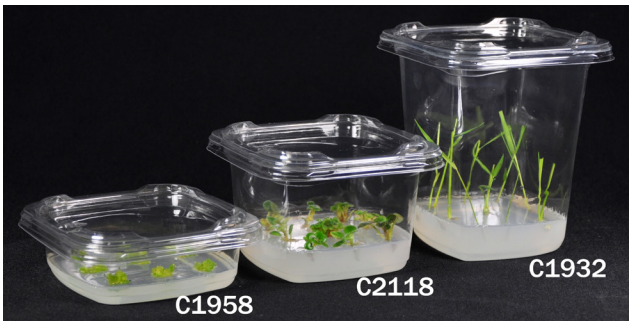
Available Package Sizes

5 Each

New Product

Culture Vessels, SteriCon™

Square, Non-Graduated Culture Vessel
Polystyrene
Sterilized by gamma-irradiation
NOT autoclavable



Product Number	Capacity	Available Package Sizes	
C1958	8 oz (237 mL)	25 Each	250 Each
C2118	16 oz (473 mL)	25 Each	250 Each
C1932	32 oz (946 mL)	25 Each	250 Each

Culture Vessels, Round, Glass Jar

Glass
Autoclavable
Polypropylene Lids Included



Product Number	Capacity	Cap Size	Package Sizes
C583	8 oz (236 mL)	70 mm	12 Each
C590	16 oz (473 mL)	70 mm	12 Each
C597	16 oz (473 mL)	89 mm	12 Each
C031	32 oz (946 mL)	70 mm	12 Each
C607	32 oz (946 mL)	89 mm	12 Each

C085 - Cup, Measuring, Graduated

Mini Measure®, Glass
- Measures 6 tsp with 1 tsp graduations
- Measures 2 Tbs with 1/2 Tbs graduations
- Measures 1 oz with 1/4 oz graduations
- Measures 30 mL with 5 mL graduations



Available Package Sizes

1 Each

Cylinders, Graduated, Polymethyl Pentene

Polymethyl Pentene
Autoclavable to 121°C (250°F)
Graduated



Product Number	Capacity	Available Package Sizes
C962	10 mL	1 Each
C964	100 mL	1 Each
C968	1000 mL	1 Each
C972	2000 mL	1 Each

Flasks, Erlenmeyer

Borosilicate Glass,
Autoclavable

F979 Uses S983
(Stopper No. 8);
F980 Uses S984
(Stopper No. 10)

- F979: 25 mL Graduations
- F980 and F985: 50 mL Graduations
- F986: 100 mL Graduations



Product Number	Flask Sizes	Available Package Sizes	
F934	125mL	12 Each	
F938	300mL	12 Each	24 Each
F979	250mL	6 Each	12 Each
F980	500mL	6 Each	24 Each
F985	1000mL	1 Each	6 Each
F986	2000mL	1 Each	4 Each

Foil, Aluminum

Aluminum foil is often used for sterilization of flasks, test tubes, culture vessels and/or equipment.

- For sterilization of flasks and test tubes, seal them with a single-layer of aluminum foil over the opening(s).
- For an air-tight seal, secure the aluminum foil folds with autoclave tape.



Product Number	Dimensions	Package Sizes
F041	250 ft² (12" x 250 ft)	1 Each
F035	750 ft² (18" x 500 ft)	1 Each

Forceps, Bayonet, Utility Grade

- Stainless Steel, Serrated Tip



Product Number	Length	Tip Width	Package Sizes
F083	6.25 in	1.8 mm	1 Each
F081	7 in	1.8 mm	1 Each
F957	8.25 in	2.3 mm	1 Each

Forceps, Bayonet, Miltex®

- Stainless Steel, Serrated Tip
- German-manufactured
- High Quality

* Denotes Premium Grade



Product Number	Length	Tip Width	Package Sizes
F303	14 cm	1.3 mm	1 Each
F312	16.5 cm	2.0 mm	1 Each
F633	21 cm	1.8 mm	1 Each
F639	21 cm	2.0 mm	1 Each
F315*	21 cm	2.5 mm	1 Each

©2014 PhytoTechnology Laboratories®

Forceps, Curved, Utility Grade

• Stainless Steel, Serrated Tip



Product Number	Length	Tip Width	Package Sizes
F955	6 in	1.1 mm	1 Each
F956	8 in	1.3 mm	1 Each

Forceps, Dressing, Utility Grade

• Stainless Steel, Serrated Tip



Product Number	Length	Tip Width	Package Sizes
F950	6 in	1.3 mm	1 Each
F951	8 in	3.4 mm	1 Each
F952	10 in	3.8 mm	1 Each
F953	12 in	4.4 mm	1 Each
F328	14 in	4.1 mm	1 Each
F347	16 in	4.1 mm	1 Each

New Product

Forceps, Dressing, Miltex®

• Stainless Steel, Serrated Tip
• German-manufactured
• High Quality

* Denotes Premium Grade



Product Number	Length	Tip Width	Package Sizes
F246	6 in	3.3 mm	1 Each
F228*	6 in	2.0 mm	1 Each
F268	8 in	3.8 mm	1 Each
F261*	8 in	2.5 mm	1 Each
F3158*	9.5 in	4.1 mm	1 Each
F272*	10 in	1.5 mm	1 Each

F292 - Forceps, Dressing, 10 in, Tungsten Carbide

• Stainless Steel, Serrated Tip
• German-manufactured
• High Quality
• Tungsten Carbide tips ensure long lasting use.
• Forceps Length: 10 in
• Tip Width: 2.0 mm



Available Package Sizes
1 Each

Forceps, Fine Point, Utility Grade

Stainless Steel



F343 F340 F086 F335 F028 F091

Product Number	Length	Tip Width	Package Sizes
F343	4.37 in	0.51 mm	1 Each
F340	4.65 in	0.4 mm	1 Each
F086	4.75 in	0.25 mm	1 Each
F335	4.8 in	0.4 mm	1 Each
F091	6.5 in	1.0 mm	1 Each

Forceps, Dressing, Fine Point, Miltex®

• Stainless Steel, Serrated Tip
• German-manufactured
• High Quality
* Denotes Premium Grade



Product Number	Length	Tip Width	Package Sizes
F178	4.75 in	1.2 mm	1 Each
F208*	4.75 in	0.5 mm	1 Each

Gloves, Autoclave

Beige cotton terry cloth
• For use up to 232°C



Product Number	Glove Sizes	Available Package Sizes
G092	13 Inch Length	1 Pair
G089	18 Inch Length	1 Pair

G368 - Glove Dispenser

Double Box Holder; Epoxy-Coated Wire; Blue
Autoclavable at 121°C (250°F)
Dimensions:
30.5 cm Wide
10.8 cm Deep
21 cm Tall



Available Package Sizes
1 Each

Gloves, Latex, Powder Free

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G414	Small	1 Each
G415	Medium	1 Each
G417	Large	1 Each
G418	X-Large	1 Each

Gloves, Latex, Low Powder

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G405	Small	1 Each
G406	Medium	1 Each
G408	Large	1 Each
G412	X-Large	1 Each

Gloves, Nitrile, Powder Free

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G941	Small	1 Each
G946	Medium	1 Each
G948	Large	1 Each
G949	X-Large	1 Each

Gloves, Nitrile, Low Powder

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G453	Small	1 Each
G454	Medium	1 Each
G456	Large	1 Each
G457	X-Large	1 Each

For More Information on Recommended Basic Laboratory Equipment

See "Figure 1. Recommended Basic Laboratory Equipment" on page 218 in the Technical Section.

©2014 PhytoTechnology Laboratories®

New Product

G3314 - Gloves, Nitrile, Black, Powder Free

Black
Nitrile
Powder-free
90 gloves per 1 Each package size



Available Package Sizes

1 Each

Gloves, PVC Vinyl, Powder Free

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G317	Small	1 Each
G319	Medium	1 Each
G324	Large	1 Each
G327	X-Large	1 Each

Gloves, PVC Vinyl, Light Powder

Ambidextrous
• 5 mil
• 100 per box
• US Standard Sizing



Product Number	Glove Sizes	Available Package Sizes
G361	Small	1 Each
G366	Medium	1 Each
G367	Large	1 Each
G377	X-Large	1 Each

Hairnets, Spunbond Polypropylene

Polypropylene Bouffant Cap with elastic opening
• 100 per package



Product Number	Hairnet Sizes	Available Package Sizes
H332	19 inch opening	1 Each
H336	24 inch opening	1 Each

H049 - Heat Sealer

Impulse Sealer, 120 V
8 in



Available Package Sizes

1 Each

H291 - Homogenizer, Variable Speed

Disperse, stir, and grind using a single drive unit with no possibility of cross-contamination



- Ultra-Turrax® Tube Drive
- Anti-Locking Function
- 110 - 240 VAC
- Universal disposable disperser system with hermetically sealable disposable sample tubes (Product No. H293, sold separately)

Available Package Sizes

1 Each

H293 - Homogenizer/Grinding Tubes

BMT-20S Stainless Steel Ball-Mill-Tube; For use with product no. H291



- Useful in milling of dry and brittle samples, cell maceration, and processing of materials mixed with liquids
- Volumes from 2 to 15 mL
- 1 each contains 25 grinding tubes

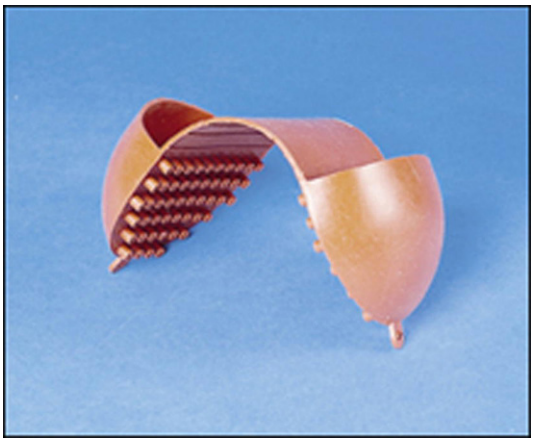
Available Package Sizes

1 Each

H042 - Hot Hand Protector

Silicone Rubber
Protruding studs for enhanced grip

- Designed for a temperature range of -57°C to 260°C



Available Package Sizes

1 Each

Hot Plate/Stirrer

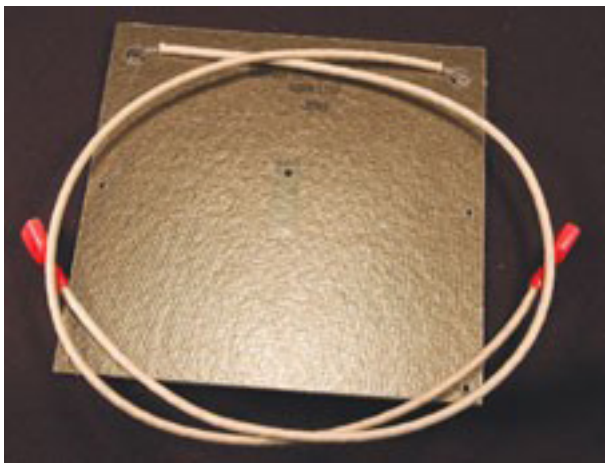
- 100 - 450 °C Heating Capacity
- 0 - 1500 RPM Stirring Capacity
- 18.8 cm x 18.8 cm Square Pan



Product Number	Hot Plate Types	Available Package Sizes
H926	110-120 Volt	1 Each
H947	220-240 Volt	1 Each

Hot Plate/Stirrers Heater Elements

H372 for use with H926 Hot Plate/Stirrer
H387 for use with H947 Hot Plate/Stirrer
600 Watt

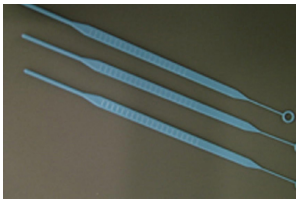


Product Number	Element Types	Available Package Sizes
H372	110-120 Volt	1 Each
H387	220-240 Volt	1 Each

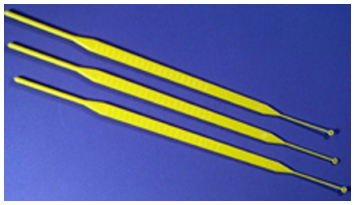
©2014 PhytoTechnology Laboratories®

Innoculating Loops

Plastic, Sterile
170mm Length



I382



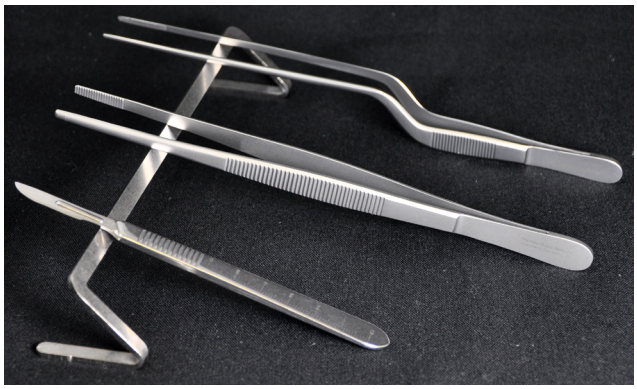
I395

Product Number	Loop Sizes	Available Package Sizes
I382	4.06 mm	25 Each 100 Each 1000 Each
I395	1.01 mm	25 Each 100 Each 1000 Each

New Product

I4013 - Instrument Rest, Horizontal Bar

Stainless Steel
Allows instruments and tools to rest when not in use or when cooling.

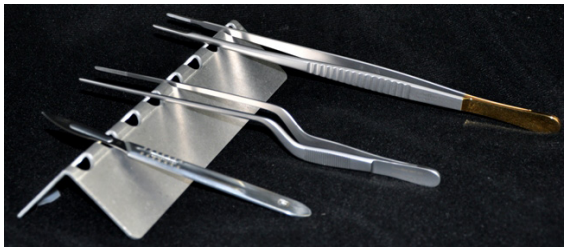


Available Package Sizes

1 Each

I556 - Instrument Rest, Horizontal

Used to rest sterile instruments in a laminar flow hood
Made from machine-cut, heavy-duty aluminium.



Available Package Sizes

1 Each

I623 - Instrument Rest, Vertical

Vertical tool rest for use in a laminar flow hood.
Made from machine-cut, heavy-duty aluminium.



Available Package Sizes

1 Each

Magnetic Mixer-Stirrers

Continuously variable speed from 0 - 1,500 rpm; good for volumes up to 800 mL; Largest Stir Bar: 30x8 mm



M655 M659

Product Number	Features	Available Package Sizes
M655	110 mm Diameter 115 VAC	1 Each
M659	115 mm Diameter 100-240 VAC	1 Each

Mask, Face

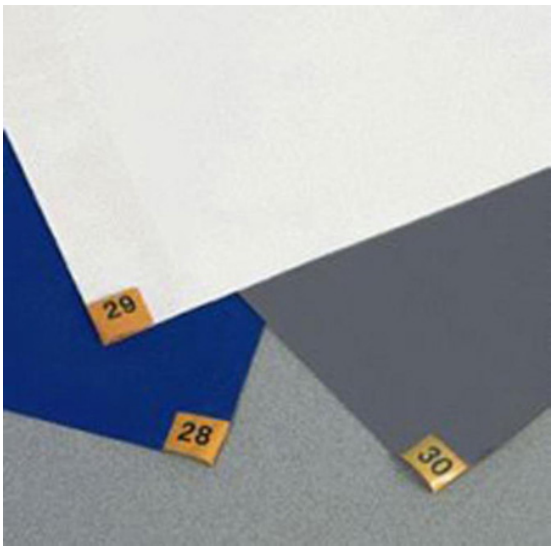
Non-Woven 3-Ply
Latex Free
• 50 per box



Product Number	Design Style	Available Package Sizes	
M480	Ear Loop	50 Each	500 Each
M487	Tie-On	50 Each	500 Each

M493 - Mat, Floor

Adhesive Tack Mat
Peel-away



Available Package Sizes	
1 Each	4 Each

D678 - Petri Dish, 60 x 15mm

Clear, Sterile Polystyrene
• Disposable/Recyclable
• 20 per Sleeve
• Optically Clear
• Not Autoclavable



Available Package Sizes	
20 Each	500 Each

For More Information on Culture Vessels

See "Figure 35. Culture Vessel Selection Guide" on page 261 in the Technical Section.

Petri Dishes, Sterile, Polystyrene

Single-use, disposable polystyrene plastic
Not autoclavable
100 mm Diameter



Product Number	Height	Available Package Sizes	
D940	15 mm	20 Each	500 Each
D942	20 mm	20 Each	500 Each
D943	25 mm	20 Each	500 Each

©2014 PhytoTechnology Laboratories®

D965 - Petri Dish, Glass

Glass
Autoclavable
• 100 mm Diameter x 15 mm Height

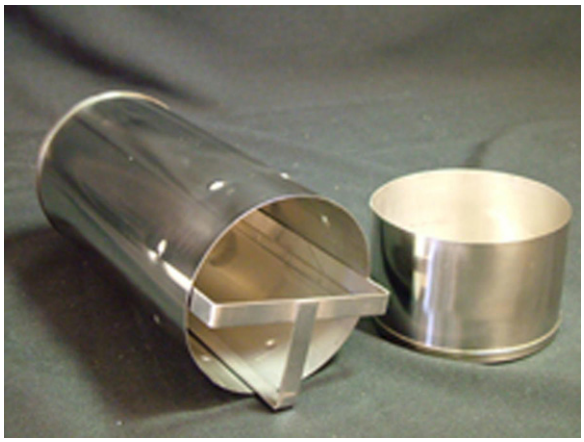


Available Package Sizes

12 Each 72 Each

D824 - Petri Dish Sterilizing Canister

Stainless Steel
Removable Rack
Holds up to 10 D965 (100 mm x 15 mm) Petri Dishes
Holds up to 18 100 mm x 10 xx Petri Dishes
• 10.16 cm Diameter x 26.67 cm Height



Available Package Sizes

1 Each

pH Indicator Strips



P958



P959

Product Number	pH Range	Available Package Sizes
P958	4.0 - 7.0	100 Each
P959	1.0 - 14.0	100 Each

New Product

P6930 - pH Meter

• Handheld unit
• 1-, 2- or 3-Point Calibration, dual buffer set recognition of US and NIST buffer sets
• Automatic temperature compensation
• Waterproof
• Battery life of over 300 hours; low battery indicator
• Uses B235, B236 and B237 Buffer Solutions
• 0.00 - 14.00 pH Range
• pH Accuracy: ± 0.02
• ATC Temperature Range: 0.0 - 99.9 °C
• Temperature Accuracy ± 0.3°C

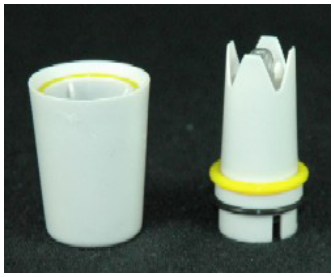


Available Package Sizes

1 Each

P084 - pH Meter Electrode, Replacement, Jenco®, VisionPlus pH 630

Replacement electrode that fits P6930 Jenco Vision Plus pH 630 pH meter



Available Package Sizes

1 Each

pH Paper

• 1/4 in x 15 ft Roll with Color Chart



P329



P334

Product Number	Paper Types	Available Package Sizes
P329	pH 1 - 14	1 Each
P334	pH 4.5 - 7.5	1 Each

Pipette Pumps

P922 for use with P990 and P992 Pipettes

P923 for use with P993 and P994 Pipettes

P924 for use with P995 Pipettes



Product Number	Capacity	Available Package Sizes
P922	2.0 mL	1 Each
P923	10.0 mL	1 Each
P924	25.0 mL	1 Each

Pipette Pumps, Handle with Thumbwheel

Features an ergonomic design that allows for easy manipulation of the thumbwheel.



Product Number	Capacity	Available Package Sizes
P302	2.0 mL	1 Each
P304	10.0 mL	1 Each
P306	25.0 mL	1 Each

Pipette Pumps, Quick-release

P790 for use with P990 and P992 Pipettes

P791 for use with P993 and P994 Pipettes

P792 for use with P995 Pipettes



Product Number	Capacity	Available Package Sizes
P790	2.0 mL	1 Each
P791	10.0 mL	1 Each
P792	25.0 mL	1 Each

Pipettes, Serological

Sterile, Polystyrene
Graduated
Individually Wrapped

P990 uses P790 and P922 Pumps
P992 uses P071, P072, P790 and P922 Pumps
P993 uses P071, P072, P791 and P923 Pumps
P994 uses P071, P791 and P923 Pumps
P995 uses P071, P072, P792 and P924 Pumps
P996 uses P071 and P072 Pumps

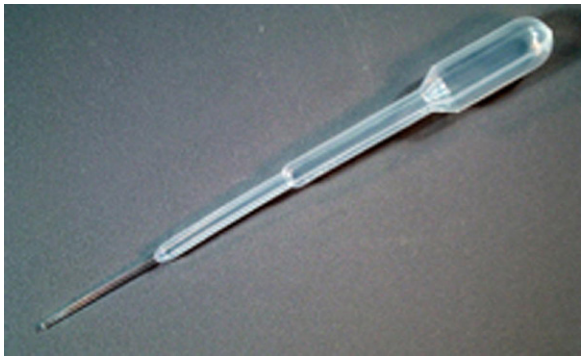


Product Number	Pipette Info	Package Sizes
P990	1.0 mL 0.01 mL Graduations	25 Each 100 Each 1000 Each
P992	2.0 mL 0.01 mL Graduations	25 Each 100 Each 500 Each
P993	5.0 mL 0.1 mL Graduations	25 Each 100 Each 200 Each
P994	10.0 mL 0.1 mL Graduations	25 Each 100 Each 200 Each
P995	25.0 mL 0.2 mL Graduations	25 Each 100 Each 200 Each
P996	50.0 mL 0.5 mL Graduations	25 Each 100 Each

©2014 PhytoTechnology Laboratories®

P067 - Pipette, Transfer

Disposable
Non-Graduated
Extended fine tip with small bulb
• 1.0 mL Approximate Volume



Available Package Sizes

100 Each	400 Each

Pipette Cans

• Stainless steel
• Autoclavable
• P6996 holds up to thirty-two 0.5 mL Pipets, and up to eighteen 10 mL Shortie Pipets.
• P815 holds up to sixty-four 0.5 mL Pipets, and up to thirty-six 10 mL Shortie Pipets.



Product Number	Can Sizes	Available Package Sizes
P6996	5 x 5 x 24 cm	1 Each
P815	10 x 10 x 24 cm	1 Each

New Product

P6715 - Pipettor, Serological

Green
Rechargeable Lithium-Ion Battery (Illuminated LED array shows battery charge on the pipettor)
Works with P992, P993, P994, P995, and P996 pipettes

Package Includes:
• Omega Pipettor
• Universal Power Supply
• Wall Mount
• Name Labels to Personalize Pipettor
• Manufacturer's Warranty Registration Card
• Instruction Manual
• Utility Knife



Available Package Sizes

1 Each

S736 - Pressure Cooker, Saniclave 100

Sterilizer with self-contained electric (120 VAC) heating element
• Complete cycle (warm up & sterilization) in 45 min or less
• 122°C internal temperature; 16 psi pressure
• Fully programmable; digital display
• Removable stainless steel chamber & cover
• Fusible plug pressure release
• Over-temperature thermal cutout

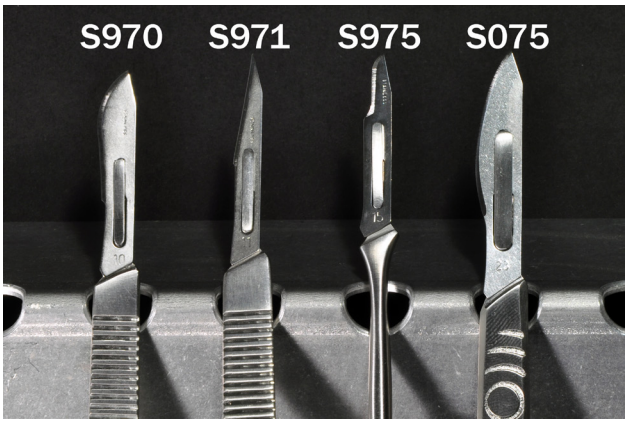


Available Package Sizes

1 Each

Scalpel Blades, Carbon Steel

Carbon Steel, individually wrapped, sterile



Product Number	No.	Available Package Sizes
S970	10	100 Each
S971	11	100 Each
S975	15	100 Each
S075	23	100 Each

Scalpel Handle & Blade Compatibility Chart			
Scalpel Handle	Handle Type	Blade Compatibility by Product Number	Blade Compatibility by Blade Types
S963	No. 3	S970, S971, S975	No. 10, No. 11, No. 15
S973	No. 3L	S970, S971, S975	No. 10, No. 11, No. 15
S967	No. 7	S970, S971, S975	No. 10, No. 11, No. 15
S094	No. 4	S075	No. 23
S648	No. 4L	S075	No. 23
S653	No. 4L Angular	S075	No. 23

B004 - Scalpel Blade Remover

Plastic box used for the removal and storage of used scalpel blades



Available Package Sizes
1 Each

Scalpel Handles, Stainless Steel

Stainless Steel



Product Number	No.	Length	Package Sizes
S963	3	12.70 cm	1 Each
S973	3L	20.96 cm	1 Each
S967	7	16.20 cm	1 Each
S648	4L	22.10 cm	1 Each
S094	4	13.49 cm	1 Each
S653	4L	20.90 cm	1 Each

Scissors, Miltex®

Stainless Steel
German Manufactured
Research Grade

*Denotes Premium Grade



S641 S644 S652

Product Number	Length	Blades	Package Sizes
S641	5.5 in (14 cm)	Sharp	1 Each
S644*	6 in (15.4 cm)	Sharp	1 Each
S652	9 in (22.9 cm)	Beveled	1 Each

©2014 PhytoTechnology Laboratories®

Scissors, Economical Grade

Stainless Steel

S087



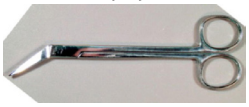
S836



S988



S989

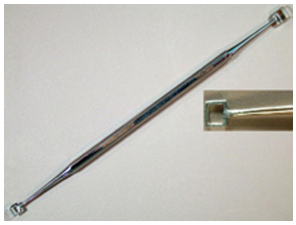


Product Number	Scissor Sizes	Available Package Sizes
S087	Straight, 8 inch	1 Each
S836	Straight, $6^{3/8}$ inch	1 Each
S988	Straight, 5.6 inch	1 Each
S989	Curved, 6 inch	1 Each

Scoops/Transfer Tools

Stainless Steel, Double-Ended, Open End
Excellent for transferring callus, orchid protocorms, or sowing seeds

S008 has square scoops
S009 has round scoops





Product Number	Scoop Spherical Diameter	Package Sizes
S008	3.18 x 5.56 mm small end 4.37 x 6.75 mm big end	1 Each
S009	3.57 x 3.97 mm small end 5.16 x 5.56 mm big end	1 Each

For More Information on Recommended Basic Laboratory Equipment

See "Figure 1. Recommended Basic Laboratory Equipment" on page 218 in the Technical Section.

Sealing Film, Parafilm®

Used to seal culture vessels and to help control contamination. Autoclavable to 121°C (250 °F)



Product Number	Dimensions	Available Package Sizes	
S801	2 in x 250 ft	1 Each	12 Each
S823	4 in x 125 ft	1 Each	12 Each
S911	4 in x 250 ft	1 Each	10 Each

A003 - Sealing Film

PVC Film
- 3.0 - 3.5 cm Roll Width x 7.8 - 8.3 cm Roll Diameter
- Approximately 150 m Roll Length



Available Package Sizes	
1 Each	10 Each

P6635 - Seed Testing Papers, 70 mm, Round

See Seed Testing Section for Complete Listing

P6645 - Seed Testing Papers, 90 mm, Round

See Seed Testing Section for Complete Listing

S819 - Shoe Cover, Non-Skid

Polypropylene with elastic opening
Gripping treads on the bottom
• One size fits all
• 50 per package



Available Package Sizes

1 Each

Spatulas, Stainless Steel

Stainless Steel

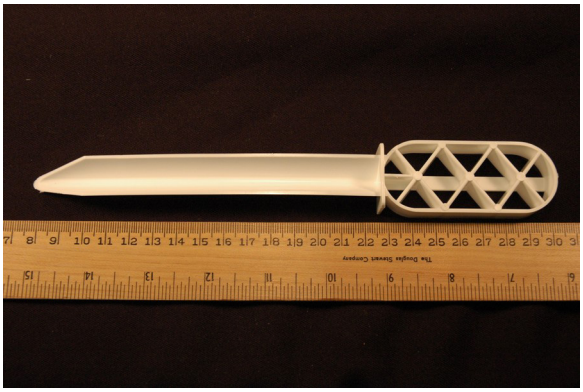


Product Number	Length	Style	Package Sizes
S977	20.80 cm	Flat	1 Each
S978	22.54 cm	Flat/Spoon	1 Each

S830 - Spatula

V-Shaped with handle
Plastic, Autoclavable

• 22.5 cm Length

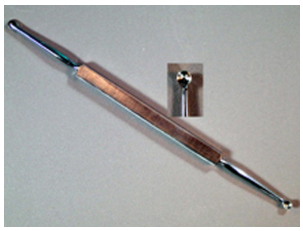


Available Package Sizes

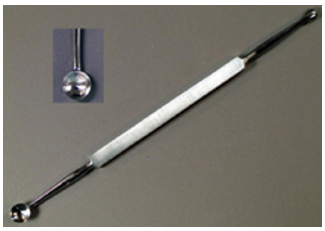
1 Each

Spoon / Microspoons

Stainless Steel, Double-Ended
Excellent for weighing small quantities of chemicals



S014



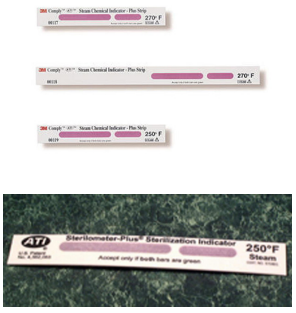
S018

Product Number	Scoop Spherical Diameter	Package Sizes
S014	2.65 mm Small End 3.57 mm Big End	1 Each
S018	4.76 mm Small End 6.35 mm Big End	1 Each

Sterilization Indicators

For use in steam autoclaves at 121 °C (250 °F)

• S787 are 3M™ Comply™ Steam Chemical Indicator-Plus Strips



Product Number	Box Sizes	Available Package Sizes
S787	200 per Box	1 Each
S991	250 per Box	1 Each

©2014 PhytoTechnology Laboratories®

New Product

S7484 - Diack® Sterilization Monitor

Diack sterilization monitors are used to verify if sterilization temperatures were reached during autoclaving.
The temperature sensitive pellets melt to indicate when temperatures reach 121°C (250°F).

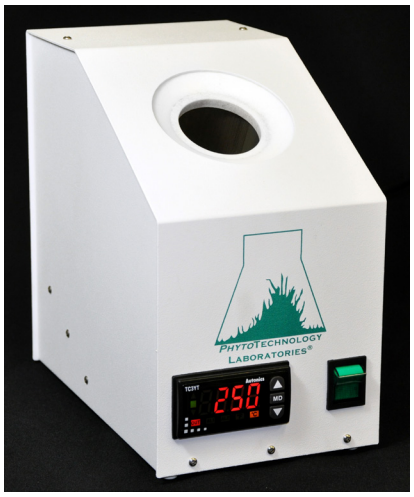


Available Package Sizes	
10 Each	100 Each

New Product

Sterilizer, ErgoSteri™ VT Glass Bead

Ergonomic design with slanted bead well.
Digital temperature controller for precise temperature readings.
Manufactured and assembled in the USA.
• Reaches temperature of 250°C in 20 minutes.



Product Number	Volts	Hertz	Package Sizes
S7510	110V	60Hz	1 Each
S7520	220V	50Hz	1 Each

S638 - Glass Beads

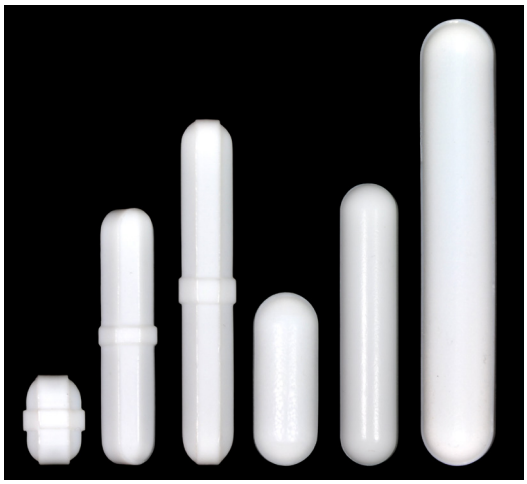
Replacement Beads for S7510 & S7520 Glass Bead Sterilizers
• Bead Diameter: 1.7 mm to 2.5 mm
• ca. 450g of glass beads per package
• Contains beads to fill the wells of S7510 & S7520 Glass Bead Sterilizers



Available Package Sizes
1 Each

Stir Bars, Magnetic

Teflon®, Polygon
Autoclavable



Product Number	Dimensions (mm)	Available Package Sizes
B010	7.9 x 12.7	1 Each
B011	7.9 x 38.1	1 Each
B012	7.9 x 50.8	1 Each
B013	9.5 x 25.4	1 Each
B015	9.5 x 50.8	1 Each
B017	12.7 x 76.2	1 Each

B016 - Stir Bar Retriever, Magnetic

Polyethylene
Contains a magnet sealed in one end with a hanging loop on the other end.
• 0.37 in Diameter x 18 in Length (9.5 mm x 45.72 cm)

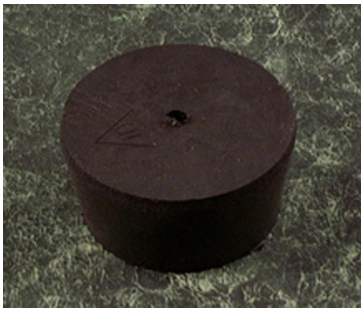


Available Package Sizes

1 Each

Stoppers, Black Rubber

Black Rubber, One Hole
S981 fits F934 Erlenmeyer Flask
S983 fits F938 and F979 Erlenmeyer Flasks
S984 fits F980 Erlenmeyer Flask



Product Number	Stopper Sizes	Available Package Sizes	
S981	No. 6½	25 Each	100 Each
S982	No. 7	25 Each	100 Each
S983	No. 8	25 Each	100 Each
S984	No. 10	25 Each	50 Each

Autoclave Indicator Tape



Product Number	Tape Width	Tape Length	Package Sizes	
T789	2.54cm	54.9m	1 Each	
T998	1.27cm	54.9m	1 Each	6 Each

Tape, Label

Manufactured from proprietary materials that resist moisture and most solvents; No sticky residue lingers when tape is removed
Will adhere to Teflon® fluoropolymer resin-covered materials and any clean surface
Autoclavable
Temperature Range: -73°C to 257°C
Tape Size: 3/4 in x 40 yd



Product Number	Tape Color	Available Package Sizes
T690	White	1 Each
T695	Blue	1 Each
T696	Green	1 Each
T697	Orange	1 Each
T699	Yellow	1 Each
T706	Red	1 Each

©2014 PhytoTechnology Laboratories®

T969 - Tape, Micropore, Surgical

• 1 in x 10 yd (2.54 cm x 9.14 m)



Available Package Sizes

1 Each	12 Each	120 Each

New Product

T7939 - Tape, Label, Wide

Manufactured from proprietary materials that resist moisture and most solvents; No sticky residue lingers when tape is removed
Will adhere to Teflon® fluoropolymer resin-covered materials and any clean surface
Autoclavable
Temperature Range: -73°C to 257°C
Tape Size: 1 in x 40 yd
Color: White



Available Package Sizes

1 Each

T719 - Test Tube Basket

• With Lid; Polypropylene
• Autoclavable
• Dimensions: 152 mm L x 152 mm W x 152 mm H
• For storing, cleaning, and autoclaving test tubes and other laboratory glassware



Available Package Sizes

1 Each

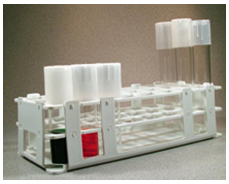
Test Tube Racks, Autoclavable Polypropylene

Chemical-resistant Polypropylene; White
Autoclavable to 121 °C (250 °F)

Holds 25 mm Tubes (C930 and C935)

Rack Sizes
R662: 128 x 105 x 43 mm
T078: 245 x 105 x 70 mm





Product Number	Positions	Available Package Sizes
R662	12	1 Each
T078	24	1 Each

T171 - Test Tube Rack, Stainless Steel

Stainless Steel, Autoclavable
Holds up to 40 C930 or C935 (25 mm) Culture Tubes
• 300 mm Width x 125 mm Length x 55 mm Height

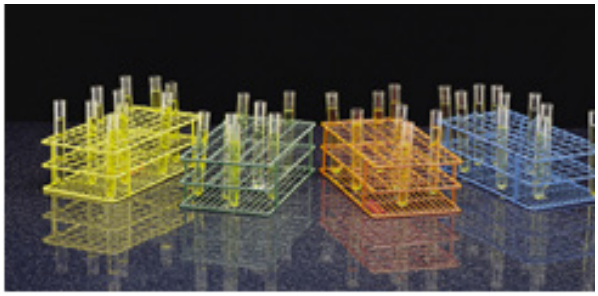


Available Package Sizes

1 Each

Test Tube Racks, Epoxy-coated Wire, Stainless Steel

Epoxy-coated wire is resistant to organic solvents, weak acids and bases, salts; Green
Autoclavable to 121°C (250°F)



Product Number	Rack Sizes	Available Package Sizes
R664	4x10 (40) tube slots 293 x 128 x 83 cm	1 Each
R666	8x10 (80) tube slots 293 x 242 x 83 cm	1 Each

T786 - Thermometer, Digital

Capable of reading °C and °F
Stainless steel probe that comes in a protective sleeve
Resistant to acids, bases, solvents, and most chemicals
Rotating Digital Display
• -50°C to 280°C / -58°F to 536°F Temperature Range
• 8 in x 1/8 in Probe Length



Available Package Sizes

1 Each

New Product

T8077 - Tray

Autoclavable
Holds up to 12 *Phyto*Con culture vessels
Dimensions:
• Outer Top Length: 19 5/8 in (49.85 cm)
• Outer Top Width: 13 3/8 in (33.98 cm)
• Inside Bottom Length: 18 1/4 in (46.35 cm)
• Inside Bottom Width: 11 5/8 in (29.52 cm)



Available Package Sizes

1 Each 25 Each

W1933 - Water Bath

5.5 Liter Capacity
• Temp. Range: 25° - 90°C (±0.4°C)
• Digital Display: 3 Digit, 0.1°C
• Inner Dimensions (cm): 32 x 17 x 13.3 H



Available Package Sizes

1 Each

©2014 PhytoTechnology Laboratories®

Antistatic Pour Boats

Polystyrene weigh boats designed to conveniently weigh liquids and statically-affected powders.
250 per Pack



Product Number	Boat Sizes	Available Package Sizes
W598	20mL 80 x 41 x 8 mm	1 Each
W578	140mL 133 x 76 x 25 mm	1 Each
W568	270mL 197 x 121 x 25 mm	1 Each

Weigh Boats

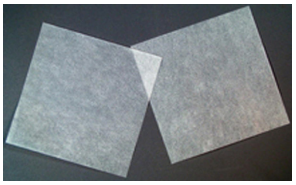
Polypropylene Weigh Boats



Product Number	Boat Sizes	Available Package Sizes
W879	4.1 x 4.1 x 0.8 cm	500 Each
W880	8.9 x 8.9 x 2.5 cm	500 Each
W881	14 x 14 x 2.5 cm	500 Each

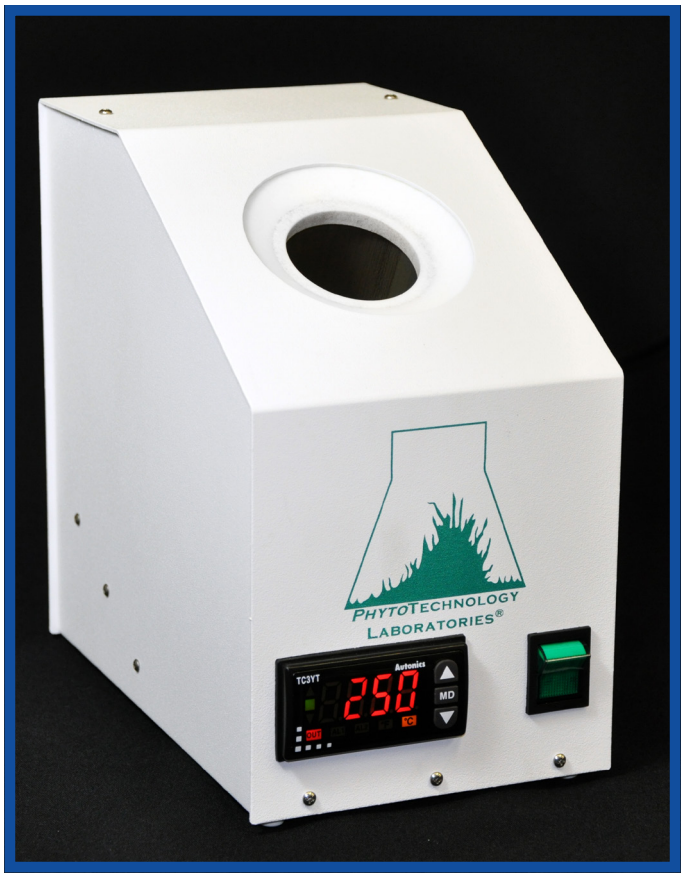
Weigh Paper

Strong and nonabsorbent



Product Number	Paper Sizes	Available Package Sizes
W917	7.62 x 7.62 cm	500 Each
W921	10.16 x 10.16 cm	500 Each
W925	15.24 x 15.24 cm	500 Each

Introducing the *Phyto*Technology Laboratories Designed, Ergonomic Glass Bead Sterilizer: S7510/S7520 ErgoSteri VT™



ErgoSteri VT™

*Phyto*Technology Laboratories is pleased to introduce their new ErgoSteri™ glass bead sterilizer. This unique unit features a slanted bead well that is more ergonomically friendly than convention units that are vertical. Another important feature is a digital temperature controller that is adjustable between 110 and 350° C. Most units on the market today feature either factory preset temperatures that cannot be changed, or analog knobs that make it difficult to set an exact temperature. The only other digital model, the Steripot brand, has a very limited temp range (250 to 275° C).

The ErgoSteri™ was designed with quality and accurate temperature maintenance in mind. The unit is manufactured and assembled in the USA, and the digital temperature controller allows for accurate temperature adjustments within a broad range. The construction of the unit allows for easy maintenance and care-free operation; however, *Phyto*Tech™ offers a one-year warranty on parts & labor should a problem be encountered. And since all manufacturing and assembly are performed in the USA *Phyto*Tech™ can offer a quick turnaround if any unit should require warranty work.

The ErgoSteri™ heats fast, reading a stable 200° C in under 20 minutes. *Phyto*Tech's unique design also prohibits glass beads from sliding into any other part of the unit other than the bead well making filling and emptying much easier.

Please visit our website for more information on the ErgoSteri glass bead sterilizer.

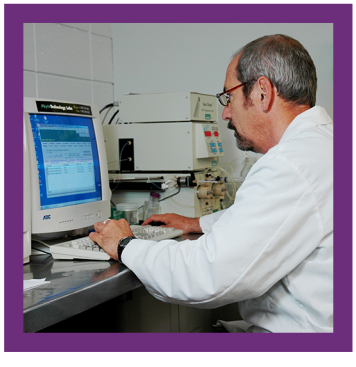
Product Number	Product Description	Product Notes		Dimensions and Other Info		Pkg Size
S7510	**ERGOSTERI VT™, 110 V** Glass Bead Sterilizer	Temperature Read-Out:	Digital	Body Height:	20.1 cm (8.25 in)	1 ea
		Temperature Range:	110 to 350°C	Body Width:	14.5 cm (5.75 in)	
S7520	**ERGOSTERI VT™, 220 V** Glass Bead Sterilizer	Manufactured in:	USA	Body Length: (front to back)	23.5 cm (9.25 in)	
		Warranty:	1-year	Bead Well Diameter:	5 cm (2 in)	
				Bead Well Depth:	12.7 cm (5 in)	
S638	**BEAD REPLACEMENTS** Glass Bead Sterilizer Beads	Packaged specifically for the ErgoSteri bead well capacity.		Quantity:	450 g	1 ea

Competitor	Model	Country of Origin	Temperature	Temperature Read-Out	Ergonomic Design
A	MODEL BS-1000	INDIA	PRE-SET	NONE	NO
B	STERI-350	SWITZERLAND	PRE-SET	ANALOG	NO
C	STERIPOT-S150D with Digital Controller	INDIA	ADJUSTABLE	DIGITAL	NO
D	LAB ASSOCIATES G3301	THE NETHERLANDS	ADJUSTABLE	NONE	NO
*Phyto*Tech	ERGOSTERI VT™	USA	ADJUSTABLE	DIGITAL	YES

©2014 *Phyto*Technology Laboratories®

TECHNICAL INFORMATION









Technical Information – Table of Contents

Lab Set-Up and Safety
Organization of a Tissue Culture Lab 217
Recommended Basic Laboratory Equipment 218
Basic Laboratory Procedures 221
Lab Safety 224

Sterilization Techniques
Sterilization Techniques 224
Minimum Autoclaving Time For Plant Tissue Culture Media 224

Plant Tissue Culture Media
What is Plant TC Media? 226
Media for Stages of Growth 226
Why Use Pre-Made Powdered Media? 226
Custom Formulations 227
Examples of Media Designed for a Specific Stage of Growth 227
Powdered Media 228
Media Preparation 228
Stock Solutions 230
Deterioration & Proper Storage 230

Plant Tissue Culture Media Components
Media Components 231
Macronutrients 232
Micronutrients 233
Carbohydrates 234
Choosing a Carbohydrate 234
Vitamins 235
Vitamin Preparation & Use 235
Amino Acids 236
Undefined Organic Supplements 236
Plant Growth Regulators 237
PGR Preparation & Use 237
Plant Growth Regulator Usage and Storage 240
Gelling Agents 242
Gelling Agent Preparation & Use 242
Usage Guide for Gelling Agents 242
Gelling Agent Clarity Comparison 244

Indexing Explants
Recognizing Contamination by Indexing Explants 244
Media Used in Indexing Explants 244

Orchid Media
Tissue Culture & Orchids 245
Terrestrial Orchid Media Selection Guide 245
Epiphytic Orchid Media Selection Guide 245
Terrestrial Orchid Media Selection Guide by Genus 246
Epiphytic Orchid Media Selection Guide by Genus 247
Orchid Media Family Relations 247
Orchid Media Selection Guide by Procedure 251

Antibiotics
Antibiotic Selection, Preparation, & Storage 252
Antibiotic/Antimycotic/Selection Agent Guide 253

GUS Gene Staining Solution
GUS Gene Staining Solution 255
GUS Gene Staining Solution Formulation 255

Phytopathology & Microbiology
Phytopathology & Microbiology Media 256

Phycology
Phycology Media 257

Seed Testing
Seed Testing – P6800 *Phyto*Select Basal Medium & SMART Media 258
Stains & Dyes Usage Table 259

Miscellaneous
Miscellaneous 260

Culture Vessels
Culture Vessel Selection Guide 261

Guides, Glossary, and Bibliography
Useful Guides 262
Glossary 263
Bibliography 264

Media Formulation Tables
Plant Tissue Culture Media Formulations A-Z 265-277
Orchid Media Formulations A-Z 278-281
Vitamin Mixtures Formulations A-Z 282
Phytopathology & Microbiology Media Formulations A-Z 283-286
Phycology Formulations A-Z 287
Seed Testing Formulations A-Z 288

©2014 PhytoTechnology Laboratories®

In This Section – Lab Setup & Basic Techniques

The next several pages will discuss how to set up a lab for tissue culture research and *in vitro* micropropagation. This section is intended mostly for hobbyists, educators, and people learning about the plant sciences for the first time. The procedures outlined in this section are not intended to replace existing protocols that your university or workplace may require.

Organization of a Tissue Culture Lab

Any laboratory in which tissue culture techniques are performed, regardless of the specific purpose, must contain a number of basic facilities. These usually include the following:

- A general washing area,
- A media preparation, sterilization, and storage area,
- An aseptic transfer area,
- Environmentally controlled incubators or culture rooms, and
- An observation/data collection area.

Washing Area

The washing area should contain large sinks, draining boards, and racks, and have access to deionized/distilled water. Space for drying ovens or racks, automated dishwashers, acid baths, pipet washers and driers, and storage cabinets may be necessary in the washing area, depending on the work being performed.

Media Preparation Area

The media preparation area should have ample storage space for the chemicals, culture vessels and closures, and glassware required for media preparation and dispensing. Bench space for hot plates/stirrers, pH meters, balances, water baths, and media-dispensing equipment should be available. Other necessary equipment may include air and vacuum sources, Bunsen burners with a gas source, refrigerators and freezers for storing stock solutions and chemicals, a microwave or convection oven, and an autoclave or domestic pressure cooker for sterilizing media, glassware, and instruments.

In preparing culture media, analytical grade chemicals should be used and good weighing habits practiced. To ensure accuracy, an exact, step-by-step routine should be developed for media preparation. This routine should be contained in a complete media preparation checklist required to be completed by all technicians preparing media, even for the simplest media.

The water used in preparing media should be highly purified through deionization and/or distillation. Tap water is not recommended because it may contain undesirable salts and dissolved gases, microorganisms (algae, fungi, bacteria), and particulate matter (silt, oils, organic matter, etc.). Water used for plant tissue culture should meet, at a minimum, the standards for type II reagent grade water, i.e.: be free of pyrogens, gases, and organic matter and have an electrical conductivity less than 1.0 µmho/cm.

The most common and preferred method of purifying water to type II standards is a deionization treatment followed by one or two glass distillations. The deionization treatment removes most ionic impurities, and the distillation process removes large organic molecules, microorganisms, and pyrogens. Three other methods that will produce type II purity water are absorption filtration, which uses activated carbon to remove organic contaminants and free chlorine; membrane filtration, which removes particulate matter and most bacterial contamination; and reverse osmosis, which removes approximately 90% of the bacterial, organic, and particulate matter as well as about 90% of the ionized impurities.

Transfer Area

Under very clean and dry conditions, tissue culture techniques can be successfully performed on an open laboratory bench. However, it is advisable that a laminar flow hood or sterile transfer room be utilized for making transfers. Within the transfer area there should be a source of electricity, gas, compressed air, and vacuum.

The most desirable arrangement is a small dust-free room equipped with an overhead ultraviolet light and a positive-pressure ventilation unit. The ventilation should be equipped with a high-efficiency particulate air (HEPA) filter. A 0.3-µm HEPA filter of 99.97-99.99% efficiency works well. All surfaces in the room should be designed and constructed in such a manner that dust and microorganisms do not accumulate and the surfaces can be thoroughly cleaned and disinfected. A room of such design is particularly useful if large numbers of cultures are being manipulated or large pieces of equipment are being utilized.

Another type of transfer area is a laminar flow hood. Air is forced into the unit through a dust filter then passed through a HEPA filter. The air is then either directed downward (vertical flow unit) or outward (horizontal flow unit) over the working surface. The constant flow of microbe-free filtered air prevents non-filtered air and particulate matter in the room from settling on the working surface.

The simplest type of transfer area suitable for tissue culture work is an enclosed plastic box, commonly called a glove box. This type of culture hood is sterilized by an ultraviolet light and wiped down periodically with 70% alcohol when in use. This type of unit is used when relatively few transfers are performed.

Culture Room

All types of tissue cultures should be incubated under conditions of well-controlled temperature, humidity, air circulation, and light quality and duration. These environmental factors may influence the growth and differentiation process, either directly during culture, or indirectly by affecting their response in subsequent generations. Protoplast cultures, low-density cell suspension cultures, and anther cultures are particularly sensitive to environmental conditions.

Typically, the culture room for growth of plant tissue cultures should have a temperature between 15 to 30 °C, with a temperature fluctuation of less than ±0.5°C; however, a wider range in

temperature may be required for specific experiments. It is also recommended that the room have an alarm system to indicate when the temperature has reached preset high or low temperature limits, as well as a continuous temperature recorder to monitor temperature fluctuations. The temperature should be constant throughout the entire culture room (i.e., no hot or cold spots). The culture room should have enough fluorescent lighting to reach 10,000 lux; the lighting should be adjustable in terms of quantity and photoperiod duration. Both light and temperature should be programmable for a 24-hour period. The culture room should have fairly uniform forced-air ventilation, and a humidity range of 20-98% controllable to ±3%. Many incubators, large growth chambers, and walk-in environmental chambers meet these specifications.

Recommended Lab Equipment

The table below **(See Figure 1)** details a basic recommendation for what is needed to setup a successful plant tissue culture laboratory. Many of the recommended items are available from *Phyto*Technology Laboratories® and are listed in this catalogue.

This list does not include any recommendations for plant tissue culture media that may be required for research.

Figure 1. Recommended Basic Laboratory Equipment

Recommended Basic Laboratory Equipment			
Quantity	**Description**	**Product #**	**Item Function**
1	Water Purification System	**n/a**	Purification of water for media preparation
1	Electronic Balance (0.01 g readability; 200 g minimum capacity)	**B798**	Measuring out biochemicals and media
1	pH meter (range 0-14 +/- 0.01; automatic temperature compensation 0-60 °C; one or two point calibration)	**P6930**	Measurement and adjustment of media pH
1	Hot Plate/Stirrer (7" x 7" ceramic top; variable heating range from ambient to 400°C; variable stirring speed from 50-150 rpm; chemically resistant)	**H926**	Mixing & heating media and stock
1	Refrigerator/freezer; capable of maintaining a refrigerator temperature of 2-6 °C with a freezer temperature of approximately –20°C.	**n/a**	Storage of stock solutions, media, plant growth regulators, etc.
1	Laminar Flow Transfer Hood; incoming air should be HEPA filtered to remove 99.99% of particles larger than 0.3 µm; should meet or exceed the Class 100 Clean Standard 209D; should maintain a flow of 90 fpm +/- 20% at static pressures of 0.6-1.2"	**n/a**	Provide a sterile atmosphere to transfer cultures
1	4 liter 70% Isopropyl alcohol (or several pint bottles purchased from a local pharmacy)	**n/a**	Used to sterilize instruments and work areas
1 roll	Aluminum foil, heavy duty; (18" x 500' roll)	**F035**	Used to wrap instruments prior to sterilization, cover vessels
12	Beakers, 250 mL	**B910**	Mixing solutions
12	Beakers, 1000 mL	**B931**	Mixing solutions
6	Beakers, 2000 mL	**B939**	Mixing solutions and media
6	Beakers, 4000 mL	**B960**	Mixing solutions and media
4 each	Bottle, Water; pre-labeled for use in dispensing water; 500 mL capacity	**B987**	Rinsing instruments, beakers, & transplants from tissue culture
4 each	Bottle, Isopropyl Alcohol; pre-labeled for use in dispensing isopropyl alcohol; 500 mL capacity	**B974**	Rinsing sterile hood work surfaces
1 case	Bottle, 500 mL; Type 1 borosilicate glass with volume graduations; supplied with 33-340 black polypropylene cap with rubber liner; non-sterile	**n/a**	Storage of stock solutions, sterile distilled water, media
1 case	Bottle, 1000 mL; Type 1 borosilicate glass with volume graduations; supplied with 33-340 black polypropylene cap with rubber liner; non-sterile	**n/a**	Storage of stock solutions, sterile distilled water, media
2	Brushes, flask or bottle	**n/a**	Cleaning glassware
1 case	Culture tubes, 25 x 150 mm, borosilicate glass; 500 tubes/case	**C930**	Starting cultures in Stage I

©2014 PhytoTechnology Laboratories®

Recommended Basic Laboratory Equipment

Quantity	Description	Product #	Item Function
1 case	Culture tube racks; holds 40, 25 mm culture tubes; withstands temperatures up to 121°C	**T171, R664**	Holding culture tubes
500	Closures, for 25 mm culture tubes, 500 each	**C069**	Sealing culture tubes
1 case	*Phyto*Tech™ SteriCon™, Sterilized culture vessels	**C1958, C2118, C1932**	Culture vessel for maintaining plant cultures
1 case	*Phyto*Caps; autoclavable closure for baby food jars (fits product C1770); clear polypropylene closure; 100/case	**C070**	Closure for baby food culture vessels
1 case	Culture vessels; autoclavable culture vessel and lid made from clear polypropylene; round vessel. Measures 115mm in diameter. 250 per case.	**C209, C215, C221**	Culture vessel for maintaining plant cultures
1 liter	Detergent	**C284**	Cleaning glassware
1 box	Diack Sterilization Monitor	**S7484**	Verifying if sterilization temperatures were reached during autoclaving.
1 case	Culture dishes, disposable, sterile, 100 x 15 mm	**D940**	Sterile surface for cutting explants (for Stage I cultures)
1 gallon	Chlorine bleach (sodium hypochlorite)	**n/a**	Surface sterilize explants
6	Erlenmeyer flask, 250 mL	**F979**	Mixing media
6	Erlenmeyer flask, 500 mL	**F980**	Mixing media
1	Erlenmeyer flask, wide mouth, 1000 mL	**F985**	Mixing media
1	Erlenmeyer flask, wide mouth, 2000 mL	**F986**	Mixing media
1 dozen	Filtration system, vacuum; disposable, plastic, sterile system designed for filtration of fluids needed in tissue culture; polystyrene, screw-cap base for sterile storage; 200 mL; 47 mm diameter/0.22 µm pore size nylon membrane	**n/a**	Sterilization of heat labile stock solutions
3	Forceps, dressing; 10" length, serrated, stainless steel	**F952**	Transferring tissue
3	Forceps, bayonet; stainless steel	**F957**	Transferring tissue
3	Forceps; stainless steel, fine point, 6.5" length	**F091**	Transferring tissue
1	Graduated cylinder, glass or plastic, 10 mL	**C962**	Preparing stock solutions
1	Graduated cylinder, glass or plastic, 100 mL	**C964**	Preparing stock solutions
1	Graduated cylinder, glass or plastic, 1000 mL	**C968**	Preparing stock solutions
1 pkg	Lab markers, assorted colors (10)	**n/a**	Labeling cultures
1 roll	Parafilm® (4" x 250')	**S911**	Wrapping culture closures
100 each	Pipets, 1 mL, graduated, sterile, disposable, individually wrapped	**P990**	Measuring out stock solutions
100 each	Pipets, 5 mL, graduated, sterile, disposable, individually wrapped	**P993**	Measuring out stock solutions
100 each	Pipets, 10 mL, graduated, sterile, disposable, individually wrapped	**P994**	Measuring out stock solutions
100 each	Pipets, 25 mL, graduated, sterile, disposable, individually wrapped	**P995**	Measuring out stock solutions
1	Pipet pump, electric	**P6715**	For safely measuring liquids
1 pair	Gloves, hot or autoclave; provides protection up to 350°F	**G089, G092**	Safely removing hot items from autoclave
2 each	Scalpel handle; No 3: 5" length; stainless steel	**S963**	Cutting explants
2 each	Scalpel handle; No 3L: 8" length; stainless steel	**S973**	Cutting explants
1 box	Scalpel blades; No 10; stainless steel; individually wrapped; sterile; 100/box	**S970**	Cutting explants
1 each	Scoop, large plastic 5-3/4" x 9" bowl	**n/a**	Measuring large volumes of biochemicals
1	Spatula, 6" V-shaped, plastic	**S830**	Measuring small to medium amounts of biochemicals

Recommended Basic Laboratory Equipment

Quantity	Description	Product #	Item Function
2	Spatula/Spoon, double-ended, stainless steel	**S978**	Measuring small to medium amounts of biochemicals
2	Spatula, double-ended, stainless steel	**S977**	Measuring small to medium amounts of biochemicals; rounded ends, 2" end length
1 each	Sterilizer, pressure cooker; operates between 116-126°C; 10-20 psi; aluminum sterilizer has a 9 x 7 inch chamber; is supplied with chamber, lid with pressure gauge, immersion heater and safety valve, electric (for small operations)	**S736**	Sterilizing media and instruments
1 each	Sterilizer, autoclave; operates at 121°C with dial for fast or slow exhaust; 0-60 minute timer; stainless unit with 66 x 41 cm chamber (for large operations)	**n/a**	Sterilizing media and instruments
1 each	Sterilizer, dry heat with glass beads 115-120 V	**S7510**	Sterilizes instruments in hood between transfers
1 pkg	Stir bars, magnetic; Teflon covered	**B010, B011, B012, B013, B015, B017**	Used for mixing stock solutions and in media preparation
1 each	Stir bar retriever; contains a magnet sealed in polyethylene; 18" length	**B016**	Retrieving stir bars from mixing vessel
1 roll	Tape, autoclave indicator; impregnated to show the word "Autoclaved" after 15 minutes of exposure at 121°C	**T998**	Identifying autoclaved media
1 roll	Tape, label; all purpose, self-adhesive tape can be written on with pen or permanent marker	**T690, T695, T696, T697, T699, T706**	Labeling cultures, storage bottles, media vessels, etc.
2 each	Thermometer; digital, -20-2000°C temperature range	**T786**	Measuring temperature of liquids and culture room
1	Timer; electronic, countdown timer alarm, stopwatch feature	**n/a**	Timing sterilization and general lab use
1 case	Paper towels; commercial, single fold	**n/a**	Can be sterilized to provide sterile work surface for cutting explants, general lab use
1 each	Tool rests; horizontal (I556), vertical (I623), or wire (I4013)	**I556, I623, I4013**	Holds instruments after sterilization
500 each	Weigh boats, small, plastic; can be utilized for liquid or solid samples; 1-5/8" x 1-5/8" x 5/16"	**W879**	Measuring chemicals
500 each	Weigh boats, medium, plastic; can be utilized for liquid or solid samples; 3-5/16" x 3-5/16" x 1"	**W880**	Measuring chemicals
500 each	Weigh boats, large, plastic; can be utilized for liquid or solid samples; 5-1/2" x 5-1/2" x 1"	**W881**	Measuring chemicals

Laboratory Glassware

The glassware used in tissue culture can generally be found in most laboratories. The glassware, particularly the culture vessels, should be made of Pyrex or borosilicate glass. Due to the increasing expense of this type of glass, many laboratories are successfully converting to soda glass, which may be significantly cheaper. Wide-neck Erlenmeyer flasks (50-, 125-, 250-mL capacity) are commonly used as culture vessels; large volume Erlenmeyer flasks are required for media preparation. Test tubes, Petri dishes, mason jars, baby food jars, and other glassware can also be adapted to tissue culture. Since new glass may release substances that affect the composition of the medium, it is recommended that all new glassware be filled with water, autoclaved twice with detergent, and rinsed between autoclaving before being used for tissue culture. Other glassware commonly required in a tissue culture facility includes beakers, volumetric flasks, pipets, and graduated cylinders.

©2014 PhytoTechnology Laboratories®

Basic Laboratory Procedures

The majority of laboratory operations utilized in the *in vitro* propagation of plants can be easily learned. One needs to concentrate mainly on accuracy, cleanliness, and strict adherence to details when performing *in vitro* techniques.

Weighing

The preparation of media requires careful weighing of all components. Even if a commercially prepared medium is used, care must be taken in preparing it and any stock solutions that are required.

Because of the diversity of laboratory balances, it is impossible to review the details of their operation. The manufacturer's instructions should be consulted before using any balance. The types of balances most often encountered in the laboratory include the top-loading single-pan balance, triple-beam balance, double-pan torsion balance, analytical single-pan balance, and top-loading electronic balance. The last type has become quite popular in recent years due to its accuracy, ease of use, and durability. With certain models of top-loading electronic balances, milligram accuracy is possible. Such accuracy previously required the use of analytical balances.

Several common precautions must be observed to obtain accurate weights. First, the balance should be located on a hard, stable, level surface which is free of vibrations and excessive air drafts. The balance or weigh area should always be kept clean. Most importantly, the balance should never be overloaded (see manufacturer's specification). It is advisable to use a lightweight weighing container or paper rather than placing the material to be weighed directly on the pan surface.

Measuring Liquids

Calibrated glassware (e.g., beakers, flasks, and pipets) are required for the preparation of culture media. Graduated cylinders of 10-, 25-, 100-, and 1000 mL capacities are used for many measuring operations, but volumetric flasks and pipets are required for more precise measurements. Measurement of solutions with pipets or graduated cylinders is only accurate when the bottom of the curved air-liquid interface is aligned with the measuring mark.

Pipets should be filled with a hand-operated device, called a pipettor, which eliminated the hazards of pipetting by mouth. Never pipet by mouth! Three types of pipettors are commonly used. The first is a bulb-type pipettor, which is controlled by a series of valves. The second type of pipettor is operated simply by rotating a small wheel on the side of the handle. Rotating the wheel upward creates a suction bringing the liquid into the pipet; rotating the wheel in the opposite direction releases the liquid. A third type of pipettor utilizes an electric air pump. Liquid is drawn into the pipet and released by pressing the appropriate buttons.

Cleaning Glassware

The conventional method of washing glassware involves soaking glass in a chromic acid-sulfuric acid bath followed by tap water rinses, distilled water rinses, and finally double-distilled water rinses. Due to the corrosive nature of chromic acid, the use of this procedure has been eliminated except for highly contaminated or soiled glassware. Adequate cleaning of most glassware for tissue culture purposes can be achieved by washing in hot water (70°C+) with commercial detergents, rinsing with hot tap water (70°C+), and finally rinsing with distilled and double-distilled water. However, highly contaminated glassware should be cleaned in a chromic acid-sulfuric acid bath or by some other proven method such as (1) ultrasonic cleaning, (2) washing with sodium pyrophosphate, or (3) boiling in metaphosphate (e.g., Alconox®), rinsing then boiling in a dilute hydrochloric acid solution, and then finally rinsing in distilled water. Cleaned glassware should be inspected, air dried (or preferably at 150°C in a drying oven), capped with aluminum foil, and stored in a closed cabinet.

The following general procedure is recommended for cleaning glassware that contains media and cultures after all data have been collected:

1. Autoclave all glassware with media and cultures still in it. This kills any contaminating microorganisms that may be present.
2. After the autoclaved media has cooled, but while it is still in a liquid state, pour it into biohazard plastic bags or thick plastic bags, seal, then discard.
3. Wash all glassware in hot soapy water using a suitable bottle brush to clean the internal parts of the glassware. Any glassware that is stained should be soaked in a concentrated sulfuric acid-potassium dichromate acid bath (or other stain removing preparation) for 4 hr, and then thoroughly rinsed before washing it with soapy water.
4. All glassware should be rinsed three times in tap water, three times in deionized/distilled water, dried, and stored in a clean place.
5. Wash all instruments and new glassware in a similar manner.

Sterilization

The most critical parts of *in vitro* techniques are sterilizing plant materials and media and maintaining aseptic conditions once they have been achieved. Bacteria and fungi are the two most common contaminants observed in cell cultures. Fungal spores are lightweight and present throughout our environment. When fungal spores come into contact with the culture media used in tissue culture, conditions are optimal for germination of the spores and subsequent contamination of the culture.

Sterilizing Culture Rooms and Transfer Hoods

Large transfer rooms are best sterilized by exposure to ultraviolet (UV) light. Sterilization time varies according to the size of the room and should only be done when there are no experiments in progress. Ultraviolet radiation is harmful to the eyes. Transfer rooms can also be sterilized by washing them 1-2 times a month with a commercial brand of disinfectant. Smaller transfer rooms

and hoods also can be sterilized with UV lights or by treatment with disinfectants. Laminar flow hoods are easily sterilized by turning on the hood and wiping down all surfaces with 70% alcohol 15 min before initiating any operation under the hood. Culture rooms should be cleaned with a disinfecting detergent. All floors and walls should be washed gently on a weekly basis with a similar solution; extreme care must be used to avoid stirring up any contamination that has settled. Commercial disinfectants such as Lysol® and Roccal® diluted at manufacturer's recommended rates can be used to disinfect work surfaces and culture rooms.

Sterilizing Glassware and Instruments

Metal instruments are best sterilized using a glass bead sterilizer, Product Number S7510/S7520. These sterilizers heat to approximately 230 to 250 °C and will destroy bacterial and fungal spores that may be found on your instruments. The instruments simply need to be inserted into the heated glass beads for a period of 15 to 60 sec. The instruments should then be placed on a sterile rack under the hood to cool until needed. Metal instruments, glassware, aluminum foil, etc., can also be sterilized by exposure to hot dry air (250°C) for 2-4 hr in a hot-air oven. All items should be sealed before sterilization in aluminum foil or heat-resistant bags. Autoclaving is not advisable for low-grade stainless and carbon steel metal instruments because they may rust and become blunt under these conditions.

Instruments can be dipped in ethyl alcohol, flamed, and then used. This technique is called flame sterilization. Safety is a major concern when using ethyl alcohol. Alcohol is flammable and if spilled near a flame will cause a flash fire. This problem is compounded in laminar flow hoods due to the strong air currents blown towards the worker. Fires commonly start when a flamed instrument is thrown back into the alcohol beaker. In case of fire do not panic. Limiting the supply of oxygen by covering the container of alcohol (e.g., glass Petri plate) can easily put out a fire.

Autoclaving is a method of sterilizing with steam under pressure. Cotton plugs, gauze, lab ware, plastic caps, glassware, filters, pipets, water, and nutrient media can all be sterilized by autoclaving. Microbes are killed by exposure to the super-heated steam of an autoclave for 10-15 minutes. All objects should be sterilized at 121°C and 15 psi for 15-20 min.

Sterilizing Nutrient Media

Two methods (autoclaving and membrane filtration under positive or negative pressure) are commonly used to sterilize culture media. Culture media, distilled water, and other heat-stable mixtures can be autoclaved in glass containers that are sealed with cotton plugs, aluminum foil, or plastic closures. However, solutions that contain heat-labile components must be filter-sterilized.

Generally, nutrient media are autoclaved at 15 psi and 121°C. For small volumes of liquids (100 mL or less), the time required for autoclaving is 15-20 min, but for larger quantities (2-4 liter), 30-40 min or longer is required. The pressure should not exceed 20 psi, as higher pressures may lead to the decomposition of carbohydrates and other thermo-labile components of a medium. Since certain proteins, vitamins, amino acids, plant extracts, hormones, and carbohydrates are thermo-labile and may decompose during autoclaving, filter sterilization may be required. There are many brands of filters available today. These are typically purchased pre-sterilized. The porosity of the filter membrane should be no larger than 0.2 micrometers (µm). Empty glassware that is to hold filter-sterilized media must be sterilized in an autoclave before filter sterilization.

Nutrient media that contain thermo-labile components can be prepared in several steps. That is, a solution of the heat-stable components is sterilized in the usual way by autoclaving, and then cooled to 50 to 60 °C under sterile conditions. In a separate operation, solutions of the thermo-labile components are filter-sterilized. The sterilized solutions are then combined under aseptic conditions to give the complete media.

Surface-Sterilizing (Disinfesting) Plant Material

Obtaining sterile plant material is difficult, and despite any precautions taken, 95% of cultures will end up contaminated if the explant is not disinfested in some manner. Because living materials cannot be exposed to extreme heat and retain their biological capabilities, plant organs and tissues are surface-sterilized by treatment with a disinfecting solution. Solutions used to disinfest explants must preserve the plant tissue but at the same time destroy any fungal or bacterial contaminants.

Once explants have been obtained, they should be washed in a mild soapy detergent before treatment with a sterilizing solution. Some herbaceous plant materials (e.g., African violet leaves) may not require this step, but woody material, tubers, etc., must be washed thoroughly. After the tissue is washed, it should be rinsed under running tap water for 10-30 min and then be submerged into the disinfectant under sterile conditions. All surfaces of the explant must be in contact with the sterilant. After the allotted time for sterilization, the sterilant should be decanted and the explants washed at least three times in sterile distilled water. For materials that are difficult to disinfest, it may be necessary to repeat the treatment 24-48 hr before culturing the final explants. This allows previously viable microbes time to develop to a stage at which they are vulnerable to the sterilant.

Sterile Culture Techniques

Successful control of contamination depends largely upon the operator's techniques in aseptic culture. One should always be aware of potential sources of contamination such as dust, hair, hands, and clothes. Obviously, hands should be washed, sleeves rolled up, long hair tied back, etc. Washing hands with 70% alcohol is an easy precautionary measure that can be taken. Talking or sneezing while culture material is exposed also can lead to contamination. When transferring plant parts from one container to another, do not touch the inside edges of either vessel. By observing where contamination arises in a culture vessel, you may be able to determine the source of the contaminant.

In plant tissue culture, small pieces of plant tissue are placed on or in a medium rich in nutrients and sugar. If bacteria or

©2014 PhytoTechnology Laboratories®

fungi come in contact with the plant tissue or the medium, the culture becomes contaminated. The contaminants (bacteria and fungi) will use nutrients from the medium and quickly multiply and overwhelm the culture. Pathogenic contaminants will also destroy the plant tissue. The aim is to surface sterilize the plant tissue and put it on a sterile growth medium without any bacteria or fungi getting on the plant or medium. This is not easy because bacteria and fungal spores are in the air, on us, in us, and under us!

By observing sunlight shining in a window, from certain angles, dust particles are visible in the air. There are hundreds of bacteria attached to each dust particle. A horizontal laminar flow unit is designed to remove the particles from the air. Room air is pulled into the unit and pushed through a HEPA (High Efficiency Particulate Air) filter with a uniform velocity of 90 ft/min across the work surface. The air is filtered by the HEPA filter so nothing larger than 0.3 µm (micrometer) can pass through. This renders the air sterile. The flow of air from the unit prevents fungal spores or bacteria from entering. All items going inside the unit should be sterile or sprayed with alcohol. They will remain sterile unless they are exposed to outside contamination.

A transfer cabinet provides an enclosed environment that is not sterile but can be sterilized. A cardboard box lined with aluminum foil or plastic, or a well-cleaned aquarium, provides a shield to reduce contamination. A box that is 20-24 inches wide, 20-24 inches high, and 12-16 inches deep provides a good work area. Working inside any of these does not guarantee success.

When working in a group, the following precautions are necessary for all work areas.

1. The room should be swept and if possible, mopped. It's best to avoid carpeted rooms, if possible.
2. Each work surface should be washed with 70% alcohol, 10% chlorine bleach, Lysol®, or other disinfectant solution.
3. Doors and windows should be closed.
4. Air conditioners and fans should be turned off. A draft-free room is optimal.
5. If possible, each person should have a work space that can be properly treated against contamination (e.g., the box or aquarium mentioned earlier, a new large clear plastic bag, or a piece of poster paper lying on the table to indicate the student's sterile workspace).
6. Have spray bottles filled with 70% ethanol or isopropanol (never methanol) placed so each person has access to one bottle. Spray everything going into the sterile area.
7. Have a central supply area so all necessary items can be picked up and taken to the workspace as needed. Items can be returned to the central supply area after being used.
8. Sterile instruments will be needed for each person. One way to accomplish this is to have a ½-pint jar of 70% ethanol for scalpels and short forceps. When tissue has to be positioned in a vessel, long 10-inch forceps are needed. The long forceps need to be placed deep enough in alcohol so that any part of the forceps that might come into contact with the vessel is sterilized. A 100 mL graduated cylinder can be used to hold the alcohol and long forceps. A ½-pint jar of sterile water is needed for dipping the instruments to remove the residual alcohol that might dry out plant tissues.
9. A sterile work surface is needed on which to place the sterile tissue to trim it. A sterile Petri dish is a convenient surface upon which to work. Glass Petri dishes can be autoclaved and reused. Pre-sterilized plastic dishes are used and discarded. Spray the bag of dishes with 70% alcohol before opening it and place the desired number of unopened dishes at each station. Each dish has two sterile surfaces-the inside top and inside bottom.
10. Long hair should be tied back or covered. Hands should be washed, not scrubbed (scrubbing dries hands and creates flakes of skin that have bacteria) and sprayed with 70% ethyl or isopropyl alcohol or coated with isopropyl alcohol gel. Gloves and masks provide extra protection. Do not talk while performing sterile operations. Do not lean over the work area. Keep your back against the backrest of your chair. Try to work with your arms straight; this position may feel awkward, but it will reduce contamination. Do not pass non-sterile items over sterile areas or items. Reach around rather than over. Make your movements smooth and graceful so that you do not disturb the air more than is necessary; work quickly though, the longer it takes to manipulate the tissues the greater the chance of contamination. Have only the necessary items in the sterile work area. Remove items that are no longer needed as quickly as possible. Think about each step before beginning so that you understand what you are about to do.

Store cultures in a well-lit area (not in direct sunlight), and do not allow the temperature to exceed 26°C (80°F) where the cultures are stored. If cultures are to be placed under lights, use only fluorescent lighting. The preferred schedule is 16 hours of light and 8 hours of dark. Check the temperature prior to placing the cultures under the lights because temperature will build even under fluorescent lights.

Check cultures every 3-5 days for contamination. Slimy areas mean bacterial contamination while fuzzy areas are typically due to fungal contamination. Do not open containers that are contaminated. The contaminants could be harmful. The only safe way to dispose of these is to autoclave (or pressure-cook) them for 15 minutes at 15 psi. Contaminated plastic dishes can be placed inside a large can or autoclavable bag to be sterilized before discarding.

Determining pH

The pH of a solution is a measure of the concentration of hydrogen ions in the solution. The pH scale extends from very acid (0) to very alkaline (14) with 7 being the "neutral" point. The pH of most culture media is adjusted to 5.7 ± 0.1 before autoclaving. The pH can influence the solubility and availability of ions in nutrient media, the ability of agar to gel, and the subsequent growth of cells. Thus accurate determination and control of media pH are necessary. Generally, pH is determined with a pH meter.

Lab Safety

Observing commonsense safety practices can significantly reduce the possibility of accidents or injuries occurring in a laboratory.

For your safety and that of others, observe the following:

- Always wear shoes and a laboratory jacket in the laboratory.
- Be extremely careful handling alcohol around open flames. It is flammable!
- Never pipet by mouth.
- Handle hydrochloric acid, sulfuric acid, sodium hydroxide, and other strong acids and alkalis (bases) with extreme caution. They are very corrosive!
- Wash and bandage all cuts immediately.
- Before opening an autoclave, be sure the pressure is reduced to zero and the temperature is below 100°C.

In addition to safety concerns, cleanliness and proper care of equipment are vital to the efficient operation of a tissue culture laboratory. The following tasks should be performed routinely before the laboratory is closed at night:

1. Mop floors in the lab and culture room with an approved disinfectant.
2. Turn off hood, unless used continuously to reduce particulates in the air.
3. Fill distilled water tanks and turn off stills.
4. Clean off benches completely and put away chemicals, instruments, glassware, etc.
5. Put microscopes on lowest magnification; turn off, and cover them.
6. Shut off all water outlets.
7. Wash and dry all dirty glassware (tubes, pipets, flasks, etc.).
8. Put away all clean, dry glassware, racks, etc.
9. Turn off all electrical equipment that is not in use overnight (e.g., stirrers, pH meters, balances).
10. Put all chemicals, reagents, and solutions in their proper storage areas.

Sterilization Techniques

Instrument Sterilization with Glass Bead Sterilizer (Product No. S7510/S7520)

*Phyto*Technology Laboratories® offers a glass bead sterilizer for sterilization of instruments used in micropropagation. Product Number S7510 has a chamber depth of 12.7 cm and chamber diameter of 5.08 cm. Small instruments such as scalpels and forceps are placed into the glass beads and are sterilized within 15-60 seconds. The instruments will cool down to working temperatures with 30-60 seconds. These units are very effective in killing microorganisms and their spores. ***These units are for sterilizing metal instruments only!*** To use these units simply follow the instructions below:

11. Fill the well with the glass beads from the bead packet. Using a funnel when pouring the beads will help prevent them from spilling.
12. Plug the sterilizer into an acceptable electrical outlet and turn the sterilizer power switch on. All units are preset at 250°C. Allow approximately 20-30 minutes to heat up. The glass beads will reach a temperature of approximately 250°C. The unit is controlled by an electronic thermostat, which continuously cycles the heater on and off, producing a uniform heating cycle.
13. Instruments should be wiped free of culture medium prior to insertion into the glass beads. This will ensure proper sterilization of the instruments and extend the life of the glass beads.
14. Insert clean, dry instruments into the glass beads for 10-15 seconds. Only the part of the instrument touching the glass beads will be sterilized. ***Do not leave the instruments inserted in the glass beads for more than one minute.***
15. When you have finished with the sterilizer for the day, turn off the power switch.

Replacing Glass Beads

With constant daily use, the glass beads will last about one month. The glass beads should be cool before pouring them in a glass recycling or waste container. Refill the bead well with replacement glass beads (Product No. S638).

Sterilization of Media

Plant tissue culture media are generally sterilized by autoclaving at 121°C and 1.05 kg/cm2 (15 psi). The time required for sterilization depends upon the volume of medium in the vessel. The minimum times required for sterilization of different volumes of medium are listed below. It is advisable to dispense medium in small aliquots whenever possible as many media components are broken down on prolonged exposure to heat. There is evidence that medium exposed to temperatures in excess of 121°C may not properly gel or may result in poor cell growth.

Figure 2. Autoclaving Times by Volume

Minimum Autoclaving Time For Plant Tissue Culture Media			
Volume of Media per Vessel (mL)	Minimum Autoclaving (min)[a]	Volume of Media per Vessel (mL)	Minimum Autoclaving (min)[a]
25	20	500	35
50	25	1000	40
100	28	2000	48
250	31	4000	63

[a]Minimum Autoclaving time includes the time required for the liquid volume to reach the sterilizing temperature (121°C) and 15 min at 121°C (Burger, 1988). Times may vary due to differences in autoclaves. Validation with your system is recommended.

Several medium components are considered heat-labile and should not be autoclaved. Stock solutions of the heat-labile components are prepared and filter sterilized through a 0.22 µm filter into a sterile container. The filtered solution is aseptically added to the culture medium, which has been autoclaved and allowed to cool to approximately 35 to 45 °C. The medium is then dispensed under sterile conditions. See the previous section

©2014 PhytoTechnology Laboratories®

"Sterilizing Nutrient Media" on page 222 for information regarding sterilization of heat-labile compounds commonly used in plant tissue culture. Experimentation with your system is recommended.

Surface Sterilizing Plant Material

To avoid bacterial and fungal growth, which is detrimental to culture growth, explants are surface sterilized before they are used to establish *in vitro* axenic cultures. The most common disinfectants are listed below with the concentration and exposure times that preserve the explants but at the same time destroy any microbial contamination.

Procedures:

1. Wash explants in a mild detergent before treatment with the disinfecting solution. (Herbaceous material may not require this step.)
2. Rinse explants thoroughly under running tap water for 10-30 minutes.
3. Submerge explants into the disinfectant solution. Seal bottle and gently agitate.

Under sterile conditions, decant the solution and rinse explants several times with sterile distilled water.

Sterilization Procedures May Be Enhanced By:

1. Placing the material in a 70% ethyl alcohol solution prior to treatment with another disinfectant solution. The use of a two-step (two source) sterilization procedure has proven beneficial with certain species.
2. Using a wetting agent such as Tween 20® or Tween 80® (*Phyto*Technology Product Numbers P720 or P738, respectively) can be added to the disinfectants to reduce surface tension and allow better surface contact.
3. Conducting the sterilization process under vacuum. This results in the removal of air bubbles and provides a more efficient sterilization process.

In This Section – Plant TC Media

The next section will cover plant Tissue Culture (TC) media, covering the basic components of media, and providing a look at the general recommendations for nutrient concentrations and the products available from *Phyto*Technology Laboratories® for designing your own media formulations.

What is Plant TC Media?

Plant TC media is the suspension, either in gel or aqueous solution, of nutrients that plant tissue requires for growth. *In vitro* growth of plant cells is possible because of totipotency, the property of plant cells that allows for the growth of an entirely new plant from a single plant cell. Media formulations vary from plant to plant, based on the specific growth nutrient requirements of the plant.

Plant TC media was popularized in 1962 with the development of the Murashige & Skoog Basal Salts (Product Number M524) and the Murashige & Skoog Medium with Vitamins (Product Number M519). Since then, hundreds of formulations have been developed for different plant species. *Phyto*Technology Laboratories® offers over 150+ different formulations of pre-made plant TC media for purchase.

Media for Stages of Growth

Plant cells require different types and concentrations of nutrients during different growth stages **(See Figure 3)**. *Phyto*Technology Laboratories® provides the world's largest selection of plant tissue culture media, which covers different formulations for every stage of *in vitro* plant growth **(See Figure 5)**.

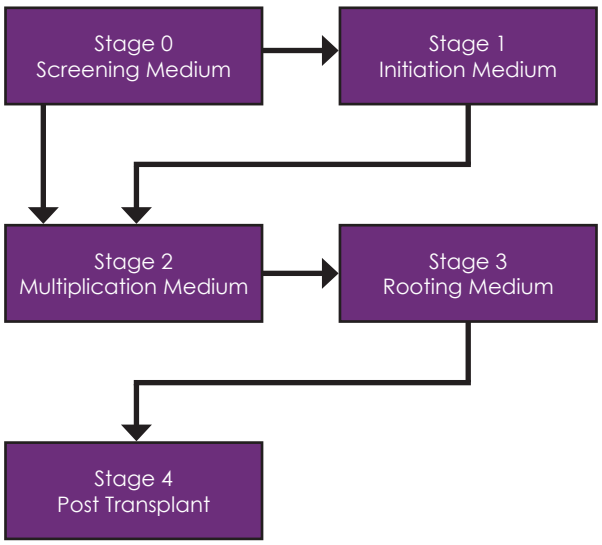


Figure 3. *In Vitro* **Stages of Growth Flowchart**

Stage 0 – Screening Stage: This stage involves the preparation of explant material. Material may be grown in controlled environments or mother blocks to reduce the exposure to insects and/or diseases. Explant material may be indexed on a media such as Leifert & Waites (L476 Product Number) or Bacterial Screening Medium (Product Number B129) prior to transfer to a tissue culture initiation media.

Stage 1 – Initiation Stage: This stage involves the sterile establishment of the explant material. Explants must be disinfested, then placed on an initiation medium which is generally low in plant growth regulators, or excluded altogether.

Stage 2 – Multiplication Stage: This stage involves the multiplication of explant material. Media used in this stage is generally high in cytokinins and low in auxins. The goal of this stage is to produce as many new shoots as possible.

Stage 3 – Rooting Stage: This stage involves the rooting and/or acclimatization of plantlets to prepare them for transfer to the greenhouse. In this stage, the levels of cytokinins are reduced or eliminated, the levels of auxins may be increased and the concentration of carbohydrates in the medium may be reduced by 33-66%.

Why Use Pre-Made Powdered Media?

For years, the sole option scientists had for using plant tissue culture media was to weigh out the individual components. By purchasing pre-made media, you save time and money while reducing lot-to-lot variation as well as adding a degree of assurance that the medium was manufactured correctly **(See Figure 4)**.

Figure 4. Why Use Pre-Made Media?

	Why Use Pre-Made Media?	
	Pre-Made Media	Make it Yourself Media
Equipment required?	DI Water, pH meter, pH adjustment chemicals, balance with sensitivity to .01g, large flasks, mixer/stirrer, autoclave.	Weigh paper/boats, scoops, balance with sensitivity to .01g, spatulas, biochemicals in formulation, DI Water, pH meter, pH adjustment chemicals, large flasks, mixer/stirrer, autoclave.
Control of Formula?	Wide selection of available formulations, as well as available custom manufacturing.	Total control of formula.
Ease of Application?	With pre-made media only water is necessary, adjust the pH, and add any additional components desired. Media production is fast and easy.	With made-from-scratch media, you have to weigh each individual component. Validating and tracking the weights of the added components, and the simplest media can have more than a dozen components. Then you still have to provide water, adjust pH, and add any additional components.
Lot-to-lot variation?	Minimal lot-to-lot variation. Proprietary manufacturing processes. Independently validated by ISO 9001 audits ensure consistent media production.	Technician error can lead to increased lot-to-lot variation when each batch is made from scratch.
Cost?	Can be less expensive. 1 Liter of media can be as cheap as $1.15 USD. Buying larger volumes results in cheaper per liter cost.	If not making stock solutions or large batches, making media yourself can be more expensive. More labor intensive.

©2014 PhytoTechnology Laboratories®

Custom Formulations

In addition to the many popular formulations offered by *Phyto*-Technology Laboratories® we also offer custom manufacturing services for your proprietary research formulations. Custom formulations provide all of the benefits of pre-made media but tailored to your specific research needs. Eliminate variability between batches of media by using custom formulations manufactured with ISO 9001:2008 and cGMP standards of quality.

See "Custom Services" on page 12 for more information about Custom Media.

Figure 5. Examples of Media Designed for a Specific Stage of Growth

Examples of Media Designed for a Specific Stage of Growth		
Growth Stage	Product Number	Media Description
Screening Stage 0	B129 L476 N601 N611 S7536	Bacteria Screening Medium 523 Leifert & Waites Sterility Test Medium Nutrient Broth Nutrient Agar Sabouraud Dextrose Medium
Initiation Stage I	C222 H435 H3959 M519 M524 R756	Carrot Shoot Development Medium Hosta Initiation/Multiplication Medium StageI/II Medium Hosta Initiation/Multiplication Medium II for Stage I/II Murashige & Skoog Basal Medium with Vitamins Murashige & Skoog Basal Salt Mixture Rose Initiation Medium
Multiplication/ Replate Stage II	C206 H435 H436 H3959 M555 M507 M508 M509 M511 M536 M527 M491 M462 M579 O139 O156 O753 P656 P781 P782 P785 P793 R757 T864 T867	Cape Sundew / Venus Fly Trap Multiplication Medium Hosta Initiation/Multiplication Medium StageI/II Medium Hosta Multiplication Medium Stage II Medium Hosta Initiation/Multiplication Medium II for Stage I/II Murashige & Skoog Modified Multiplication Medium Murashige Cattleya Orchid Multiplication Medium Murashige Fern Multiplication Medium Murashige Gerbera Multiplication Medium Murashige Kalanchoe Multiplication Medium Murashige Modified Basal Multiplication Medium Murashige Modified Multiplication Medium Murashige Shoot Multiplication Medium Musa (Banana) Multiplication Medium Mitra Maintenance/Replate Medium Orchid Maintenance/Replate Medium without Charcoal and Agar Orchid Maintenance/Replate Medium contains Banana and Charcoal without agar Orchid Multiplication Medium *Phyto*Tech™ *Phalaenopsis* Replate Medium *Phyto*Tech™ Orchid Replate Medium *Phyto*Tech™ Orchid Replate Medium *Phyto*Tech™ Orchid Replate Medium Orchid Multiplication Medium without Charcoal and Agar Rose Modified Multiplication Basal Medium Tobacco Shoot Multiplication Medium Tobacco Modified Shoot and Root Basal Medium
Rooting Stage III	H437 R758 T861 T867	Hosta Rooting Medium Stage III Medium Rose Modified Rooting Basal Medium Tobacco Modified Root Initiation Medium Tobacco Modified Shoot and Root Basal Medium
Callus	C212 T856	Carrot Callus Initiation Medium from Pith Tissue Tobacco Modified Callus Initiation Medium

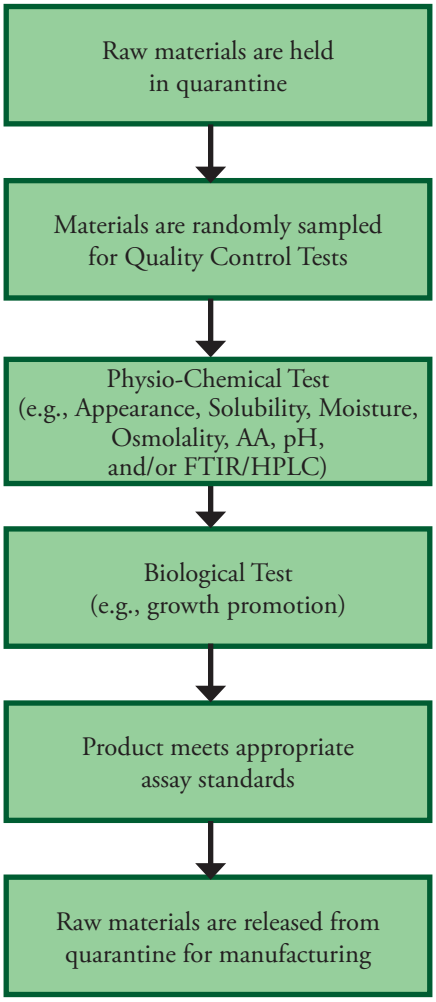
Powdered Media

All powdered media are highly hygroscopic and must be stored in airtight containers. Once the bottle has been opened, the remaining contents should be protected from atmospheric moisture. Desiccation prolongs the storage period. Store at 2 to 6 °C. Powdered media is available in 1 liter (1 L), 10 L, and 50 L units. Larger sizes are available for selected media and upon request for others.

Quality Control

All raw materials used in the production of powdered tissue culture media are held in quarantine until assayed according to appropriate specifications. All raw materials must pass Physio-Chemical and Biological testing before they are accepted for use in manufacturing **(See Figure 6)**.

Figure 6. Explanation of *Phyto*Tech™ Quality Control Process



Prepared Powdered Media

Prepared media offers the following advantages over using media prepared from stock solutions.

1. Less weighing is required when making media from prepared powder media. This helps eliminate technician errors that can be made when preparing media.
2. Eliminates errors that occur in weighing or preparing concentrated stock solutions.
3. Homogenous powdered media ensures that all components of the media are included.
4. Lot-to-Lot consistency – *Phyto*Technology Laboratories® manufactures all media following cGMP so that each batch of media is manufactured in the same manner every time.
5. Large Batch Availability – By reserving lots of media, you can use the same lot of media for an entire project or production cycle. This ensures uniformity in production of plants, or research projects.
6. Cost Savings – Most labs find that the use of powdered media actually results in cost savings in their media production operations, as less time is required to weigh out and prepare the media.

Media Preparation

Powdered media are extremely hygroscopic and must be protected from atmospheric moisture. If possible the entire contents of each package should be used immediately after opening. Preparing the medium in a concentrated form is not recommended as some salts added to the medium may affect shelf life and storage conditions.

*Phyto*Technology Laboratories® also offers liquid 10x solutions. To avoid precipitation over long-term storage, *Phyto*Technology Laboratories® has formulated two solutions; Macronutrient Solution (Product Number M654) and Micronutrient Solution (Product Number M529), when mixed at the proper dilution, makes a solution with the appropriate salt concentration.

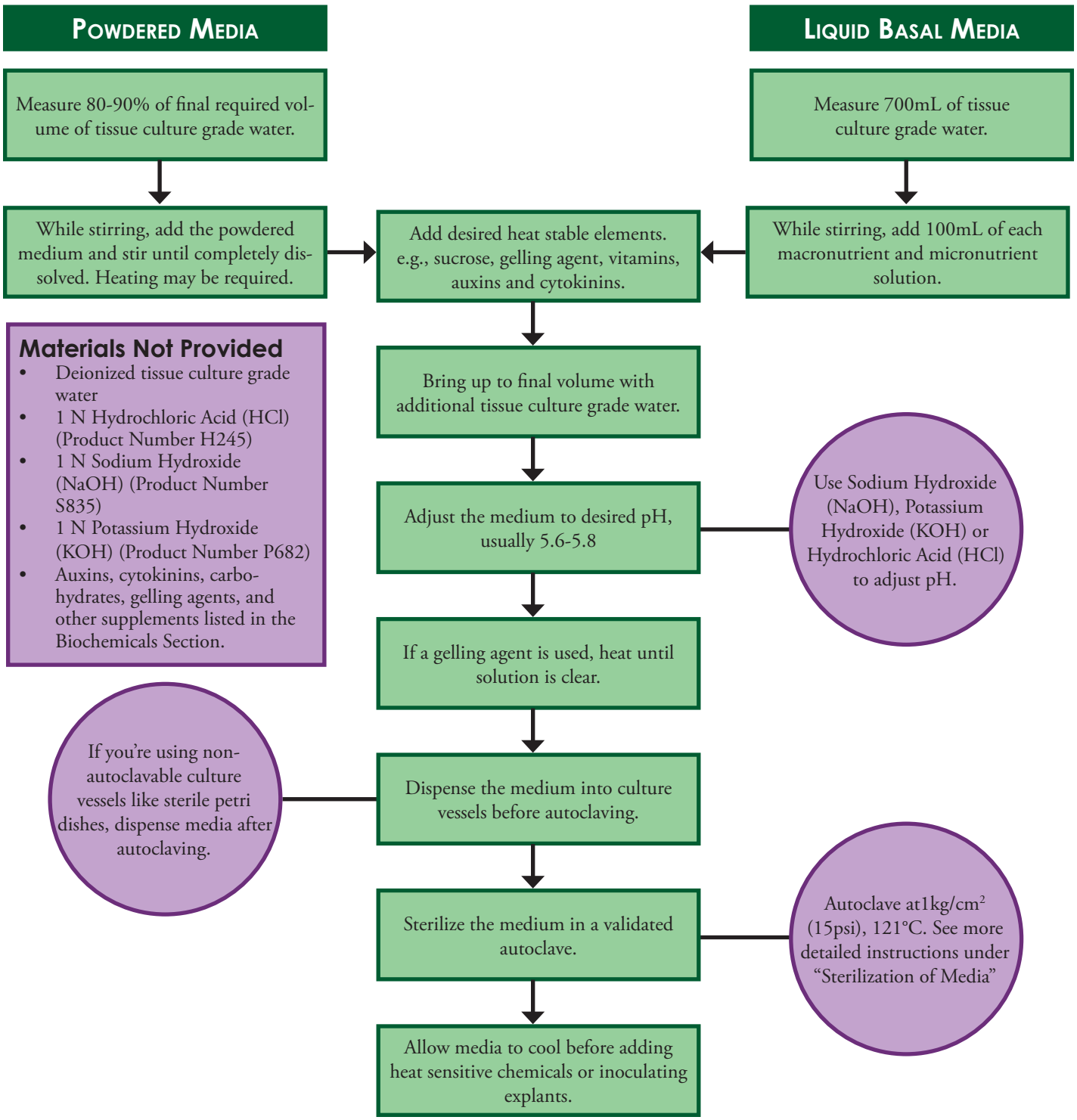
CAUTION: Basal salt solutions are supplied in non-autoclavable bottles; if autoclaved, the bottles will melt.

Media are prepared to 1x concentration and are sterilized by autoclaving for a time appropriate to the volume. Attempts to prepare concentrated media from powdered products are not recommended. Liquid media prepared in 5x to 10x concentrations from powdered products will often result in the formation of salt complexes observable as precipitation.

©2014 PhytoTechnology Laboratories®

The basic steps for preparing 1 liter of culture medium are as follows **(See Figure 7)**:

Figure 7. Basic Steps to Preparing 1 Liter of Medium



Stock Solutions

The use of stock solutions reduces the number of repetitive operations involved in media preparation and, the chance of human or experimental error. Moreover, direct weighing of media components (e.g., micronutrients and hormones) that are required only in milligram or microgram quantities in the final formulation cannot be performed with sufficient accuracy for tissue culture work. For these components, preparation of concentrated stock solutions and subsequent dilution into the final media is standard procedure. In addition, concentrated solutions of some materials are more stable and can be stored for longer periods than more dilute solutions.

To prepare a stock solution, weigh out the required amount of the compound and place it in a clean flask. It is common practice to make a stock solution at 10x, 100x, or 1000x, depending upon the solubility of the compound. Once the chemical is in the flask, dissolve it in a small amount of water, ethyl alcohol, DMSO, 1 N KOH, 1 N NaOH, or 1 N HCl. Next, slowly add deionized water to the flask, while agitating. Continue this until the proper volume is reached. Label the flask with the name of the solution, preparation and expiration dates, and the name or initials of the person preparing the stock solution. Certain items, e.g., IAA, must be prepared and stored in amber bottles to prevent photodecomposition. The volumes of stock solutions prepared at various concentrations that must be used to achieve various final concentrations are presented in tabular form in the Plant Growth Regulator Section.

Storage of Stock Solutions

For convenience, many labs prepare stock solutions and then divide them into aliquots sufficient to prepare from 1 to 10 liters of medium; these aliquots are stored in small vials or plastic bags in a freezer. This procedure removes the inconvenience of having to thaw a large volume of frozen stock each time medium is prepared. Some have found that heating in a microwave oven is a satisfactory and quick method of thawing concentrated medium.

Deterioration & Proper Storage

Signs of Deterioration of Powdered Media

- Color variations,
- Granulation, clumping, or particulate matter throughout the powder,
- Insolubility,
- pH change, and
- Inability to promote growth when properly used.

Signs of Deterioration of Basal Salt Solutions and/or Stock Solutions

- Color variations,
- pH change,
- Precipitation of components, and
- Inability to promote growth when properly used.

Precipitation in Plant Tissue Culture Powdered Media

Precipitates are known to occur, with time, in plant tissue culture media. These precipitates have been analyzed (Dalton *et al.*, 1983). They are composed of small, pale yellow-white particles. Analysis of precipitates indicated a predominance of iron, phosphate, and zinc. The probable cause of the precipitates is the inevitable oxidation of ferrous ions. Reports of detrimental effects on growth and development in plant tissue culture due to the precipitates are inconsistent.

Proper Storage of Media

Proper storage of your media, liquid basal medium, and vitamin stock solutions is vital to ensure maximum shelf life of the products.

- Unless otherwise noted on the product label, all tissue culture media, liquid basal medium, and vitamin stock solutions are stored at 2 to 6 °C.
- While media can be shipped or temporarily stored at room temperature without losing stability, it is not recommended for long term storage.
- When selecting a storage location, make sure to choose a dark, dry area of the refrigerator.
- Media will absorb moisture in the air, which can cause yellowing and clumping. It is important, therefore, to ensure that the lid on the bottle is always tightly sealed and when opening the media to dispense a portion of it, that it is exposed to open-air for the shortest amount of time possible.
- When working with liquid basal medium and vitamin stock solutions, it is important to use sterile pipettes when dispensing the solutions. Solutions from *Phyto*Technology Laboratories® come sterile filtered, but improper handling or dispensing outside of a laminar flow hood, or failing to secure the lid tightly between uses, can allow for bacterial or fungal contamination of the solution.

©2014 PhytoTechnology Laboratories®

Media Components

One of the most important factors governing the growth and morphogenesis of plant tissues in culture is the composition of the culture medium. The basic nutrient requirements of cultured plant cells are very similar to those of whole plants.

Plant tissue and cell culture media are generally made up of some or all of the following components: macronutrients, micronutrients, vitamins, amino acids or other nitrogen supplements, sugar(s), other undefined organic supplements, solidifying agents or support systems, and growth regulators.

Deficient Media: A basal salt mixture that lacks one or more essential elements. Macronutrient and micronutrient stock solutions are considered deficient media.

Basal Salt Mixtures: Contain only the inorganic elements of tissue culture media. Inorganic elements are divided into macronutrients and micronutrients. Typically, at least vitamins, carbohydrates, and a gelling agent will need to be added before inoculating the media with plant tissue.

Media: Media are basal salt mixtures (inorganic elements) plus the addition of either vitamins, gelling agents, or carbohydrates. Typically, the other organic components will need to be added before inoculating the media with plant tissue. Media can also be referred to as Basal Media.

Complete Media: A medium that contains the basal salts, vitamins, carbohydrates, and plant growth regulators.

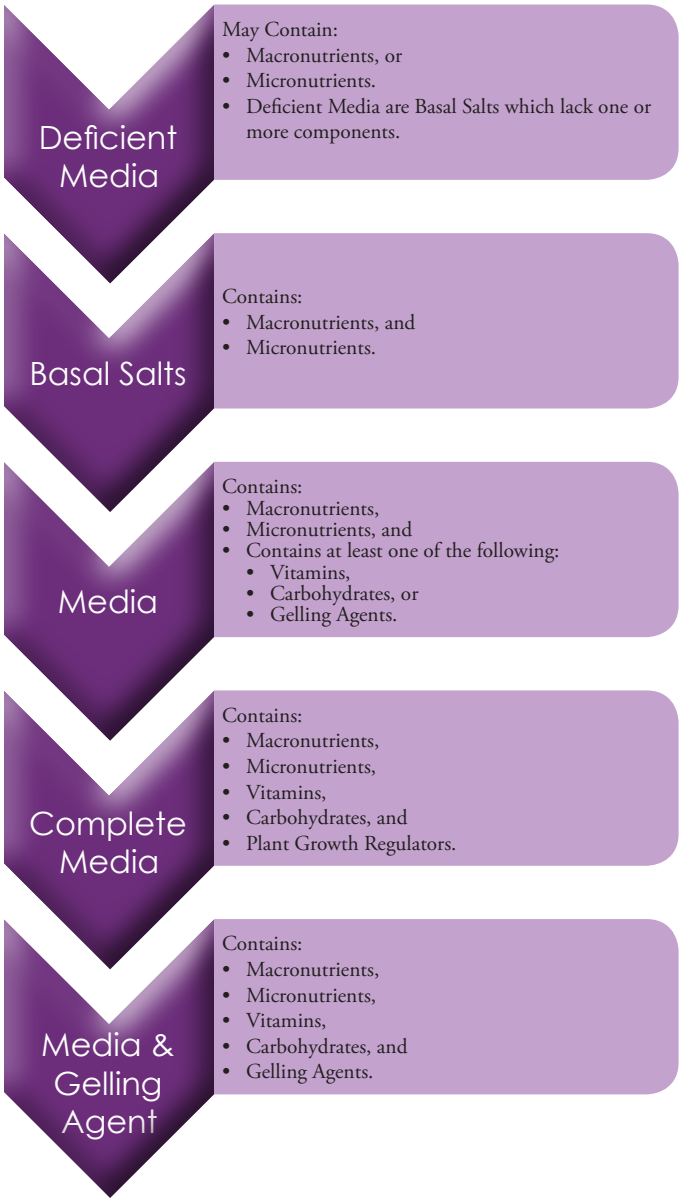
Media with Gelling Agents: Generally considered to be comprised of media (inorganic elements plus vitamins) but also include a gelling agent and carbohydrate.

Amino acids or other nitrogen sources and undefined organic supplements are typically considered optional or are dependent on the stage of plant growth. Despite this, *Phyto*Technology Laboratories® offers a variety of media formulations that include these optional components.

The next several pages will take a closer look at the components of media, the products that can be used to fulfill the nutrient requirements of your plants, and information on the typical working concentrations of the various media components.

Several media formulations, or modifications of them, are commonly used for the majority of all cell and tissue culture work. These media formulations include those described by Murashige and Skoog (1962), Gamborg, et al. (1968), Schenk and Hildebrandt (1972), Nitsch and Nitsch (1969), and Lloyd and McCown (1981).

Figure 8. Media Type by Components Flowchart



Macronutrients

The macronutrients provide the six major elements: nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) required for plant cell or tissue growth **(See Figure 9)**. The optimum concentration of each nutrient for achieving maximum growth rates varies considerably among plant species.

Culture media should contain at least 25-60 mM inorganic nitrogen for adequate plant cell growth. Plant cells may grow on nitrates alone. However, considerably better results are obtained with most plant species when the medium contains both a nitrate and ammonium nitrogen source. Certain species require ammonium or another source of reduced nitrogen for cell growth to occur. Nitrates are usually supplied in the range of 10-40 mM; typical ammonium concentrations range between 2 and 20 mM. However, ammonium concentrations in excess of 8 mM may be deleterious to cell growth of certain species. Cells can grow on a culture medium containing ammonium as the sole nitrogen source if one or more of the tricarboxylic acid cycle (TCA Cycle) acids (e.g., citrate, succinate, or malate) are also included in the culture medium at concentrations of approximately 10 mM. When nitrate and ammonium sources of nitrogen are utilized together in the culture medium, the ammonium ions typically will be utilized more rapidly and before the nitrate ions.

Potassium (K) is required for cell growth of plant species. Most media contain K in the nitrate, sulfate, or chloride form, at concentrations of 20-30 mM. The optimum concentrations of phosphorus (P), magnesium (Mg), sulfur (S), and calcium (Ca) range from 1-3 mM when all other requirements for cell growth are satisfied. Higher concentrations of these nutrients may be required if deficiencies in other nutrients exist.

Murashige and Skoog (MS) medium (Product Numbers M519 & M524), Schenk and Hildebrandt (SH) medium (Product Numbers S816 & S813), and Gamborg's B-5 medium (Product Numbers G398 & G768) are all high in macronutrients, while the other media formulations contain considerably less of the macronutrients.

Macronutrient Stock Solutions

Stock solutions of macronutrients can be prepared at 10 times the concentration of the final medium. A separate stock solution for calcium salts may be required to prevent precipitation. Stock solution of macronutrients can be stored safely for several weeks in a refrigerator at 2 to 6 °C.

Figure 9. List of Macronutrient Sources & *Phyto*Tech™ Product Numbers

Macronutrient	Product Number	Product Description
Calcium (Ca)	C266	Calcium Chloride, Anhydrous
	C625	Calcium Chloride, Anhydrous, USP Grade
	C135	Calcium Chloride, Dihydrate
	C231	Calcium Gluconate, Monohydrate
	C180	Caclium Nitrate
	C274	Calcium Phosphate, Tribasic
Magnesium (Mg)	M521	Magnesium Chloride
	M542	Magnesium Nitrate, Hexahydrate
	M635	Magnesium Sulfate Anhydrous, USP Grade
	M150	Magensium Sulfate, Anhydrous
	M200	Magnesium Sulfate, Heptahydrate
Nitrogen (N) from Ammonium	A109	Ammonium Chloride
	A112	Ammonium Molybdate (VI), Tetrahydrate
	A113	Ammonium Phosphate
	A114	Ammonium Citrate
	A300	Ammonium Nitrate
	A305	Ammonium Sulfate
	F374	Ferric Ammonium Citrate
Nitrogen (N) from Nitrates	A300	Ammonium Nitrate
	C180	Calcium Nitrate
	C193	Cobalt Nitrate, Hexahydrate
	M542	Magnesium Nitrate, Hexahydrate
	P100	Potassium Nitrate
	S169	Silver Nitrate
	S802	Sodium Nitrate
	Z897	Zinc Nitrate, Hexahydrate
Phosphorus (P)	A113	Ammonium Phosphate, Monobasic
	C274	Calcium Phosphate, Tribasic
	G3623	Glycerol Phosphate Disodium Salt
	P705	Potassium Phosphate, Dibasic
	P846	Potassium Phosphate, Monobasic
	S515	Sodium Phosphate, Monobasic
	S745	Sodium Phosphate, Dibasic
Potassium (K)	P661	Potassium Acetate
	P671	Potassium Acetate Solution 3.0 M
	P614	Potassium Carbonate
	P704	Potassium Chloride
	P730	Potassium Chloride Solution 3.0 M
	P729	Potassium Citrate, Monohydrate
	P840	Potassium Iodide
	P640	Potassium Iodide, USP Grade
	P100	Potassium Nitrate
	P705	Potassium Phosphate, Dibasic
	P846	Potassium Phosphate, Monobasic
	P854	Potassium Sulfate, Anhydrous
Sulfur (S)	A305	Ammonium Sulfate
	F388	Ferric Sulfate
	F263	Ferrous Sulfate
	F629	Ferrous Sulfate, Heptahydrate, USP Grade
	F318	Ferrous Sulfate/Chelate Solution (100x)
	M635	Magnesium Sulfate, Anhydrous, USP Grade
	M150	Magnesium Sulfate, Anhydrous
	M200	Magnesium Sulfate, Heptahydrate
	M250	Manganese Sulfate
	M637	Manganese Sulfate, Monohydrate, USP Grade
	P854	Potassium Sulfate, Anhydrous
	S843	Sodium Sulfate, Anhydrous

©2014 PhytoTechnology Laboratories®

Micronutrients

The essential micronutrients for plant cell and tissue growth include iron (Fe), manganese (Mn), zinc (Zn), boron (B), copper (Cu), and molybdenum (Mo) **(See Figure 10)**. Chelated forms of iron and zinc are commonly used in preparing culture media. Iron may be the most critical of all the micronutrients. Iron citrate and tartrate may be used in culture media, but these compounds are difficult to dissolve and frequently precipitate after media are prepared. Murashige and Skoog used an ethylene diaminetetraacetic acid (EDTA)-iron chelate to circumvent this problem.

Cobalt (Co) and iodine (I) may also be added to certain media, but strict cell growth requirements for these elements have not been established. Sodium (Na) and chlorine (Cl) are also used in some media but are not essential for cell growth. Copper and cobalt are normally added to culture media at concentrations of 0.1 µM, Fe and Mo at 1 µM, I at 5 µM, Zn at 5-30 µM, Mn at 20-90 µM, and B at 25-100 µM.

Micronutrient Stock Solution

Micronutrient stock solutions are generally made up at 100 times their final strength. It is recommended that micronutrient stocks be stored in either a refrigerator or freezer until needed. Micronutrient stock solutions could be stored in a refrigerator for up to 1 year without appreciable deterioration. Iron stock solutions should be prepared and stored separately from other micronutrients in an amber storage bottle.

Figure 10. List of Micronutrient Sources & *Phyto*Tech™ Product Numbers

Micronutrient	Product Number	Product Description
Iron (Fe) -Ferric Sources	E349	FeNa-EDDHA
	E676	FeNa-EDTA
	F374	Ferric Ammonium Citrate
	F383	Ferric Chloride
	F352	Ferric Citrate
	F388	Ferric Sulfate
	I338	Iron Chelate, Sequestrene® 138
Iron (Fe) -Ferrous Sources	F263	Ferrous Sulfate, Heptahydrate
	F629	Ferrous Sulfate, Heptahydrate, USP Grade
	F318	Ferrous Sulfate/Chelate Solution (100x)
Iron (Fe) -Chelating Agents	E582	EDTA Solution, 0.5 M, pH 8.0
	E410	Sodium EDTA
	E316	EDTA Free Acid
Manganese (Mn)	M455	Manganese Chloride
	M250	Manganese Sulfate, Heptahydrate
	M637	Manganese Sulfate, Heptahydrate, USP Grade
Zinc (Zn)	Z897	Zinc Nitrate, Hexahydrate
	Z101	Zinc Sulfate, Heptahydrat
Boron (B)	B210	Boric Acid
	B619	Boric Acid, USP Grade
Copper (Cu)	C375	Cupric Sulfate
	C628	Cupric Sulfate, USP Grade
Molybdenum (Mo)	M651	Sodium Molybdate (VI), Dihydrate
	A112	Ammonium Molybdate (VI), Tetrahydrate
Cobalt (Co)	C350	Cobalt Chloride, Hexahydrate
	C193	Cobalt (II) Nitrate, Hexahydrate
Iodine (I)	P840	Potassium Iodide
	P640	Potassium Iodide, USP Grade
Sodium (Na)	S624	Sodium Chloride
	S663	Sodium Citrate, Dihydrate
	M651	Sodium Molybdate
	S802	Sodium Nitrate
	S745	Sodium Phosphate, Dibasic
	S515	Sodium Phosphate, Monobasic
	S843	Sodium Sulfate, Anhydrous
Chlorine (Cl)	A127	Aluminum Chloride, Hexahydrate
	A109	Ammonium Chloride
	C266	Calcium Chloride, Anhydrous
	C625	Calcium Chloride, Anhydrous, USP Grade
	C135	Calcium Chloride, Dihydrate
	C232	Choline Chloride
	C350	Cobalt Chloride
	F383	Ferric Chloride
	M521	Magnesium Chloride, Hexahydrate
	M455	Manganese Chloride, Tetrahydrate
	N478	Nickel Chloride, Hexahydrate
	P704	Potassium Chloride
	P730	Potassium Chloride Solution, 3.0 M
	S624	Sodium Chloride

Carbohydrates

The preferred carbohydrate in plant cell culture media is sucrose. Glucose and fructose may be substituted in some cases, glucose being as effective as sucrose and fructose being somewhat less effective. Other carbohydrates that have been tested include lactose, galactose, rafinose, maltose, and starch. For a list of carbohydrates used in plant tissue culture **See Figure 11.** Sucrose concentrations in culture media normally range between 2 and 3 percent. Use of autoclaved fructose can be detrimental to cell growth.

Carbohydrates must be supplied to the culture medium because few plant cell lines have been isolated that are fully autotrophic, i.e., capable of supplying their own carbohydrate needs by CO2 assimilation during photosynthesis.

Figure 11. List of Carbohydrate Types & *Phyto*Tech™ Product Numbers

Carbohydrate Type	Product Number	Product Description
Monosaccharides	F563 G386 G360 M486	D-(-)-Fructose D-(+)-Glucose, Anhydrous D-(+)-Glucose, Monohydrate D-(+)-Mannose
Disaccharides	S391 S829 M588	D-Sucrose D-Sucrose, Ultra Pure D-Maltose, Monohydrate
Sugar Alcohols	G381 M562 S744 I703	Glycerol D-Mannitol D-Sorbitol myo-Inositol

Figure 12. Choosing a Carbohydrate

Choosing a Carbohydrate			
Glucose	**Fructose**	**Maltose**	**Sucrose**
Glucose must be used with another carbohydrate	Fructose must be used with another carbohydrate	Maltose must be used with another carbohydrate	Does not require the addition of another carbohydrate source.
May add sucrose or fructose	Typically add sucrose or glucose	Must add sucrose or fructose	Adding glucose may increase results
Monosaccharide	Monosaccharide	Is cleaved into glucose & glucose	Is cleaved into glucose & fructose
Can be autoclaved	Can NOT be autoclaved	Can be autoclaved	Can be autoclaved
More Expensive 28 % higher cost than Sucrose	More Expensive 314 % higher cost than Sucrose	Most Expensive 399% higher cost than Sucrose	Cheapest

©2014 PhytoTechnology Laboratories®

Vitamins

Normal plants synthesize the vitamins required for their growth and development. Vitamins are required by plants as catalysts in various metabolic processes. When plant cells and tissues are grown *in vitro*, some vitamins may become limiting factors for cell growth. The vitamins most frequently used in cell and tissue culture media include thiamine (B1), nicotinic acid, pyridoxine (B6), and *myo*-Inositol **(See Figure 13)**. Thiamine is the one vitamin that is basically required by all cells for growth. Thiamine is normally used at concentrations ranging from 0.1 to 10.0 mg/L. Nicotinic acid and pyridoxine are often added to culture media but are not essential for cell growth in many species. Nicotinic acid is normally used at concentrations of 0.1-5.0 mg/L; pyridoxine is used at 0.1-10.0 mg/L.

myo-Inositol is commonly included in many vitamin stock solutions. Although it is a carbohydrate, not a vitamin, it has been shown to stimulate growth in certain cell cultures. Its presence in the culture medium is not essential, but in small quantities *myo*-Inositol stimulates cell growth in most species. *myo*-Inositol is generally used in plant cell and tissue culture media at concentrations of 50-5000 mg/L.

Other vitamins such as biotin, folic acid, ascorbic acid, pantothenic acid, vitamin E (tocopherol), riboflavin, and p-aminobenzoic acid have been included in some cell culture media. The requirement for these vitamins by plant cell cultures is generally negligible, and they are not considered growth-limiting factors. These vitamins are generally added to the culture medium only when the concentration of thiamine is below the desired level or when it is desirable to grow cells at very low population densities.

Figure 13. List of Vitamins used in plant tissue culture & *Phyto*Tech™ Product Numbers

Vitamin	Product Number	Product Description
A	n/a	Retinol
B_1	T390	Thiamine Hydrochloride
B_2	R779	Riboflavin
B_3	N609 N765	Niacinamide Nicotinic Acid
B_4	A120 C232	Adenine Choline Chloride
B_5	C186	Calcium Pantothenate
B_6	P866	Pyridoxine Hydrochloride
B_7 (H)	B140	D-Biotin
B_9(B_c)	F430	Folic Acid
B_{12}	C242	Cyanocobalamin
B_x	A103	p-Aminobenzoic Acid
C	A106	L-Ascorbic Acid
D_3	V883	Cholecalciferol
M	F430	Folic Acid

Vitamin Stock Solutions

*Phyto*Technology Laboratories® offers a number of ready-to-use vitamin solutions. ***Please see the "Vitamin Formulations Table" on page 282 for a complete list of our Vitamin Stock Solutions.*** Vitamins are prepared as 100x or 1000x stock solutions and stored in a cooler (2 to 6 °C) or freezer (-20°C) until used. Vitamin stock solutions should be made up each time media is prepared if a refrigerator or freezer is not available. Vitamin stock solutions can be stored safely in a refrigerator for 2-3 months but should be discarded after that time.

Vitamin Preparation & Use

Vitamin Mixtures

Powdered vitamin mixtures are hygroscopic and must be protected from atmospheric moisture. The entire contents of each package should be used immediately after opening. The basic steps for preparing 1000x concentrated solutions with vitamin mixtures are listed below:

1. Measure out 70% of the final required volume of tissue culture grade water.
2. While stirring the water, add the powdered vitamin mixture. Stir until completely dissolved.
3. Rinse the original container with a small volume of water to remove traces of the powder. Add to the solution in step 2.
4. Add additional water to bring solution to the final volume.
5. Adjust the pH and temperature as required. Mixture may need to be warmed to 35-37 °C.
6. The resulting 1000x concentrated solution should be used at a concentration of 1 mL/L of medium.
7. Follow the same steps to prepare a 100x concentrate and use at 10 mL/L of medium.

Vitamin Solutions

1. The vitamin solutions are sterile filtered through a double 0.2 µm filtration unit and are ready for use.
2. Vitamin solutions (1000x) should be added at a concentration of 1 mL/L of medium and vitamin solutions (100X) should be added at a concentration of 10 mL/L of medium to prepare the final recommended concentration of vitamins in the medium.

Materials not provided:

Basal media and additives as required

- Deionized tissue culture grade water
- 1 N Hydrochloric Acid (HCl) (Product No. H245)
- 1 N Sodium Hydroxide (NaOH) (Product No. S835)
- 1 N Potassium Hydroxide (KOH) (Product No. P682)

Store vitamin solutions at 2 to 6 °C.

Precipitates in Vitamin Solutions

Vitamin solutions may develop precipitates during storage; the most common occurrence of this due to the high concentration of *myo*-Inositol in many of the 1000x solutions. This can be re-dissolved without any detrimental effects to the vitamin's quality by warming the solution in a water bath (35 to 37 °C) for a short period of time.

Amino Acids

Amino Acids or Other Nitrogen Supplements

Although cultured cells are normally capable of synthesizing all of the required amino acids, the addition of certain amino acids or amino acid mixtures may be used to further stimulate cell growth **(See Figure 14)**. The use of amino acids is particularly important for establishing cell cultures and protoplast cultures. Amino acids provide plant cells with an immediately available source of nitrogen, which generally can be taken up by the cells more rapidly than inorganic nitrogen.

The most common sources of organic nitrogen used in culture media are amino acid mixtures (e.g., casein hydrolysate), L-glutamine, L-asparagine, and adenine. Casein hydrolysate is generally used at concentrations between 0.05% and 0.1%. When amino acids are added alone, care must be taken as they can be inhibitory to cell growth. Examples of amino acids included in culture media to enhance cell growth are glycine at 2 mg/L, L-glutamine up to 8 mM, L-asparagine at 100 mg/L, L-arginine and L-cysteine at 10 mg/L, and L-tyrosine at 100 mg/L. L-Tyrosine has been used to stimulate morphogenesis in cell cultures but should only be used in an agar medium. Supplementation of the culture medium with adenine sulfate can stimulate cell growth and greatly enhance shoot formation (Torres, 1989).

Figure 14. List of Amino Acids by Type & *Phyto*Tech™ Product Numbers

Amino Acid Type	Product Number	Product Description
Nonpolar	G503	Glycine
	A121	L-Alanine
	C204	L-Cysteine
	C248	L-Cystine
	L574	L-Leucine
	M539	L-Methionine
	P778	L-Phenylalanine
	P698	L-Proline
	V878	L-Valine
Polar (Uncharged)	A107	L-Asparagine, Monohydrate
	G229	L-Glutamine
	S807	L-Serine
	T857	L-Threonine, Methyl Ester, Hydrochloride
	T873	L-Tyrosine
Acidic (Negatively Charged)	A117	L-Aspartic Acid
	G399	L-Glutamic Acid
Basic (Positively Charged)	A143	L-Arginine
	L594	L-Lysine, Monohydrate
	O626	L-Ornithine, Hydrochloride

Undefined Organic Supplements

Addition of a wide variety of organic extracts to culture media often results in favorable tissue responses **(See Figure 15)**. Supplements that have been tested include protein hydrolysates, coconut water, yeast extracts, malt extracts, ground banana, orange juice, and tomato juice. However, undefined organic supplements should only be used as a last resort. Only coconut water, ground banana, and protein hydrolysates are used to any extent today. Protein (casein) hydrolysates are generally added to culture media at a concentration of 0.05-0.1%, while coconut water is commonly used at 5-20% (v/v).

The addition of activated charcoal (AC) to culture media may have a beneficial effect. The effect of AC is generally attributed to one of three factors: adsorption of inhibitory compounds, adsorption of growth regulators from the culture medium, or darkening of the medium. The inhibition of growth in the presence of AC is generally attributed to the adsorption of plant growth regulators to AC. α-Naphthaleneacetic acid (NAA), kinetin, 6-benzylaminopurine (BA), indole-3-acetic acid (IAA), and 6-(γ-γ-dimethylallylamino)purine (2iP) all bind to AC, with the latter two growth regulators binding quite rapidly. The stimulation of cell growth by AC is generally attributed to its ability to bind to toxic phenolic compounds produced during culture. Activated charcoal is generally added to the culture medium at a concentration of 0.5% to 2.0% (Torres, 1989).

Figure 15. List of Common Undefined Organic Supplements & *Phyto*Tech™ Product Numbers

Form	Product Number	Product Description
Powder	A124	Apple Powder
	B852	Banana Powder
	C184	Casein, Enzymatic, Hydrolysate
	C325	Charcoal, Activated
	C187	Coconut Powder
	M474	Malt Extract
	M567	Meat Extract
	P721	Peptone, From Soymeal
	P780	Peptone, Glysate
	P775	Peptone, Type 1, Peptic Digest of Meat
	P862	Pineapple Powder
	P692	Potato Powder
	T872	Tomato Powder
	T832	Tryptone, Enzymatic Digest of Casein
	T848	Tryptose
	Y892	Yeast Extract
Liquid	C195	Coconut Water

©2014 PhytoTechnology Laboratories®

Plant Growth Regulators

Four broad classes of growth regulators are important in plant tissue culture: auxins, cytokinins, gibberellins, and abscisic acid. Miller and Skoog (1953) were the first to report that the ratio of auxin to cytokinin determined the type and extent of organogenesis in plant cell cultures. Both an auxin and cytokinin are usually added to culture media in order to obtain morphogenesis, although the ratio of hormones required for root and shoot induction typically are different. Considerable variability exists among genera, species, and even cultivars in the type and amount of auxin and cytokinin required for induction of morphogenesis.

Auxins

The auxins commonly used in plant tissue culture media are indole-3-acetic acid (IAA), indole-3-butyric acid (IBA), 2,4-dichlorophenoxyacetic acid (2,4-D), and α-naphthaleneacetic acid (NAA). The only naturally occurring auxin found in plant tissues is IAA. Other synthetic auxins that have been used in plant cell culture include 4-chlorophenoxyacetic acid or ρ-chlorophenoxyacetic acid (4-CPA, PCPA), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), 3,6-dichloro-2-methoxybenzoic acid (dicamba), and 4-amino-3,5,6-trichloropicolinic acid (picloram).

The various auxins differ in their physiological activity and in the extent to which they move through tissue, are bound to the cells, or are metabolized. Naturally occurring IAA has been shown to have less physiological activity than synthetic auxins. Based on stem curvature assays, 2,4-D has eight to twelve times the activity, 2,4,5-T has four times the activity, PCPA and picloram have two to four times the activity, and NAA has two times the activity of IAA. Although 2,4-D, 2,4,5-T, PCPA, and picloram are often used to induce rapid cell proliferation, exposure to high levels or prolonged exposure to these auxins, particularly 2,4-D, results in suppressed morphogenetic activity. Auxins are generally included in a culture medium to stimulate callus production and cell growth, to initiate roots and to a lesser degree shoots, to induce somatic embryogenesis, and stimulate growth from shoot apices and shoot tip cultures (Torres, 1989).

Cytokinins

The cytokinins commonly used in the culture media include 6-benzylaminopurine or 6-benzyladenine (BA), 6-(γ-γ-dimethylallylamino)purine (2iP), kinetin, and zeatin. Zeatin and 2iP are considered to be naturally occurring cytokinins, while BA and kinetin are synthetically derived cytokinins. Many plant tissues have an absolute requirement for a specific cytokinin for morphogenesis to occur, whereas some tissues are considered to be cytokinin independent, i.e., no cytokinin or specific cytokinin is required for organogenesis.

The cytokinins are generally added to a culture medium to stimulate cell division, to induce shoot formation and axillary shoot proliferation, and to inhibit root formation.

The type of morphogenesis that occurs in a plant tissue culture largely depends upon the ratio and concentrations of auxin and cytokinin present in the medium. Root initiation of plantlets, embryogenesis, and callus initiation all generally occur when the ratio of auxin to cytokinin is high, whereas adventitious and axillary shoot proliferation occurs when the ratio is low. The concentrations of auxins and cytokinins are equally as important as their ratio.

Gibberellins & Abscisic Acid

Gibberellins (GA_3) and abscisic acid (ABA) are two other growth regulators occasionally used in culture media. Plant tissue cultures can usually be induced to grow without either GA_3 or ABA, although, certain species may require these hormones for enhanced growth. Generally, GA_3 is added to culture media to promote the growth of low-density cell cultures, to enhance callus growth, and to elongate dwarfed or stunted plantlets. Abscisic acid is generally added to culture media to either inhibit or stimulate callus growth (depending upon the species), to enhance shoot or bud proliferation, and to inhibit latter stages of embryo development.

The importance of plant growth regulators in plant tissue culture is well documented **(See Figure 17)**. *Phyto*Technology Laboratories® offers a broad range of plant growth regulators specifically tested for plant cell culture. Each product is assayed for physical and chemical characteristics, then is biologically tested following the criteria established for powdered media.

Plant growth regulators are for laboratory use, plant tissue culture media preparation, and plant research purposes only. They are not for use as plant growth regulators on developed plants. They are not for drug or household use.

See page 238 for more information about Plant Growth Regulators.

PGR Preparation & Use

Product Use

Auxins: Auxins are generally used in plant cell culture at a concentration range of 0.01-10.0 mg/L. When added in appropriate concentrations they may regulate cell elongation, tissue swelling, cell division, formation of adventitious roots, inhibition of adventitious and axillary shoot formation, callus initiation and growth, and induction of embryogenesis.

Cytokinins: Cytokinins are generally used in plant cell culture at a concentration range of 0.1-10.0 mg/L. When added in appropriate concentrations they may regulate cell division, stimulate auxiliary and adventitious shoot proliferation, regulate differentiation, inhibit root formation, activate RNA synthesis, and stimulate protein and enzyme activity.

Gibberellins: Gibberellins are generally used to promote stem elongation, flowering, and breaking dormancy of seeds, buds, corms, and bulbs. There are over 90 forms of gibberellins, but GA3 is the most commonly used form. Compounds like paclobutrazol and ancymidol inhibit the synthesis of gibberellins.

Abscisic Acid: Abscisic Acid (ABA) plays a role in dormancy development in embryos, buds and bulbs, and in leaf abscission. When used in tissue culture, ABA inhibits the growth of shoots and the germination of embryos. Fluridone may inhibit ABA synthesis.

Polyamines: Polyamines are compounds that occur in high levels within plants and are used in tissue culture media at concentrations of 10-1000 mM. Polyamines may enhance regeneration of roots, shoots and embryos, delay or prevent senescence, and regulate flowering.

See also **"Plant Growth Regulators Usage and Storage Chart" on page 240**

Growth Regulator Stock Solutions

*Phyto*Technology Laboratories® offers a number of ready-to-use plant growth regulator stock solutions. Please see "Plant Growth Regulators functions in Plant Tissue Culture" on page 239 for a list of available, sterile stock solutions.

The auxins NAA and 2,4-D are considered to be stable and can be stored at 4°C for several months; IAA should be stored at -20°C. Auxin stock solutions are generally prepared at 100x to 1000x of the final desired concentrations. Solution of NAA and 2,4-D can be stored for several months in a refrigerator or approximately one year at -20°C. Generally, IAA and 2,4-D are dissolved in a small volume of 95% ethyl alcohol or KOH and then brought to volume with deionized water; NAA can be dissolved in a small amount of 1 N NaOH or KOH.

The cytokinins are considered to be stable and can be stored at -20°C. Cytokinin stock solutions are generally prepared at 100x to 1000x concentrations. Many of the cytokinins are difficult to dissolve, and a few drops/mL of either 1 N HCL, 1 N NaOH/KOH, or DMSO are required to bring them into solution.

Methods Of Preparation

To prepare a 1 mg/mL stock solution: Add 100 mg of the plant growth regulator to a 100 mL volumetric flask or other glass container. Add 3-5 mL of solvent to dissolve the powder. Once completely dissolved, bring to volume with deionized water. Stirring the solution while adding water is recommended to keep the material in solution. Store the stock solution as recommended in the tables. One mL of the stock solution in 1 liter of medium will yield a final concentration of 1.0 mg/L of the plant growth regulator. **(See Figure 16)**.

$$\text{Volume of Stock Solution Required} = \frac{\text{Desired Hormone Concentration} \times \text{Media Volume}}{\text{Stock Solution Concentration}}$$

Figure 16. Stock Solution Dilution Chart

To use this chart:

1. Determine the final concentration of the hormone/vitamin etc. desired in the culture medium. In column A, locate the final concentration desired under the heading corresponding to the quantity of medium you will prepare.
2. Once you have located the desired final concentration then go across the chart to column B to determine the concentration of stock solution to prepare.
3. Find the volume of stock solution to use to achieve the final desired concentration in the medium in column C.

B	C	A				
		Concentration of Final Solution (mg/L)				
Concentration of Stock Solution (mg/mL)	Amount to Use (mL)	250mL	500mL	1L	2L	10L
0.01	0.1	0.004	0.002	0.001	0.0005	0.0001
	0.5	0.02	0.01	0.005	0.025	0.005
	1.0	0.04	0.02	0.01	0.005	0.001
	10.0	0.4	0.2	0.1	0.05	0.01
0.1	0.1	0.04	0.02	0.01	0.005	0.001
	0.5	0.2	0.1	0.05	0.25	0.05
	1.0	0.4	0.2	0.1	0.05	0.01
	10.0	4.0	2.0	1.0	0.5	0.1
1.0	0.1	0.4	0.2	0.1	0.05	0.01
	0.5	2.0	1.0	0.5	0.25	0.5
	1.0	4.0	2.0	1.0	0.5	0.1
	10.0	40.0	20.0	10.0	5.0	1.0
10.0	0.1	4.0	2.0	1.0	0.5	0.1
	0.5	20.0	10.0	5.0	2.5	0.5
	1.0	40.0	20.0	10.0	5.0	1.0
	10.0	400.0	200.0	100.0	50.0	10.0

©2014 PHYTOTECHNOLOGY LABORATORIES®

Figure 17. Plant Growth Regulators functions in Plant Tissue Culture

PGR Classification	Product Description	Product Number	Function in Plant Tissue Culture
Auxins	Auxindole™ Indole-3-Acetic Acid Indole-3-Butyric Acid Indole-3-Butyric Acid, K-Salt α-Naphthaleneacetic Acid α-Naphthaleneacetic Acid, K-Salt 2,4-D (Solutions) ρ-Chlorophenoxyacetic acid 4-Bromophenoxy-acetic Acid Picloram Dicamba β-Naphthoxyacetic Acid Indole-3-Propionic Acid	A147 I885/**I364** I538/**I460** I560 N600/**N605** N610 D295/**D309** C213 B148 P717 D159/**D165** N564 I409	Adventitious root formation (high concentration) Adventitious shoot formation (low concentration) Induction of somatic embryos Cell Division Callus formation and growth Inhibition of axillary buds Inhibition of root elongation
Cytokinins	6-Benzylaminopurine (BA, BAP) N6-Benzoyladenine CPPU 6-(γ,γ-Dimethylallylamino)purine (2iP) Kinetin Thidiazuron (TDZ) Zeatin Zeatin Riboside Adenine Adenine Hemisulfate meta-Topolin	B800/**B130** B151 C279 D525/**D217** K750/**K483** T888/T438 Z125/**Z860** Z899/**Z875** A120 A545 T841/**T7885**	Adventitious shoot formation Inhibition of root formation Promotes cell division Modulates callus initiation and growth Stimulation of axillary bud breaking and growth Inhibition of shoot elongation Inhibition of leaf senescence
Gibberellins	Gibberellic Acid (GA3) GA4/7	G500/**G198**/**G362** G358	Stimulates shoot elongation Release seeds, embryos, and apical buds from dormancy, Inhibits adventitious root formation
Abscisic Acid	(±) Abscisic Acid	A102	Stimulates bulb and tuber formation Stimulates the maturation of embryos Promotes the start of dormancy, leaf abscision
Polyamines	Putrescine Spermidine	P733 S837	Promotes adventitious root formation Promotes somatic embryogenesis Promotes shoot formation
Antimitotics	Colchicine Oryzalin Trifluralin	C226 O630 T828	Binds to the tubulin dimers during cell division thus preventing the formation of spindle fibers; this results in doubled chromosomes
Dwarfing Agents/ "Anti-GA's"	Ancymidol CCC Paclobutrazol Trinexapac-Ethyl	A123 C207 P687 T761	Interferes with gibberellin synthesis or activity Reduces internodal elongation Promotes tuber, corm, and bulb formation

Bold font items represent available sterile filtered stock solutions of plant growth regulators.

Figure 18. Plant Growth Regulators Usage and Storage Chart

Plant Growth Regulator Usage and Storage

Product Number	Product Dscription	Molecular Weight	Cas Number	mg/L to PGR µM Conversion[1] (See explanation below table)						Solvent[2]	Dilute In	Product Storage Temperature	Stock Solution Storage Temperature	Sterilize By	Typical Working Concentration
				0.1	0.3	0.5	0.7	0.9	1.0						
A102	ABA	264.3	1437545-2	0.38	1.1	1.9	2.65	3.4	3.8	KOH	Water	F	F	CA/F	0.1-10.0
A120	Adenine	135.1	73-24-5	0.74	2.2	3.7	5.18	6.7	7.4	1N HCl	Water	RT	C	CA	50-250
A545	Adenine Hemisulfate	404.4	321-30-2	0.25	0.7	1.2	1.73	2.2	2.5	Water	Water	RT	C	CA	50-250
A123	Ancymidol	256.3	12771-68-5	0.39	1.2	2	2.73	3.5	3.9	DMSO	Water	C	F	CA/F	1.0-10.0
A147	Auxindole™	269.9	n/a	0.37	1.1	1.8	2.59	3.3	3.7	EtOH	Water	F	F	F	0.003-3.0
B148	4-Bromophenoxy-acetic Acid	231.1	1878-91-7	0.43	1.3	2.2	3.02	3.9	4.3	KOH	Water	RT	C	F	0.01-5.0
B155	Bromoxynil	276.9	1689-84-5	0.36	1.1	1.8	0.25	3.3	3.6	DMSO	Water	RT	F	F	—
B151	N6-Benzoyladenine	239.2	4005-49-6	0.42	1.3	2.1	2.94	3.8	4.2	DMSO	Water	C	F	F	0.1-10.0
B800	BA	225.3	1214-39-7	0.44	1.3	2.2	3.11	4	4.4	KOH	Water	RT	C	CA	0.1-5.0
B130	BA Solution, 1 mg/mL	225.3	1214-39-7	0.44	1.3	2.2	3.11	4	4.4	n/a	Water	C	C	CA	0.1-5.0
C207	Chlormequat Chloride (CCC)	158.1	999-81-5	0.63	1.9	3.2	4.43	5.7	6.3	Water	Water	RT	C	CA	Up to 500
C213	4-CPA	186.6	122-88-3	0.54	1.6	2.7	3.75	4.8	5.4	EtOH	Water	RT	C	CA	0.1-10.0
C279	4-CPPU	247.7	68157-60-8	0.4	1.2	2	2.82	3.6	4	DMSO	Water	C	C	F	0.001-1.0
C283	trans-Cinnamic Acid	148.2	140-10-3	0.68	2	3.4	4.72	6.1	6.7	KOH	Water	RT	C	CA	0.1-10.0
C226	Colchicine	399.4	64-86-8	0.25	0.8	1.3	1.75	2.3	2.5	Water	Water	RT	C	F	—
D159	Dicamba	221	1918-00-9	0.45	1.4	2.3	3.17	4.1	4.5	EtOH	Water	C	C	CA	0.01 to 10.0
D165	Dicamba Solution, 1mg/mL	221	1918-00-9	0.45	1.4	2.3	3.17	4.1	4.5	n/a	Water	C	C	CA	0.01 to 10.0
D297	Dikegulac	274.3	18467-77-1	0.36	1.1	1.8	2.52	3.2	3.6	EtOH	Water	C	C	F	0.05-10.0
D295	2,4-D Solution, 1 mg/mL	221	94-75-7	0.45	1.4	2.3	3.17	4.1	4.5	n/a	Water	C	C	CA	0.01-5.0
D309	2,4-D Solution, 10 mg/mL	221	94-75-7	0.45	1.4	2.3	3.17	4.1	4.5	n/a	Water	C	C	CA	0.01-5.0
D525	2iP	203.2	2365-40-4	0.49	1.5	2.5	3.44	4.4	4.9	KOH	Water	F	F	CA	1.0-30.0
D217	2iP Solution, 1 mg/mL	203.2	2365-40-4	0.49	1.5	2.5	3.44	4.4	4.9	n/a	Water	F	F	CA	1.0-30.0
F357	Fluridone	329.3	59756-60-4	0.30	0.9	1.5	2.13	2.7	3.0	DMSO	Water	C	C	F	—
F376	Flurprimidol	312.3	56425-91-3	0.32	1	1.6	2.24	2.9	3.2	EtOH/ DMSO	Water	C	C	F	0.01-5.0
G345	Glyphosate	169.1	1071-83-6	0.59	1.8	3	4.13	5.3	5.9	KOH	Water	RT	C	F	0.01-5.0
G500	GA_3	346.4	77-06-5	0.29	0.9	1.4	2.02	2.6	2.9	EtOH	Water	RT	C	CA/F	0.01-5.0
G198	GA_3 Solution, 1 mg/mL	346.4	77-06-5	0.29	0.9	1.4	2.02	2.6	2.9	n/a	Water	C	C	CA/F	0.01-5.0
G362	GA_3 Solution, 13 mg/mL	346.4	77-06-5	0.29	0.9	1.4	2.02	2.6	2.9	n/a	Water	C	C	CA/F	0.01-5.0
G358	Gibberellins A_4+A_7	n/a	n/a	n/a						EtOH	Water	C	F	CA/F	0.01-5.0
I885	IAA	175.2	87-51-4	0.57	1.7	2.9	3.99	5.1	5.7	KOH	Water	F	F	CA/F	0.01-3.0
I364	IAA Solution, 1 mg/mL	175.2	87-51-4	0.57	1.7	2.9	3.99	5.1	5.7	n/a	Water	F	F	CA/F	0.01-3.0
I538	IBA	203.2	133-32-4	0.49	1.5	2.5	3.44	4.4	4.9	KOH	Water	C	F	CA/F	0.1-10.0
I460	IBA Solution, 1 mg/mL	203.2	133-32-4	0.49	1.5	2.5	3.44	4.4	4.9	n/a	Water	F	F	CA/F	0.1-10.0
I560	IBA K-Salt	241.3	60096-23-3	0.41	1.2	2.1	2.9	3.7	4.1	Water	Water	C	F	CA/F	0.1-10.0
I409	IPA	189.2	830-96-6	0.52	1.6	2.6	3.69	4.8	5.3	KOH	Water	F	F	CA/F	0.1-10.0
K750	Kinetin	215.2	525-79-1	0.46	1.4	2.3	3.25	4.2	4.7	KOH	Water	F	F	CA/F	0.1-5.0
K438	Kinetin Solution, 1 mg/mL	215.2	525-79-1	0.46	1.4	2.3	3.25	4.2	4.7	n/a	Water	F	F	CA/F	0.1-5.0
M494	Maleic Acid Hydrazide	112.1	123-33-1	0.89	2.7	4.5	6.24	8	8.9	KOH	Water	RT	C	F	0.01-10.0
N600	NAA	186.2	86-87-3	0.54	1.6	2.7	3.76	4.8	5.4	KOH	Water	RT	C	CA	0.1-10.0
N605	NAA Solution, 1 mg/mL	186.2	86-87-3	0.54	1.6	2.7	3.76	4.8	5.4	n/a	Water	C	C	CA	0.1-10.0

©2014 PhytoTechnology Laboratories®

Plant Growth Regulator Usage and Storage

Product Number	Product Dscription	Molecular Weight	Cas Number	mg/L to PGR µM Conversion[1] (See explanation below table)						Solvent[2]	Dilute In	Product Storage Temperature	Stock Solution Storage Temperature	Sterilize By	Typical Working Concentration
				0.1	0.3	0.5	0.7	0.9	1.0						
N610	K-NAA	224.3	15165-79-4	0.44	1.3	2.2	3.12	4	4.5	Water	Water	RT	C	CA	0.1-10.0
N564	β-Naphthoxy-acetic Acid	202.2	120-23-0	0.49	1.5	2.5	3.48	4.5	5.0	KOH	Water	RT	C	CA	0.1-10.0
O630	Oryzalin	346.4	19044-88-3	0.29	0.9	1.4	2.02	2.6	2.9	DMSO	Water	RT	C	CA	—
P687	Paclobutrazol	293.8	76738-62-0	0.34	1.0	1.7	2.4	3.1	3.4	DMSO	Water	RT	C	CA/F	—
P694	Phloroglucinol	126.1	6009-90-7	0.79	2.4	4	5.55	7.1	7.9	Water	Water	RT	C	CA/F	up to 162
P717	Picloram	241.5	1918-02-1	0.41	1.2	2.1	2.90	3.7	4.1	DMSO	Water	RT	C	CA/F	0.01-10.0
P733	Putrescine	161.1	333-93-7	0.62	1.9	3.1	4.35	5.6	6.2	Water	Water	RT	C	F	—
S837	Spermidine	145.3	124-20-9	0.69	2.1	3.4	4.82	6.2	6.9	Water	Water	C	C	F	—
S746	SADH	160.2	1596-84-5	0.62	1.9	3.1	4.37	5.6	6.2	Water	Water	C	C	CA/F	0.1-10.0
T818	Triacontanol	438.8	593-50-0	0.22	0.7	1.1	1.59	2.1	2.3	EtOH/ DMSO	Water	C	F	F	0.01-10.0
T888	Thidiazuron	220.2	51707-55-2	0.45	1.4	2.3	3.18	4.1	4.5	DMSO	n/a	RT	C	CA/F	0.001-0.05
T438	Thidiazuron (95%)	220.2	51707-55-2	0.45	1.4	2.3	3.18	4.1	4.5	DMSO	n/a	RT	C	CA/F	0.001-0.05
T841	meta-Topolin	241.5	n/a	0.41	1.2	2.1	2.89	3.7	4.1	KOH	Water	RT	F	F	0.01-5.0
T7885	meta-Topolin Solution. 1 mg/mL	241.5	n/a	0.41	1.2	2.1	2.89	3.7	4.1	n/a	Water	F	F	F	0.01-5.0
T828	Trifluralin	335.3	1582-09-8	0.30	0.8	1.5	2.09	2.7	3.0	DMSO	Water	RT	C	F	—
T761	Trinexapac-Ethyl	252.3	95266-40-3	0.4	1.2	2.0	2.77	3.6	4.0	Water	Water	C	C	F	—
Z125	Zeatin	219.2	1637-39-4	0.45	1.4	2.3	3.19	4.1	4.6	KOH	Water	F	F	CA/F	0.01-5.0
Z860	Zeatin Solution, 1 mg/mL	219.2	13114-27-7	0.45	1.4	2.3	3.19	4.1	4.6	n/a	Water	F	F	CA/F	0.01-5.0
Z899	Zeatin Riboside	351.4	6025-53-2	0.28	0.9	1.4	1.99	2.6	2.9	KOH	Water	F	F	F	0.01-5.0
Z875	Zeatin Riboside Solution, 1 mg/mL	351.4	6025-53-2	0.28	0.9	1.4	1.99	2.6	2.9	n/a	Water	F	F	F	0.01-5.0

[1] mg/L to µM conversion example: 0.1 mg/L of ABA = 0.38 µM solution.
[2] Recommended concentration of KOH is 1 N.

Storage Column Key:
F = Freezer (-20 to 0 °C)
C = Cooler/Refrigerator (2 to 6 °C)
RT = Room Temperature
The above recommendations for storage and use are for informational purposes. End user assumes the responsibility for determining proper usage of the product.

Sterilize by Column Key:
CA = Co-autoclave with other media components
F = Filter Sterilize (Heat labile or no heat stability information available)
CA/F = Co-autoclave with media components, however, some loss of activity may occur

Gelling Agents

Agar is the most commonly used gelling agent for preparing semisolid and solid plant tissue culture media. Agar has several advantages over other gelling agents. First, when agar is mixed with water, it forms a gel that melts at approximately 60 to 100 °C and solidifies at approximately 45°C; thus, agar gels are stable at typical incubation temperatures. Additionally, agar gels do not react with media constituents and are not digested by plant enzymes. The firmness of an agar gel is controlled by the concentration and strength of agar used in the culture medium and the pH of the medium. The agar concentrations commonly used in plant cell culture media range between 0.5% and 1.0%; these concentrations give a firm gel at the pH levels typical of plant cell culture media.

Another gelling agent commonly used for commercial as well as research purposes is Gellan Gum. This is a product of bacterial fermentation and should be used at 1.5-2.5 g/L, resulting in a clear gel which aids in detecting contamination.

Both purity and cost of the gelling agent are important factors in any research or production operation. *Phyto*Technology Laboratories® has expanded its line of gelling agents to allow greater selection in choosing the plant cell culture tested gelling agent. We have provided a "Usage Guide for Gelling Agents" which offers criteria, that may help in selecting the appropriate product for your application **(See Figure 19)**.

Gelling Agent Preparation & Use

Preparation of Agar (Product No. A111, A175 and A296)

Agar is by far the most common gelling agent used in plant tissue culture. It is used at a wide range of concentrations from 6 g/L for a very solid gel to 10 g/L for a brick-like gel; however, 6-8 g/L is the more commonly used range. Agar should be added slowly to the media while stirring or agitating. The pH of the media should be adjusted after the inclusion of agar. This is critical for proper gelling since the pH of the agar can vary from lot to lot. The agar gel generally becomes softer the more acidic the pH of the medium. Many types of agar will not properly gel at a pH of less than approximately 5.2.

Figure 19. Usage Guide for Gelling Agents

Usage Guide for Gelling Agents

Product Number	Product Description	General Use	Powder Color	Gel Color	Approximate Gel Strength	Recommended Concentration
A111	Agar, Micropropagation Grade	General Plant TC, Micropropagation	White to Off-White	Opaque to Off-White	≥ 1000 g/cm^2	5.0 to 8.0 g/L
A296	Agar, Bacteriological Grade	General Plant TC, Microbiology Research	Tan	Tan to Straw Colored	≥ 700 g/cm^2	6.0 to 12.0 g/L
A175	Agar, Purified	High purity agar for embryogenic or other critical research	White	Opaque to Off-White	600-700 g/cm^2	8.0 to 10.0 g/L
A133	Agargellan™—A proprietary blend of agar and gellan gum	General Plant TC or Micropropagation	Off-White	Opaque to Off-White	400-700 g/cm^2	3.5 to 5.0 g/L
A105	Agarose, Low Gelling Temp. (26 to 29 °C)	Plant TC Research	White to Off-White	Opaque to Off-White	≥ 250 g/cm^2	6 to 10 g/L
A1315	Agarose, SeaPlaque®, Low EEO Low Gelling Temp. (26 to 30 °C)	Plant TC Research	White to Off-White	Opaque to Off-White	≥ 200 g/cm^2	6 to 10 g/L
A110	Agarose, Low EEO High Gelling Temp. (>42°C)	Plant TC Research	White to Off-White	Opaque to Off-White	≥ 800 g/cm^2	6 to 10 g/L
A1050	LE Agarose, Low EEO	Nucleic Acid Electrophoresis	White to Off-White	Opaque to Off-White	≥ 1200 g/cm^2	8 to 20 g/L
C257	Carrageenan – Gelcarin® GP 812 Registered trademark of FMC Biopolymer	General Plant TC or Micropropagation	Tan	Tan	*NSE	6 to 10 g/L
C2000	Carrageenan, High Clarity	General Plant TC or Micropropagation	Tan	Slight Yellow Tint	≥ 800 g/cm^2	6 to 10 g/L
G434	Gellan Gum	General Plant TC or Micropropagation	White to Off-White	Colorless	≥ 800 g/cm^2	2 to 4 g/L
G3251	Gelzan™ – Trademark of CP Kelco®	General Plant TC or Micropropagation	White to Off-White	Colorless	≥ 400 g/cm^2	2 to 4 g/L

©2014 PhytoTechnology Laboratories®

Preparation of Agargellan™ (Product No. A133)

Agargellan™ is a proprietary blend of micropropagation grade agar and Biotech grade CultureGel (Gellan Gum) that was developed to help control hyperhydricity in plant tissue cultures. Agargellan™ provides the positive attributes of both agar and Gellan Gum and is superior to Gellan Gum alone in applications where hyperhydricity is a problem. It also serves as an economical alternative to agar for many species. Agargellan™ produces a semi-clear gel which allows for improved detection of contamination, relative to agar gels. Agargellan™ should be used at a concentration of 3.5 - 5.0 g/L. As with agar and Gellan Gum, is should be added to stirring medium that is room temperature.

Preparation of Alginate Gel/Beads (Product No. A108)

Alginic Acid has been used for a number of cell and tissue culture applications including use as a physical support similar to agarose and for the preparation of gelled beads. Both of these applications have been used to immobilize and embed suspension cells and protoplasts (Adaoha Mbanaso and Roscoe, 1982; Chee and Cantliffe, 1989; Draget et al., 1988; Larkin et al., 1988). Alginate solutions form a reversible gel at room temperature in the presence of calcium ions. The gel can be re-liquified with a chelating agent, such as citrate. Cells imbedded in gel matrices can be manipulated with significantly less physical damage during handling than cells in liquid medium.

Alginate should be dissolved in a low calcium (e.g., 2 mM) buffered medium at 1.75 - 4.0% (w/v). If protoplasts are to be embedded in the gel then the medium should contain an appropriate osmoticum. Alginic acid will require several hours to dissolve. As it dissolves, the solution will increase in viscosity. This viscosity will negate filter sterilization through a 0.2 µm membrane; a 0.45 µm membrane can be used. While some researchers have indicated that alginate solutions can be autoclaved, Larkin et al. (1988) noted a reduction in bead-making capacity with increased autoclave time.

If protoplasts are to be embedded, they should first be concentrated by centrifugation in a low calcium medium and added to alginate at an appropriate density (e.g., 1 x 10^5 cells/mL). The protoplast-alginate solution is added drop-wise to a solution containing 50 mM $CaCl_2$ and an appropriate osmoticum. Each droplet will form a bead. The beads should remain in the $CaCl_2$ for up to 45 minutes to ensure optimum gel matrix formation.

Preparation of CultureGel™ Gellan Gums (Product No. G434 and G3251)

CultureGel™ Gellan Gum is an alternative gelling agent to agars. Gellan Gum is produced from a bacterial substrate composed of glucuronic acid, rhamnose, and glucose. G434 is a biotech grade that is very clear and produces high strength gel. This aids in the detection of microbial contamination. Gellan gum offers an economical alternative to agar in many *in vitro* applications. Gellan gum will form a gel in the presence of mono- or divalent cations; the latter being more efficient, e.g., calcium, magnesium; however, gellan gum is not recommended for use with DKW (9.3 mM Ca^{++}) (Product Numbers D191, D189, D190, &D2470) or other media e.g., Quoirin & Lepoivre Basal Salt Mixture (Product Number Q673) containing high calcium levels as they have shown to produce a soft and cloudy gel.

Gellan gum is typically used at a concentration from 2 to 4 g/L. It is suspended in medium that is room temperature or colder. Attempting to suspend it in hot medium will usually result in an incomplete, lumpy suspension that will not melt and dissolve uniformly when autoclaved. It should be added to medium after all heat-stable supplements have been added.

Preparation of Carrageenan (Product No. C257 and C2000)

Carrageenan is produced from a family of red seaweeds, Rhodophyceae, of many different genera such as Chondrus, Eucheuma, Gigartina, and Iridaea. These different genera produce different types of carrageenans such as kappa, lambda, and iota. Product No. C257 is Gelcarin GP 812® which is a registered trademark of FMC BioPolymer and Product Number C2000 – Ultra High Clarity Carrageenan are both kappa-type carrageenans that form a strong, rigid gel in the presence of potassium ions, often in a process called potassium precipitation.

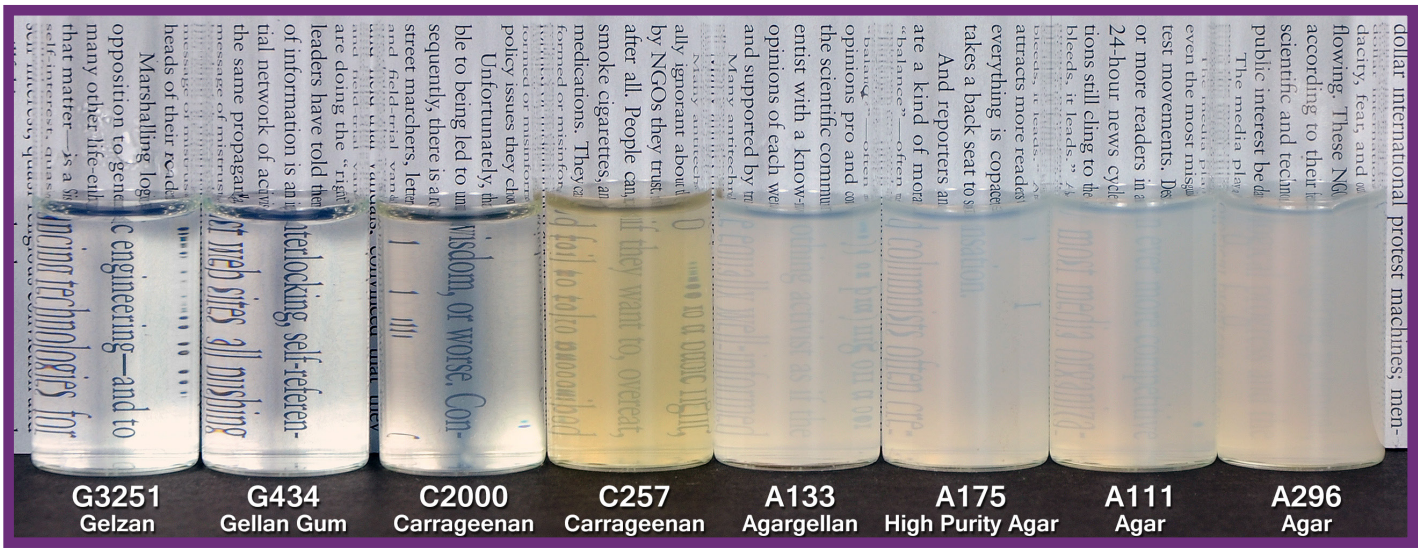
When carrageenan is dissolved properly, it will produce a rigid gel. Carrageenan is typically used at a wide range of concentrations from 6 g/L to 10 g/L. It is suspended in a medium that is at room temperature or colder, like agar. Carrageenan should be added last since the medium will become viscous. As carrageenan is a water-soluble polymer, the viscosity of carrageenan increases with concentration and decreases inversely with temperature. Moreover, carrageenan should also be added slowly to an agitated medium to help prevent clumping of the carrageenan and to create a uniform suspension. A lumpy suspension of carrageenan will not dissolve uniformly when autoclaved. Next, the pH of the medium should be adjusted. After autoclaving, stir the medium to distribute the melted carrageenan uniformly into the solution.

Alternatives to Gelling Agents

Alternative methods of support have included use of perforated cellophane, filter paper bridges, filter paper wicks, polyurethane foam, and polyester fleece. Whether explants grow best on agar or on other supporting agents varies from one species of plant to the next.

Gelling Agent Clarity Comparison

Below is a clarity comparison of gelling agents commonly used in plant tissue culture. Gellan Gums commonly produce the clearest gels and also require the smallest amount of material to produce a gel rigid enough for plant growth. Agars tend to produce cloudier gels but are the most commonly used gelling agent in plant tissue culture.



Recognizing Contamination by Indexing Explants

Explants can be contaminated with bacteria that are not visible to the naked eye. This is because bacterial growth may be suppressed in plant tissue culture medium due to its high salt content, high sucrose, pH, culture temperature, inhibitors in the explant exudates, or because the essential nutrients to support bacterial growth are not present in the plant medium. Unseen bacterial contaminants may affect *in vitro* plant growth negatively, positively, or not at all. Latent bacteria may be non-pathogenic *in vivo* (i.e., an endophyte) that becomes pathogenic *in vitro*, or an *in vivo* pathogen that becomes saprophytic *in vitro* (Herman, 1987). For these reasons it's advisable to check for potential bacterial contamination of explants whenever initiating new cultures.

There are 4 common methods to index tissue, these are:

1. Explant incubation where the entire explant is incubated in bacterial indexing medium (BIM). The BIM can be in either liquid (e.g., agitated culture) or a gelled agar plate.
2. Explant base streak where the cut surface of the explant is streaked on a gelled BIM plate.
3. Explant base sliced & incubated on gelled BIM. The base of the explant is very thinly sliced a number of times and these slices are incubated on a BIM plate.
4. Part of the explant is homogenized and plated on gelled BIM.

Each of these methods has its own advantages and the lab personnel must determine the most appropriate method for their circumstances.

Figure 20. Media Used in Indexing Explants

Media Used in Indexing Explants	
Product Number	Product Description
N601	Nutrient Agar
N611	Nutrient Broth
B129	Bacterial Screening Medium 523
L476	Leifert & Waites Medium
S7536	Sabouraud Dextrose Medium
n/a	½ MS (M519) + Peptone (P775) + Yeast Extract (Y892) [See Reed et al. 2004 for details]
n/a	Yeast Extract Dextrose Broth (e.g., 10 g/L Y892 + 20 g/L D-Glucose G386)

©2014 PhytoTechnology Laboratories®

Tissue Culture & Orchids

*Phyto*Technology Laboratories® offers several media specifically developed for the *in vitro* culture of orchids. These media range from basic seed sowing media to media for clonal propagation (mericloning) and stem propagation. We offer media that are composed of basic mineral salts, which must be supplemented with other components before use, as well as media that are complete and require only the addition of water. All of our media are manufactured according to cGMP standards in our environmentally controlled manufacturing facility in Overland Park, Kansas. Each medium is tested for physio-chemical specifications, and then biologically tested with two commercially significant orchid or other plant cell lines.

*Phyto*Technology Laboratories® is committed to maintaining inventory of its entire plant tissue culture product line.

Some features of our manufactured media include:

- All media components meet USP or ACS quality standards, where applicable
- *Phyto*Technology Laboratories® has the capacity to manufacture up to 10,000 liters of certain orchid media
- Using powder media simplifies media production and reduces technician error when preparing media
- *Phyto*Technology Laboratories® offers complete orchid media, which only require the addition of water to prepare
- Powdered media has a minimum shelf life of 3 years
- *Phyto*Technology Laboratories® offers secure on-line ordering with no minimum order requirements
- Most orders are shipped within 48 hours of receipt of the order

Have questions regarding which orchid medium will work best for your application?

*Phyto*Technology Laboratories® has prepared the following tables to help with the selection process:

Figure 21. Terrestrial Orchid Media Selection Guide

Terrestrial Orchid Media Selection Guide

Seed Sowing Media
B138/B141 – BM-1 Terrestrial Orchid Medium
M551 – Malmgren Orchid Medium
T839/T842 – Terrestrial Orchid Medium without NH_4NO_3
T849 – Terrestrial Orchid Medium
P723 – Orchid Seed Sowing Medium
F522 – Fast Terrestrial Orchid Medium

▼ ▼

Multiplication Media
B142/B470 – BM-2 Orchid Medium

▶

Replate Media
T839/T842 – Terrestrial Orchid Medium
P748 – Orchid Replate Medium
M579 – Mitra Replate/Maintenance Medium
P656 – *Phyto*Tech™ *Phalaenopsis* Replate Medium

Figure 22. Epiphytic Orchid Media Selection Guide

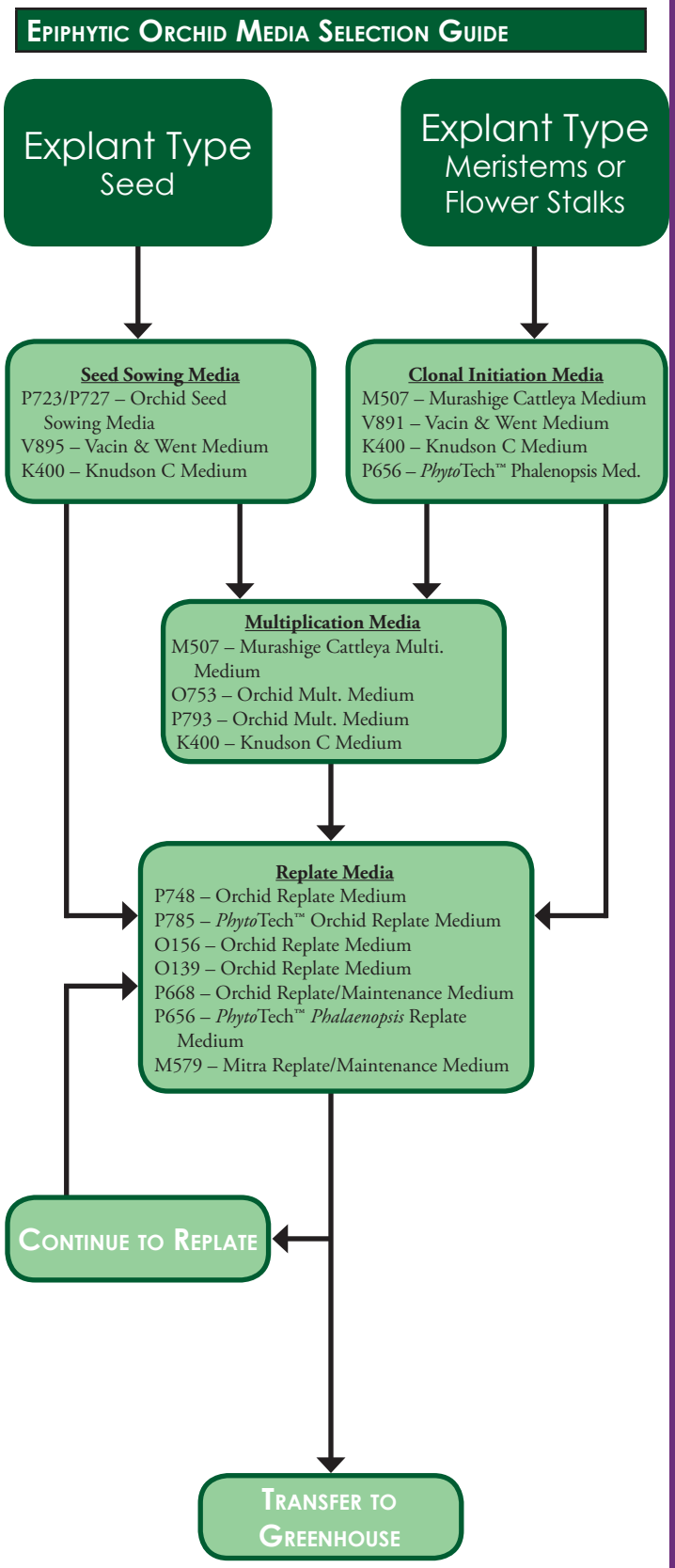


Figure 23. Terrestrial Orchid Media Selection Guide by Genus

Terrestrial Orchid Media Selection Guide by Genus			
Genus	**Germination Medium/Media**	**Replate Medium/Media**	**Multiplication Medium/ Media**
Aplectrum	K400	K400, K425	
Arethusa	K400, P723	K400, K425, P748	
Bletia	B138/B141, K400, P723, V895	P748, V895	
Bletilla	P668[1], P723	P668, P748	O753
Calopogon	K400, P723	P723, P748	
Calypso	B138/B141, B142/B470, F522	F522	
Coeloglossum	K400	K400, K425, P748	
Cymbidium	P668	P668	
Cypripedium	B142/B4702, F522, K400[1,2], M551[3], T839[2], T842[2], T849[2]	B138/B141, F522, K400[1,2], P668[1], T849	O753
Dactylorhiza	F522	F522, P748	
Epipactis	B142/B470	B138/B141, P668	
Eulophia	P723, V895	P748, V895	
Goodyera	M551, P668[1], P723	P748	
Gymnadenia	F522, M551, P668[1]	F522, M551, P748	
Limodorum	B142	B142	
Liparis	K400	K400, K425, P748	
Oeceoclades	P668[1], P723, V895	P723, V895	
Ophrys	M551	M551	
Orchis	F522, M551, P668[1]	F552, M551	
Paphiopedilum	P668[1,2]	P668[1], P668	
Phragmipedium	P668[1,2]	P668[1], P668	
Platanthera	F522, K400, L472, M551, P668[1], P723	F552, M551, P723, P748	
Pogonia	K400	K400	
Habenaria	M551, P723	M551, P748	
Sacoila	K400, M551		
Spathoglottis	P723	P668, P723, P748	O753
Spiranthes	K400, M551, P723	M551, P748	O753
Thelymitra	P723, T839, T842	P748, T839, T842, T849	
Tipularia	K400	K400, K425	
Zeuxine	P723	P723, P748	

[1] Medium used at 1/2-strength.
[2] Medium supplemented with up to 15% coconut water (Product C195).
[3] Medium supplemented with either 10 g/L sucrose (Product S391) or 5 g/L sucrose + 5 g/L glucose (Product G360).
[4] Medium supplemented with 2 g/L peptone (Product P775) many enhance germination of some species

©2014 PhytoTechnology Laboratories®

Figure 24. Epiphytic Orchid Media Selection Guide by Genus

Epiphytic Orchid Media Selection Guide by Genus			
Genus	**Germination Medium/Media**	**Replate Medium/Media**	**Multiplication Medium/ Media**
Ascocenda	K400, P668[1], P723, P785, V895	O156, P668	M507
Brassia	K400, K425, P723	K425, P748	O753
Cattleya	K400, K425, L472, P668[1], P723, P785, V895	K400, K425, O1561 P668[1], P748, P785	M507, O753
Cyrtopodium	P723	P723, P748	
Dendrobium	K400, K425, M579, V895	K400, K425, M579, V895	M507, O753
Dendrophylax	P723	P723, P748	
Encyclia	P723, P748	P748	
Epidendrum	K400, K425, M579, P668[1], P723, V895	K400, K425, O156, P668, P748, P785, V895	
Gongora	K425, P723	K425, P748	
Maxillaria	P723	P748	
Oncidium	O156[1], P668[1], P723	O156[1], P668[1], P723, P748	M507, O753
Odontoglossum	K400, K425, O156[1], P723	K400, K425, O156[1]	
Phalaenopsis	I365, K400, O156, P656, P668[1], P723, P782, P785	I365, O156, P656, P668, P748, P785	M507, O753
Pleurothallis	P668, P668[1], P723	O156, O156[1], P748	
Prosthechea	P723	P723, P748	
Schomburgkia	P723	P723, P748	
Vanda	K400, M579, P723, P785, V895	M579, O156, P723, P748, V895	
Vanilla	K400, K425	K400, K425, V895	

[1] Medium used at 1/2-strength.

*Phyto*Technology Laboratories' Orchid Media Family Relations

The following table provides information on how the orchid media in each "family" is related to each other. This guide provides a basic look at how one medium is different from another. In many cases one can be made into another with one supplement.
If you start with one medium, by making the addition or change as described, it creates the medium listed.

Figure 25. Orchid Media Family Relations

Orchid Media Family Relations				
Media Family	**Starting Medium**	**Addition or Change**	**Creates Medium**	**Media Family Application**
BM Family (BM-1, BM-2)	B138	plus Agar	B141	Developed for seed germination, replate, & multiplication of terrestrial orchids.
	B141	plus BA	B142	
	B138	plus BA	B470	
Malmgren Family	M482	plus Pineapple Powder	M534	Developed for hardy terrestrial orchids (Cypripedium in particular).
	M534	plus Agar	M551	
Maintenance/Replate Family	O139	plus Charcoal	P668	Suitable for replating most epiphytic & terrestrial orchids.
	P668	plus Agar	P658	
	P668	plus Banana Powder	O156	
	O156	plus Agar	P748	

Orchid Media Family Relations				
Media Family	**Starting Medium**	**Addition or Change**	**Creates Medium**	**Media Family Application**
Seed Sowing Family	P727	plus Charcoal	P723	Suitable for germinating most epiphytic & terrestrial orchids.
Slipper Orchid Family	T842	double Casein concentration	T839	Suitable for seed germination & replate of slipper orchids.
	T842 & T839	minus Casein; plus Ammonium Nitrate	T849	
Vacin & Went Family	V505	plus Thiamine HCl	V882	Developed for general use in seed germination, replate, & multiplication of most epiphytic orchids.
	V882	plus Sucrose	V891	
	V891	plus Agar	V895	
Multiplication Family	P793	plus Agar	O753	Suitable for the multiplication of most epiphytic & terrestrial orchids.
Proprietary Replate/Seed Sowing Family	P781	plus Gelling Agent	P782	Suitable for the seed germination, replate, & multiplication of most orchids (particular epiphytic orchids).
	P782	plus Banana Powder	P785	
*Phyto*Tech™ Proprietary Formulations	K425	Contains Charcoal, Sucrose, Banana Powder, & Gelling Agent	Suitable alternative to K400 for seed germination & replate.	
	P656	Contains Charcoal, Sucrose, Banana Powder, Potato Powder, & Gelling Agent	Developed for *Phalaenopsis* seed germination, replate, & tissue culture.	
Unique Formulations	F522	Developed for the seed germination & replate of terrestrial orchids, particularly *Cypripedium* and *Calypso*.		
	I365	Originally developed for *Phalaenopsis* seed germination, replate, & tissue culture.		
	K400	Original & classic seed germination & replate medium.		
	L472	Developed as an alternative to K400 for seed germination & tissue culture.		
	M507	Developed for the culture & multiplication of *Cattleya* & allies.		
	M579	Developed for the seed germination & replate of *Vanda* & allies.		

Orchid Seeds Germination

Orchid seeds are very small and contain little food reserves. A single seed capsule may contain 1,500 to 3,000,000 seeds. Sowing the seed *in vitro* makes it possible to germinate immature seed (green pods). It is much easier to sterilize the green capsule than individual seed after the capsule has split open. Lucke (1971) indicated that orchid seed can be sterilized when the capsule is about two-thirds ripe. Listed below are approximate normal ripening times of capsules for various orchid species. Exact capsule ripening times may vary depending on species, hybrid, and growing conditions.

Figure 26. Orchid Maturation Chart

ORCHID GENERA	TIME TO MATURITY (MONTHS)	ORCHID GENERA	TIME TO MATURITY (MONTHS)
Bulbophyllum	3	*Laelia*	9
Brassia	9	*Masdevallia*	3.5
Calanthe	4	*Miltonia*	9
Catasetum	10	*Odontoglossum*	7
Cattleya	11	*Oncidium*	9
Coelogyne	13	*Paphiopedilum*	10
Cymbidium	10	*Phaius*	7.5
Cypripedium	3.5	*Phalaenopsis*	6
Dendrobium	12	*Spathoglottis*	1.5
Encyclia	8	*Stanhopea*	7
Epidendrum	3.5	*Vanda*	20

©2014 PhytoTechnology Laboratories®

Immature (Green) Capsule Disinfestation

1. Soak the immature (green) seed capsule in 100% bleach solution for 30 minutes.
2. Dip the capsule in isopropyl alcohol or ethanol for 5-10 seconds. Remove the capsule from the alcohol and carefully flame off the excess alcohol.
3. Under aseptic conditions, using a sterile knife or scalpel, open the capsule and scrape out the seeds.
4. Carefully layer the seeds over the surface of the culture medium. Seal all culture vessels. These vessels are now your mother flasks.

Mature (Dry) Seed Disinfestation

1. Collect seed and place in a small flask or bottle.
2. Prepare a solution containing 5-10% commercial bleach containing a few drops (2 drops/100 ml) of Tween 20® (Product Number P720).
3. Add the bleach solution to the flask or bottle. Swirl the flask or bottle containing the seed and bleach for 5 to 10 minutes.
4. Remove the bleach solution and rinse the seed with sterile tissue culture grade water (Product Number W783).
5. Transfer the seed to sterile culture medium, and seal all culture vessels. These vessels are now your mother flasks.

Replating Seedlings

1. It may take anywhere from 1 month up to 9 months for the seed to begin to germinate. Approximately 30 to 60 days after germination begins, it will be necessary to transfer the seedlings to fresh medium for continued growth.
2. Prepare an orchid maintenance/replate medium, such as P748 for epiphytic orchids or T849 for terrestrial orchids.
3. Under aseptic conditions, transfer the seedling from the mother flask to the flask containing the fresh medium. You should place the seedling about ¼ inch apart on the medium.
4. Allow the seedlings to continue to grow and develop. Root formation generally begins when the plant has 2 to 3 leaves. Continue to transfer the seedlings to fresh media every 30-60 days, increasing the spacing between the plants with each transfer. When the flask is ready for transfer to a community pot in the greenhouse, most flasks should have 15 to 25 plants depending upon the species.
5. Transfer the plants into a community pot using a finely ground orchid mix.

Orchid Stem Propagation Methods

1. Remove any flowers that may remain on the flower stalk. Use clean, healthy, vigorous flower stalks with buds in their nodes. Stalks on which only a few flowers have bloomed are best. Avoid old flower stalks.
2. Wash the flower stalk under running tap water for 5 minutes.
3. Prepare a 10% chlorine bleach solution and add 2 to 3 drops of Tween 20® (Product Number P720) to this solution.
4. Section the flower stalk into smaller pieces by using a clean razor blade or scalpel and cutting between the nodes. Cut the flower stalk into approximately 13 to 20 mm (½ to ¾ inches) sections leaving about 6 mm (¼ inch) below the node and the remainder above the node.
5. Place the nodal section in the bleach solution (from Step 3) for 15 minutes. Swirl the solution every 2 to 3 minutes.
6. After surface sterilizing, discard the bleach solution, and then under aseptic conditions, carefully remove the bract from around the node.
7. Prepare a 5% chlorine bleach solution and add 2 to 3 drops of Tween 20 (Product No. P720) to this solution.
8. Once all of the bracts have been removed, surface sterilize the nodes in the 5% bleach solution prepared in Step 7. Keep in this solution for 10 minutes, swirling the solution every 2-3 min.
9. Remove all of the bleach solution and rinse the nodes with sterile distilled water. Rinse by pouring the water over the nodes, swirling, then pour off the water. Repeat this step three times.
10. Under sterile conditions, remove approximately 3 mm (⅛") from each end of the nodal sections using a clean, sterile scalpel or razor. All tools should be dipped frequently in alcohol and flamed with an alcohol lamp (Product No. B876), or heated in a glass bead sterilizer to maintain sterility.
11. Transfer the nodal section to the culture vessels containing Orchid Multiplication Medium (Product No. O753). Insert the longer portion of the nodal section into the medium at a slight angle to just below the bud. This should result in the emerging shoot pointing upwards.
12. Most shoots will generally appear within one month and they are ready for replating after about 60 days.
13. Many nodes exude phenolic compounds into the media which may turn the media dark brown to black. This phenolic exudation will kill the nodes if you do not replate them to fresh media. The use of media containing charcoal will reduce the required frequency of replating to remove phenolics as the charcoal adsorbs and binds the phenolic compounds.
14. Replate onto Orchid Maintenance Medium (Product No. P748) and allow the plantlets to continue to develop and root. Roots will begin to appear after 2 or 3 leaves have been produced.

Orchid Media Preparation Instructions

Powdered media are extremely hygroscopic and must be protected from atmospheric moisture. If possible, the entire contents of each package should be used immediately after opening. Media stored at 2 to 6 °C and tightly sealed should last 2-3 years, depending on how often and for how long the medium bottle is open. Preparing the medium in a concentrated form is not recommended as some salts in the medium may precipitate and affect shelf life and storage conditions. The basic steps for preparing the culture medium:

1. Measure out approximately 90% of the required final volume of tissue culture grade water (Product No. W783), e.g. 900 ml for a final volume of 1000 ml.
2. While stirring the water, add the powdered medium and stir until completely dissolved. Media containing charcoal, fruit extracts, and/or agar will not completely dissolve.

3. Rinse the container that the medium was packaged in with a small volume of tissue culture grade water to remove traces of the powder. Add to the solution in Step 2.
4. Add desired heat stable supplements (e.g., sucrose, gelling agent, vitamins, auxins, cytokinins, etc.). (Orchid media B142, B141, M551, P723, P748, P785, O753, T849, V895, F522, M579, and P656 are complete media and generally do not require the addition of any other components.)
5. Add additional tissue culture grade water (Product # W783) to bring the medium to the final volume.
6. While stirring, determine and adjust, if necessary, the medium to desired pH using NaOH, HCl, or KOH. A pH of 5.4 to 5.6 is recommended for most orchid media. For small labs or home hobbyists, pH can be adjusted by using baking soda to raise the pH and vinegar to lower the pH of the medium.
7. If a gelling agent is used, heat until the solution is clear or transparent. Heating may be required to bring powders into solution.
8. Dispense the medium into the culture vessels before (or after) autoclaving according to your application. Add heat labile constituents aseptically after autoclaving.
9. Sterilize the medium in a validated autoclave at 1 kg/cm2 (15 psi), 121°C, for the time period described under the section titled "Sterilization of Media".
10. Allow medium to cool and solidify prior to use.

Media Recommendation Notes

The media recommendations provided in this document are all that are currently available from *Phyto*Technology Laboratories®. We regret that we are unable to provide media recommendations for genera not listed.

If you have personal experience successfully using a *Phyto*Tech™ medium on a genus/species not listed, we welcome your writing and informing us of it. The same is true if you see a reference citing a medium successfully used on a genus not listed. Please, do not call us with recommendations; we must receive them in writing. Please e-mail your recommendation(s) to **tech@phytotechlab.com**. We will periodically update this document with the new information we receive.

Other Products for Orchids

In addition to media, *Phyto*Technology Laboratories® offers several products intended for use with orchid cell cultures.

Figure 27. Other Products for Orchid Cultures

Product Number	Product Description
	Biochemicals
B852	Banana Powder
C184	Casein
C187	Coconut Powder
C195	Coconut Water
C325	Charcoal, Activated
K424	Keiki Paste
L451	Lanolin
P721	Peptone, from Soymeal
P780	Peptone, Glysate
P775	Peptone, Type 1
P862	Pineapple Powder
P692	Potato Powder
T832	Tryptone
Y892	Yeast Extract
	Tissue Culture Kits
O799	Epiphytic Orchid Seed Sowing Kit
O755	Orchid Stem Propagation Kit
O788	Terrestrial Orchid Seed Sowing Kit
	Equipment
B693	Book, Orchid Seed Germination Media
B059	Book, Orchids To Know And Grow
B019	Book, Asymbiotic Technique Of Orchid Seed Germination

©2014 PhytoTechnology Laboratories®

Figure 28. Orchid Media Selection Guide by Procedure

Orchid Media Selection Guide by Procedure			
Procedure	Product Number	Product Description	Comments
Seed Sowing—Epiphytic Orchids	P723	Orchid Seed Sowing Medium with Agar	Complete medium with charcoal and gelling agent. Also can be used for terrestrial orchid seed germination.
	K400	Knudson C Orchid Medium	Low salt formulation. Requires the addition of gelling agent.
	V505	Vacin and Went Modified Basal Salt Mixture	Low salt formulation. Requires the addition of vitamins, sucrose, and gelling agent.
	V882	Vacin & Went Orchid Medium	Low salt formulation. Requires the addition of sucrose and gelling agent.
	V891	Vacin & Went Modified Basal Salts	Low salt formulation. Requires the addition of gelling agent.
	V895	Vacin and Went Modified Basal Salt Medium	Low salt formulation. Complete medium. Does not contain charcoal.
Seed Sowing—Terrestrial Orchids	B141	BM-1 Orchid Medium	Complete medium. Does not contain charcoal. Organic nitrogen based medium.
	M551	Malmgren's Modified Terrestrial Orchid Medium	Complete medium. Organic nitrogen based media.
	T849	Terrestrial (Cypripedium) Orchid Medium	Complete medium. Does not contain charcoal. Some species may require the addition of 1-2 mg/L of kinetin for best results. Inorganic nitrogen based media.
	F522	Fast Terrestrial Orchid Medium	Complete Medium. Does not contain charcoal. Contains both sucrose and fructose.
		Terrestrial (Cypripedium) Orchid Medium	Complete medium. Does not contain charcoal. Formulation without NH4NO3.
Stem Props (*Phalaenopsis* and other species)	O753	Orchid Multiplication Medium withAgar	Complete medium.
	P793	Orchid Multiplication Medium	Requires the addition of gelling agent.
	M507	Murashige Cattleya Orchid Multiplication Medium	Best if used at ¼ to ½ strength. May need to be supplemented with 1-2 mg/L of either BA or kinetin.
Clonal Propagation & Multiplication	P793	Orchid Multiplication Medium	Use at ¼ to ½ strength for best results.
	M507	Murashige Cattleya Orchid Multiplication Medium	Best if used at ¼ to ½ strength. May need to be supplemented with 1-2 mg/L of either BA or kinetin.
	K400	Knudson C Orchid Medium	Low salt formulation. Requires the addition of gelling agent.
	V505	Vacin and Went Modified Basal Salt Mixture	Low salt formulation. Requires the addition of vitamins, sucrose, and gelling agent.
	V882	Vacin & Went Orchid Medium	Low salt formulation. Requires the addition of sucrose and gelling agent.
	V891	Vacin & Went Modified Basal Salts	Low salt formulation. Requires the addition of gelling agent.
Replating	P748	Orchid Maintenance/Replate Medium withBanana	Complete medium. Works well with *Phalaenopsis*, *Cattleya*, *Dendrobium*, and similar species.
	P785	Orchid Replate Medium	Complete medium. Works well with Cattleya and similar species.
	P668	Orchid Maintenance Medium withCharcoal	Requires the addition of gelling agent. Should be supplemented with either banana powder or coconut water. Use at ¼ to ½ strength for best results with some species.
	O156	Orchid Maintenance Medium withBanana and Charcoal	Requires the addition of gelling agent.
	O139	Orchid Maintenance Medium without Charcoal	Requires the addition of gelling agent. Should be supplemented with either banana powder or coconut water.
	B142	BM-2 Orchid Medium	Complete medium for terrestrial orchids. May work well with some *Paphiopedilum* and *Phragmipedium* species and hybrids. The addition of banana powder, pineapple powder, and/or coconut water may be beneficial.
	M579	Mitra Replate/Maintenance Medium	Complete medium. Contains charcoal. May work well with some *Vanda* and *Dendrobium* species and hybrids. The addition of coconut water may be beneficial.
	P656	*Phyto*Tech™ *Phalaenopsis* Replate Medium	Complete medium. Contains charcoal. Works well with most *Phalaenopsis* species and hybrids, and related species and hybrids. The addition of coconut water may be beneficial.

Antibiotic Selection, Preparation, & Storage

In general, antibiotics require storage in a refrigerator or freezer. Aminoglycosides (e.g., kanamycin) are hygroscopic and should be stored in a desiccator. Storage of many powdered antibiotics at -20°C is not recommended and increases the risk of water condensation. All antibiotics should be protected from direct sunlight. Rifampicin and Amphotericin B are very sensitive to light and should be stored in the dark.

The relationship between the weight (mg) of antibiotic, the activity of the powder (µg/mg or units per mg), the volume of solution to prepare (mL), and the concentration (µg/mL) of antibiotic desired in the solution is:

$$\text{Weight} = \frac{\text{Volume} \times \text{Concentration}}{\text{Activity}}$$

Most antibiotic solutions will remain stable for up to 3 months when stored at -20 to 0 °C (unless otherwise noted on the following table). However, Rifampicin and Tetracyline should be freshly prepared for each use. Most antibiotics are heat liable and should be filter sterilized using a 0.2 µm (or smaller) low-binding membranes (e.g., cellulose acetate, teflon).

Different plant species exhibit different sensitivities to antibiotics **(See Figure 29 on page 253)**. For example, one antibiotic may have minimal toxicity to certain plant species while being extremely toxic to other species. For this reason, recommended concentrations for antibiotic use are not included in the following table. Typically, antibiotics are used at concentrations at or above that toxic to the target microbes.

Available Sterile Antibiotic Solutions

*Phyto*Technology Laboratories® offers sterile, ready-to-use antibiotic solutions for your convenience. These ready-to-use solutions eliminate the need to expose technicians to the dangers of antibiotic powder and removes the possibility of technician error. Many of our antibiotic solutions are available in packs of ten 1mL aliquots. Refer to the "Antibiotics/Antimycotics/Selection Agent Guide" on page 253 for a list of available antibiotics solutions.

Carbenicillin Preparation (Product No. C346, C540 and C2046)

Carbenicillin is a white to off-white, hygroscopic powder that is soluble in either water or alcohol. Carbenicillin is most effective against gram-negative bacteria but may also have some effect against gram-positive bacteria. Aqueous solutions of Carbenicillin are reported to be stable for up to 24 hours at room temperature and for up to 72 hours when stored at 2 to 6 °C. Solutions can be stored for 12 months at a stable -20°C (i.e., non-frostfree freezer). Carbenicillin has a relatively low toxicity to a wide range of plant species; concentrations of up to 500 mg/L have been reportedly used in plant tissue culture.

Cefotaxime Preparation (Product No. C380, C537, and C1880)

Cefotaxime is a white to off-white powder, which is freely soluble in water. Variations in color of the freshly prepared solutions do not necessarily indicate changes in potency. Store this product in an airtight container protected from light. Aqueous solutions of Cefotaxime at a pH of 4.5 to 6.2 are stable for 14 to 21 days when stored at 2 to 6 °C. Solutions can be stored for 12 months at a stable -20°C (i.e., non-frostfree freezer). Cefotaxime is most effective against gram-negative bacteria.

Geneticin® [Antibiotic G418] (Product No. G810)

Although it is related to Gentamicin, Geneticin is not normally used as a standard antibiotic. Its most common application is in molecular biology as a selection agent. Geneticin, also known as antibiotic G418 sulfate, is toxic to bacteria, yeast, protozoa, helminthes, and mammalian cells. Resistance is conferred by one of two dominant genes of bacterial origin, which can also be expressed in eukaryotic cells.

Geneticin is water-soluble and can be stored for as long as 1 year at 2-6 °C. Aqueous solutions should be stored frozen. The amount of Geneticin required for selection will vary with each cell type and growth cycle. Although cells that are multiplying will be affected sooner than those that are not, cells that are in log phase will still require 3 to 7 days for selection. Concentrations for use with plant cells have been reported to be as low as 12.5 to 50 µg/mL. This is significantly lower than typical concentrations of 200 to 400 µg/mL used with mammalian cells. Geneticin® is a registered trademark of Invitrogen, Inc.

Hygromycin B (Product No. H370, H385, & H397)

Hygromycin B is an aminoglycoside antibiotic, which is effective against prokaryotic and eukaryotic microorganisms and cells. Similar to Geneticin®, its most common application is in molecular biology as a selection agent. Cells transformed with the hph gene are resistant to Hygromycin B.

Hygromycin B is provided as a 100 mg/mL aqueous solution (H370, H385) with an average potency of 1,000 units/mg and as a powder (H397). The recommended concentration range for use as a selection agent is 10 to 400 µg/mL. Stock solutions can be stored for at least 1 year at 2 to 6 °C; solutions should NOT be frozen as this can reduce their potency.

Typical selection concentrations:
- Prokaryotes – 100 µg/mL
- Lower eukaryotes – 200 µg/mL
- Higher eukaryotes – 150-400 µg/mL

Selection and Usage Guide

Refer to the "Antibiotics/Antimycotics/Selection Agent Guide" on page 253 and pertinent scientific references for more specific application information on these and other antibiotics.

©2014 PhytoTechnology Laboratories®

Figure 29. Antibiotics/Antimycotics/Selection Agent Guide

Antibiotic/Antimycotic/Selection Agent Guide

Product Description	Product Number	Molecular Weight	Gram (+) Bacteria	Gram (-) Bacteria	Mycobacteria	Fungi	Yeast	Mycoplasma	Selection Agent	Microbe Toxicity (µg/mL)	Toxicity to Plant Tissues[1] (µg/mL)	Solubility	Solution Storage[2]
Amphotericin B	A119	924.1				++	++			2.5	>5	DMSO	C
Ampicillin	A116	371.4	++	++					++	50	100	Water DMSO	F
Ampicillin Solution (100 mg/mL)	A1116												
Amoxicillin Trihydrate	A122	419.5	+	++						Varies	-	Water Methanol	n/a
Bialaphos	B131	345.3							++	n/a	1-5	Water	F
Bialaphos Solution (1 mg/mL)	B1730												
Bacitracin Zinc	B132	1486.07	++							50	150	Water	F
Carbenicillin	C346	422.4	+	++						500	>1000	Water	F
Carbenicillin Solution (100 mg/mL)	C540												
Carbenicillin Solution (250 mg/mL)	C2046												
Carbendazim	C1888	191.19				++						HCL	n/a
Cycloheximide	C1989	281.36				++	++					DMSO	C
Cycloheximide Solution (100 mg/mL)	C1796												
Cefotaxime	C380	477.4	+	++						90	>100	Water	F
Cefotaxime Solution (100 mg/mL)	C537												
Cefotaxime Solution (250 mg/mL)	C1880												
Cephalexin Monohydrate	C1970	365.4	++	+								Water DMSO	F
Cephalexin Solution (100 mg/mL)	C2112												
CTAB	H276	364.45	+	+		+						Water	RT
CTAB Solution (100 mg/mL)	H3818												
Chloramphenicol	C252	323.1	++	++	+			+	++	128	1-64	EtOH	C
Chloramphenicol Solution (10 mg/mL)	C2010												
Erythromycin	E344	733.9	++	++						0.5-30	150	Water	C
G418 Sulfate	G810	692.7							++		50	Water	C
Gentamicin Sulfate	G570	575.7	+	++				++		50	80	Water	C
Gentamicin Solution (50 mg/mL)	G3350												
Gentamicin Solution (100 mg/mL)	G3410												
Hygromycin B	H397	527.5							++	n/a	20-400	Water	C
Hygromycin B Solution (PBS)	H370												
Hygromycin B Solution (Water)	H385												
Kanamycin Monosulfate	K378	582.6	++	++				++	++	100	2	Water	C
Kanamycin Solution (50 mg/mL)	K586												
Kanamycin Solution (100 mg/mL)	K4751												
Kasugamycin Hydrochloride	K559	433.8	++	++						64-500+		Water	F
Neomycin Sulfate	N584	908.9	++	++					++	50	900	Water	C
Neomycin Solution (50 mg/mL)	N5967												
Nystatin	N581	926.1				++	++			50	40	Not Soluble	F
Paromomycin Sulfate	P710	713.7	++						++		50	Water	C
Penicillin G	P777	356.4	++							Varies	100	Water	F
Penicillin G Solution (10 mg/mL)	P6767												
Pentachloronitrobenzene (PCNB)	P6737	295.33				++			++			DMSO	RT

Antibiotic/Antimycotic/Selection Agent Guide

Product Description	Product Number	Molecular Weight	Gram (+) Bacteria	Gram (-) Bacteria	Mycobacteria	Fungi	Yeast	Mycoplasma	Selection Agent	Microbe Toxicity (µg/mL)	Toxicity to Plant Tissues[1] (µg/mL)	Solubility	Solution Storage[2]
Polymyxin B	P6809	1385.6		++								Water	C
Polymyxin B Solution (10 mg/mL)	P6719												
Ribavirin	R795	244.2											n/a
Rifampicin	R501	822.9	++	++	++					15	100	Water (Slight)	F
Spectinomycin Dihydrochloride	S742	495.4	+	++					++	20	500	Water	F
Streptomycin Sulfate	S739	1457.4	++	++						100	16	Water	F
Streptomycin Solution (250 mg/mL)	S7739												
Tetracycline Hydrochloride	T859	480.9	++	++						10	50	Water	F[3]
Tetracycline Hydrochloride Solution (10 mg/mL)	T7859												
Timentin	T869	n/a		++					++		200	Water	F
Timentin Solution (50 mg/mL)	T7869												
Timentin Solution (100 mg/mL)	T767												
Tobramycin Sulfate	T834	1425.5		+								Water	n/a
Tyrothricin	T8110	1228.4	+						+			EtOH	C
Tyrothricin Solution (10 mg/mL)	T8020												
Vancomycin	V870	1485.7	++							5	80	Water	C
Vancomycin Solution (100 mg/mL)	V8370												

++ Effective against most microorganisms

+ Effective against certain microorganisms

[1] The concentrations for plant toxicity noted in the table may be higher or lower for different plant species due to the great differences between species in toxic sensitivity to antibiotics. A concentration showing no toxicity to one plant species may exceed the toxic concentration in a different species.

[2] Solution storage: F = Freezer (-20-0 °C); C = Refrigerator (2-6 °C); RT = Room Temperature, n/a = Stability data not yet available.

[3] Aqueous Solutions of Tetracycline hydrolyze (even if frozen) yielding a hazy appearance. Solutions should only be stored (frozen) for short periods, e.g., one week. Preparation of fresh solutions is recommended.

©2014 PhytoTechnology Laboratories®

GUS Gene Staining Solution

Background

Plants have long been known to have β-galactosidase which makes distinguishing endogenous levels versus those expressed from the lacZ gene in a reporter-type gene expression system difficult. At the same time, there are low to undetectable endogenous amounts of β-glucuronidase in tobacco, petunia, potato, tomato, brassica, maize, soybean, wheat, rice, barley, and arabidopsis (Jefferson, 1987). This is why the GUS reporter gene has become so popular in plants.

As Jefferson states in his seminal paper on the GUS gene fusion system, it is important to look at the limitations of β-glucuronidase enzyme and even other similar indigogenic methods. The β-glucuronidase enzyme is inhibited by Cu_2^+ and Zn_2^+. Therefore, EDTA is a required component of the staining solution to complex these free ions in plant tissue. The optimal pH for this enzyme is 5.2 to 8.0, with 50% being active at pH 4.3. The indigo-blue dye (5,5'-bromo,4,4'-chloroindigo) representative of GUS staining does not form from simple substrate activity of X-GLUC (5-bromo, 4-chloro, 3-indolyl, β-glucuronide) with β-glucuronidase under reducing conditions. An oxidative catalyst is needed to form the dimer between two 5-bromo, 4-chloro, 3-indole ring products from X-GLUC. Potassium ferri- and ferrocyanide have traditionally been used act as oxidative catalysts, and these catalysts increase the rate of reaction beyond any diffusion effects, so as to localize the staining to sites of expression (Lojda, 1970).

Formulation

Shown below is a typical recipe for GUS Staining Solution and relevant notes for making this solution are listed below **(See Figure 30)**.

Figure 30. GUS Gene Staining Solution Formulation

GUS Gene Staining Solution Formulation					
Product Number	Product Description	Molecular Weight [g/mol]	Amount per L	Final Concentration	Product Notes
X877	X-Gluc, Monocyclohexyl Ammonium Salt	521.8	1.00 g	2.0 mM	Must be dissolved in DMF (up to 50 mg/mL) prior to addition to final staining solution. Light sensitive.
S745	Sodium Phosphate, Dibasic (Na2HPO4)	268.07	10.37 g	38.7 mM	Amounts based on Henderson-Hasselbach for 100 mM PO4 at pH 7.0
S515	Sodium Phosphate, monobasic (NaH2PO4)	137.99	8.46 g	61.3 mM	
T8100	Triton X-100	Avg. 625	1 mL	0.1% (v/v)	Liquid is the pure form
P6826	Potassium Ferrocyanide K4Fe(CN)6·3H2O	422.41	0.21 g	0.5 mM	n/a
P6626	Potassium Ferricyanide K3Fe(CN)6	329.25	0.16 g	0.5 mM	Light sensitive
E410	EDTA, Disodium Salt	372.24	0.37 g	1.0 mM	These two components can be used interchangeably
E582	0.5 M EDTA Solution, pH 8.0	372.24	2.0 mL	1.0 mM	

Phytopathology & Microbiology Media

Preparation of Phytopathology & Microbiology Media

The *Phyto*Technology Laboratories® phytopathology and microbiology media are typically used in microbiology and molecular biology applications for the cultivation, identification, isolation and/or transformation of various plant pathogens **(See Figure 31)**. General applications and uses of *Phyto*Technology Laboratories® phytopathology and microbiology products are listed in the Phytopathology and Microbiology Media chart. These phytopathology and microbiology media contain essential nutrients to support the growth of many microorganisms.

General preparation guidelines are as followed:

1. Suspend an appropriate amount of powder in 1 liter of deionized water. Typical working concentration for various media are listed in the Phytopathology and Microbiology Media Chart. Dissolve the powder medium by stirring.
   - If the product contains a gelling agent, dissolve by heating to a boil while stirring. Avoid over heating the solution, as it might result in a softer gel and increased darkening of the medium.
   - If the product does not contain a gelling agent, but gelling agent is desired, add an appropriate amount of gelling agent and adjust the pH as desired.
2. Sterilize the medium in a validated autoclave at 1 kg/cm^2 (15 psi) 121°C. The medium should attain a temperature of 121°C for at least 15 minutes. Refer to "Sterilization of Media" on page 224, if necessary.
3. Dispense the medium as desired (before or after autoclaving).

Storage of Phytopathology & Microbiology Media

All media preparations should be stored at 2-6 °C. Store dry medium at room temperature below (30°C) or refrigerated (2-6 °C) as indicated on the product label. The dehydrated powder should be free flowing. Deterioration of the powdered medium may be recognized by: 1) granulation, clumping, or particulate matter throughout the powder; 2) pH change; or 3) inability to promote microbial growth when properly used, i.e., with control cultures in a validated protocol. Consult the certificate of analysis (available on the *Phyto*Technology Labs' website) for details concerning the appearance of the powder, pH, and solubility.

Figure 31. Phytopathology and Microbiology media available from *Phyto*Tech Labs™

Product Number	Product Description	g/L	General Application
B129	Bacteria Screening medium 523	32.15	Used in a screening protocol published by Thomas (2004)
C442	Corn Meal Agar	22	General purpose medium for culturing various fungi
C443	Czapek-Dox Broth	35.01	Used for the cultivation of fungi and soil-borne bacteria
C506	Czapek-Dox Agar	50.01	
L476	Leifert & Waites Sterility Test Medium	45.22	Used for the determination and identification of potential pathogens
M484	Malt Extract Broth	20	Used for the isolation and detection of yeast and molds
M498	Malt Extract Agar	48	
N611	Nutrient Broth	8	General purpose media for less fastidious organisms
N601	Nutrient Agar	23	
O606	Oatmeal Agar	10.5	Used for the cultivation of fungi, particularly for macrospore formation
P762	Potato Dextrose Broth	24	General purpose media for culturing bacteria, fungi and yeast
P772	Potato Dextrose Agar	39	
W887	Wilkins-Chalgren Agar	43	Used for the cultivation of anaerobes
Y893	YMB Medium	26.2	Used for the cultivation of Rhizobium and fungi
Y889	Yep Medium	40	Used for the cultivation of Agrobacteriumand yeasts
Y8565	YEP Broth	25	
Y8480	Yep Medium (ADP FREE)	45	
L5128	LB Agar, Lennox L Modification	32	Used for the cultivation of Escherichia coli for molecular biology applications
L465	LB Agar, Miller Modification	37	
L5138	LB Broth, Lennox L Modification	20	
L301	LB Broth Solution, Miller Modification	1x	
L475	LB Broth, Miller Modification	25	
M5506	Malt Extract Agar	30	Used for the isolation and transformation of yeasts and fungi.
M580	Melin-Norkrans Medium, Modified	20.81	Used for the isolation of fungi
S7536	Sabouraud Dextrose Broth	50	Used for the isolation and cultivation of yeasts, fungi, and bacteria
S657	SOC Medium Solution	1x	Used for the recovery step of Escherichia coli competent cell transformations
S7478	Sordaria Crossing Agar	35.1	Used for the genetic crossover culture of Sordaria fimicola.
T760	Terrific Broth	47	Used for the cultivation of Escherichia coli for molecular biology applications
T754	Terrific Broth Solution	1x	
T7900	Tryptic Soy Broth, Type 1	25	General purpose media for fastidious organisms
T8000	Tryptic Soy Broth, Type 2	30	

©2014 PhytoTechnology Laboratories®

Phycology Media

Our phycology products support the cultivation, maintenance and research of freshwater and marine algae as well as cyanobacteria **(See Figure 32)**. Media are available as dry powder with some sterile liquids. All of our media are manufactured under cGMP conditions which ensure lot-to-lot consistency. Each medium is tested in culture with appropriate species (e.g. BG-11 with *Synechocystis sp. PCC 6803*, TAP with *Chlamydomonas reinhardtii*, etc.). The preparation of dry powder algal media is the same as plant tissue culture media. These products will aid the research and development in algal biofuels, bioproducts, and food industries.

Figure 32. Phytopathology and Microbiology media available from *Phyto*Tech Labs™

Product Number	Product Description	Available Package Sizes	Powder [g/L] (or) Liquid [conc.]	General Application	Typical Species
B1411	BG-11 Medium	0.5L, 1L, 2L	Liquid, 50X	Freshwater Cyanobacteria	*Synechocystis sp. PCC 6803*
B1511	BG-11 Medium	1L, 10L, 50L	Powder, 1.68 g/L	Freshwater Cyanobacteria	*Synechocystis sp. PCC 6803*
B1650	Bold's Basal Medium	0.5L, 1L, 2L	Liquid, 50X	Freshwater Algae	*Chlorella vulgaris*
B1675	Bold's Basal Medium	1L, 10L, 50L	Powder, 0.71 g/L	Freshwater Algae	*Chlorella vulgaris*
F3222	f/2 Guillard's Marine Enriched Seawater with Silicate	1L, 10L, 50L	Powder, 0.10 g/L	Marine Algae - Diatoms	*Phaeodactylum tricornutum*
G3454	f/2 Guillard's Marine Enriched Seawater without Silicate	1L, 10L, 50L	Powder, 0.09 g/L	Marine Algae	*Nannochloropsis sp.*
S7668	Sueoka's High Salt Medium	1L, 10L, 50L	Powder, 2.78 g/L	Freshwater Algae	*Chlamydomonas reinhardtii*
T8050	Tris-Acetate-Phosphate (TAP) Medium	0.5L, 1L, 2L	Liquid, 1X	Freshwater Algae	*Chlamydomonas reinhardtii*
T8224	Tris-Acetate-Phosphate (TAP) Medium	1L, 10L, 50L	Powder, 3.17 g/L	Freshwater Algae	*Chlamydomonas reinhardtii*

Seed Testing – P6800 PhytoSelect Basal Medium & SMART Media

*Phyto*Select Basal Medium is formulated based on the SMART media system developed by Kawanishi et al. (2011). SMART is an acronym for: Selective Medium-Design Algorithm Restricted by Two Constraints. The two constraints that are varied to select for different microorganisms are the carbon source and the antibiotics chosen for selection.

The *Phyto*Select Basal Medium (product number P6800) contains all the main components found in each of the SMART selection media (does not contain the carbon source or antibiotics). The SMART medium formulation is ADP-Free and uses the same standard components for the basal medium, but varies the carbohydrate source along with the antibiotics to be able to select for different plant pathogens. Kawanishi et al. (2011) report that their developed media have advantages over ADP (Animal Derived Products) containing media, stating that the lack of ADP allows their formulation to be more selective for particular microorganisms. This reduces the amount of false colonies, and increases the selectivity of the medium.
Kawanishi et al. (2011) have published 5 selection media for the following plant pathogens:

- *Burkholderia glumae,*
- *Acidovorax avenae,*
- *Pectobacterium carotovorum,*
- *Ralstonia solanacearum, and*
- *Xanthomonas campestris.*

The following tables list all 5 media formulations, and the *Phyto*Tech™ product numbers for the associated components. The antibiotic solutions indicated are sterile and should be added aseptically after autoclaving, when the medium is cool enough to handle.

Figure 33. "The Smart Media Formulation for Seed Testing" lists the composition of the selective media developed by Kawanishi *et al.* (2011). Amounts listed in the table make 1L of each selection medium.

Figure 33. The Smart Media Formulation for Seed Testing

SMART-Pca medium For *Pectobacterium carotovorum*		
Product Number	Component Description	g/L or mL/L
P6800	*Phyto*Select Basal Medium	24.93 g
T7968	Trehalose	1 g
C1989 C1796	Cycloheximide: Powder or Solution (100 mg/mL)	50 mg 0.5 mL
H276 H3818	Cetrimonium (CTAB): Powder or Solution (100 mg/mL)	10 mg 0.1 mL
T8110 T8020	Tyrothricin: Powder or Solution (10 mg/mL)	10 mg 0.1 mL

SMART-Rso medium For *Ralstonia solanacearum*		
Product Number	Component Description	g/L or mL/L
P6800	*Phyto*Select Basal Medium	24.93 g
M562	D-Mannitol	1 g
C1989 C1796	Cycloheximide: Powder or Solution (100 mg/mL)	50 mg 0.5 mL
C252 C2010	Chloramphenicol: Powder or Solution (10 mg/mL)	10 mg 0.1 mL
P6809 P6719	Polymixin B: Powder or Solution (10 mg/mL)	10 mg 0.1 mL

SMART-Xca medium For *Xanthomonas campestris*		
Product Number	Component Description	g/L or mL/L
P6800	*Phyto*Select Basal Medium	24.93 g
G503	Glycine	1 g
C1989 C1796	Cycloheximide: Powder or Solution (100 mg/mL)	50 mg 0.5 mL
C1970 C2112	Cephalexin: Powder or Solution (100 mg/mL)	10 mg 0.1 mL
P777 P6767	Penicillin G: Powder or Solution (10 mg/mL)	10 mg 0.1 mL

SMART-Bgl medium For *Burkholderia glumae*		
Product Number	Component Description	g/L or mL/L
P6800	*Phyto*Select Basal Medium	24.93 g
S744	D-sorbitol	1 g
C1989 C1796	Cycloheximide: Powder or Solution (100 mg/mL)	50 mg 0.5 mL
A116 A1116	Ampicillin: Powder or Solution (100 mg/mL)	10 mg 0.1 mL
H276 H3818	Cetrimonium (CTAB): Powder or Solution (100 mg/mL)	10 mg 0.1 mL
C252 C2010	Chloramphenicol: Powder or Solution (10 mg/mL)	10 mg 0.1 mL

SMART-Aac medium For *Acidovorax avenae*		
Product Number	Component Description	g/L or mL/L
P6800	*Phyto*Select Basal Medium	24.93 g
M539	L-methionine	1 g
C1989 C1796	Cycloheximide: Powder or Solution (100 mg/mL)	50 mg 0.5 mL
A116 A1116	Ampicillin: Powder or Solution (100 mg/mL)	10 mg 0.1 mL
H276 H3818	Cetrimonium (CTAB): Powder or Solution (100 mg/mL)	10 mg 0.1 mL
P6809 P6719	Polymixin B: Powder or Solution (10 mg/mL)	10 mg 0.1 mL

©2014 PhytoTechnology Laboratories®

Stains & Dyes Usage Table

The products listed below represent the stains and dyes for use in different plant science applications that are available from *Phyto*-Technology Laboratories® **(See Figure 34).**

Figure 34. Stains & Dyes Usage Table

Stains & Dyes Usage Table		
Product Number	Product Name	Application
A1286	Alcian Blue	A widely used cationic dye used to stain acid mucopolysaccharides and glycosaminoglycans. The stained tissues are blue to bluish-green in color. Particularly useful in staining pectins present in plant cell walls. Also used to stain plant root mucilage.
A1272	Aniline Blue	Often used in plant tissue and seed testing to detect the presence of mycelium. One common use of aniline blue in seed testing is for the detection of the endophyte *Neotyphodium coenophialum* in tall fescue. Other plant tissues, such as *Glycine max* (soybean) can be stained with aniline blue to detect *Fusarium oxysporum*. Sometimes used in conjunction with lactic acid during staining.
B1714	Bromothymol Blue (BTB)	A histological stain and pH indicator: Yellow at pH 6.0, green at neutral pH (6.7), and blue at pH 7.6. It can be incorporated into a medium to observe color change, such as the inclusion of BTB in microbiology media where a pH change can be indicative of bacterial/fungal growth.
C1933	Calcofluor White M2R	A fluorescent stain that has been used to indicate cell wall biosynthesis for plant and fungal cells. Calcofluor White fluoresces when it hydrogen bonds with β-1,4 and β-1,3 glucosidic linkages, which are primary components of cellulose and chitin in cell walls. These types of fluorescent dyes are known as optical brightening agents because they absorb near-UV light (broad region λmax = 315-415 nm) and emit in the blue-green wavelength region (broad region λmax = 430-550 nm).
C1830	Crystal Violet	A component of gram staining, usually counter-stained with Safranin O.
D2362	DAPI	An indole fluorescent dye used to stain cell nuclei. DAPI binds to AT-rich regions in the minor groves of double-stranded DNA. Upon binding to DNA, it emits blue fluorescence (emission maxima, lambda max = 461 nm) when excited with near UV light (absorption maxima, lambda max = 358 nm).
E2799	Evans Blue	A viability stain on the basis of its penetration into non-viable cells. Living cells exclude Evans Blue, while dead or damaged cells take up the dye, staining blue.
F3178	Fast Green	Used to stain light colored seeds to detect mechanical damage. After soaking seeds in a solution of fast green and rinsing, damage to the seed coat will be stained green.
F2950	Fluorescein Diacetate	Identifies cell viability based on the emission of a greenish fluorescence.
I4068	Indigo Carmine	Used to stain seeds to detect dead tissues. Stain will penetrate dead cells, but will not stain living cells, this can aid in determining seed viability. Indigo Carmine can also be used as a pH indicator: It is blue at pH 11.4 and yellow at 13.0.
M5781	Methylene Blue	A cationic dye with a maximum absorption of approximately 670 nm. It has an array of uses and has been used in biological sciences as a stain since the early 1900s. It can be substituted for Crystal Violet in the Gram Staining method. Often, Methylene blue is used in solution as a redox indicator, as it changes from a blue solution to colorless when in the presence of a reducing agent. It can also be used as a nuclear stain, or for differentiating pectin compounds. In plants, the protoplast and lignified walls will stain a bright blue and the pectin compounds will stain a violet blue. In diatoms and other simple organisms, a 0.001 % solution is used for staining the nuclei. Seeds can be stained using a 1% methylene blue solution to determine the anatomy of the seed. It can be used as a viability stain, staining dead cells blue and leaving living cells unstained, for eukaryotic cells. Methylene blue will not penetrate living cells, but will stain dead cells.
N602	Nitroblue Tetrazolium	Commonly used with BCIP (5-bromo-4-chloro-3-indolyl-phosphate) for colorimetric detection of alkaline phosphatase activity.
O6350	Orange G	One of the components of Flemming's Triple Stain. Orange G is an azo dye used primarily as a histological stain. It is a pail dye that is used for faint background staining and is very soluble in water with decreased solubility in alcohol.
R7228	Rhodamine B	A protein specific fluorescent stain commonly used in fluorescence microscopy. Stains plant trichomes.
R7171	Rose Bengal	Used to detect endophytic fungi in seed testing. Fungal mycelium will stain red if present.
R7278	Ruthenium Red	Mainly used for staining pectins, mucilages, and gums. It is a stereoselective stain for pectic acid. Used at a concentration of 0.01% (w/v) in aqueous solution, seeds are soaked in Ruthenium red until the extruded mucilage is visibly stained.
S7400	Safranin O	A component of gram staining. Often a counter-stain to Crystal Violet.
S7750	Sudan IV	Primarily involved in staining lipids and fatty substances present in cells and tissues. The color imparted is a function of the solubility of the dye in the substance affected and does not involve chemical bonding. A saturated solution in isopropanol is prepared for use as a fat stain.
T8199	Tetrazolium Blue	A colorless tetrazolium compound that upon reduction forms a colored diformazan.
T8092	Toluidine Blue O	Toluidine Blue O is commonly used as a metachromatic stain that can differentiate between different types of plant tissues and if present, fungal contaminants.
T8164	Triphenyl Tetrazolium Chloride (TTC)	Most commonly used for seed viability testing. TTC is officially recognized by the International Seed Testing Association, and they provide working sheets for testing different seed types for viability. Tetrazolium chloride is a redox indicator that can differentiate between living and dead tissues based on the reduction of TTC to 1,3,5-triphenylformazan, which is red, by dehydrogenases present in the living tissues. This results in living tissues staining a degree of red, while dead tissues remain unstained.

Miscellaneous

Antioxidant Mixture

(Product Number A126)

The antioxidant mixture is intended to reduce the browning of plant tissue prior to or during culture. The product should be prepared immediately before use. Short-term storage at -20°C is acceptable. The product is supplied as a powder in packages that prepare 1 or 10 liters of antioxidant solution. If other volumes are desired the product can be prepared at 250 mg/L. When prepared at this concentration no further dilution is typically necessary. The solution can be sterilized by filtration through a 0.22 µm sterile membrane; the solution should not be autoclaved. Tissue can be placed in the solution for 5 to 30 minutes prior to placement on fresh medium.

The antioxidant mixture contains:

100 mg/L L-Ascorbic Acid, Free Acid
150 mg/L Citric Acid, Free Acid, Anhydrous

Use And Preparation Of Banana Powder

(Product Number B852)

*Phyto*Technology Laboratories® offers banana powder for use in orchid and other plant cell cultures. Product number B852 is a powder from a spray-dried mixture of banana and maltodextrin. This product is typically used between 30 to 50 g/L. To reduce clumping, add powder slowly to the culture medium with constant stirring. The presence of banana solids is common in medium containing this product.

Use And Storage Of Coconut Water

(Product Number C195)

Coconut water has been shown to stimulate shoot proliferation in many species of plants. Coconut water is prepared from selected coconuts and processed to remove most of the protein. Remaining protein levels in the water may vary from one lot to the next and may result in the formation of precipitates when the product is frozen. This precipitation should not affect the growth of the plant tissue. The precipitate can be removed by filtering or by allowing it to settle to the bottom of the bottle and then decanting. Coconut water can be divided into smaller aliquots, corresponding to your standard medium batch size, and refrozen until needed. Coconut water should be used at a concentration of 5 to 20% (v/v).

Silver Thiosulfate Solution Preparation

Prepare a 0.1 M Sodium Thiosulfate (STS) stock solution by dissolving 1.58 g of STS (Product Number S620) into 100 mL of water. Prepare a 0.1 M Silver Nitrate stock solution by dissolving 1.7 g of Silver Nitrate (Product Number S169) into 100 mL of water. Store the stock solution in the dark until needed to prepare the STS.

In general, the STS solution is prepared with a molar ratio between silver and thiosulfate of 1:4, respectively. Nearly all of the silver present in the solution is in the form of [Ag (S2O3)2]3-, the active complex for ethylene-effect inhibition.

Prepare 0.02 M STS by slowly pouring 20 mL of 0.1 M silver nitrate stock solution into 80 mL of 0.1 M sodium thiosulfate stock solution. The STS can be stored in the refrigerator for up to a month. However, preparation of the STS just prior to use is recommended.

©2014 PhytoTechnology Laboratories®

Culture Vessels

Figure 35. Culture Vessel Selection Guide

Culture Vessel Selection Guide											
Product Number	Product Description	Container Shape	Product Composition	Autoclavable	Sterile	Reusable	Dimensions in mm (round – d x h) (rectangular – l x w x h)	Approx. Surface Area of Medium (cm2)	Number of Containers per T077 Tray	Approx. Number of Containers per ft2	Recommended Closure
C1958	SteriCon™-4, Sterilized Culture Vessel	Square	HC-PS	N	Y	N	(rim) 101.6 x 101.6 x 38.8 (base) 80 x 80 x 38.8	64	8	9	Included
C2118	SteriCon™-8, Sterilized Culture Vessel	Square	HC-PS	N	Y	N	(rim) 101.6 x 101.6 x 74.9 (base) 80 x 80 x 74.9	64	8	9	Included
C1932	SteriCon™-13, Sterilized Culture Vessel	Square	HC-PS	N	Y	N	(rim) 101.6 x 101.6 x 130 (base) 70 x 70 x 130	49	12	9	Included
C1770	Culture Vessel, 6 oz Glass Jar	Round	Glass	Y	N	Y	58 x 90	26.4	50	25	C070
C583	Culture Vessel, 9 oz. Glass Jar	Round	Glass	Y	N	Y	73 x 87	41.8	20	16	Included (C566)
C597	Culture Vessel, 16 oz Glass Jar	Round	Glass	Y	N	Y	89 x 95	62.2	12	9	Included (C579)
C590	Culture Vessel, 16 oz Glass Jar	Round	Glass	Y	N	Y	77 x 135	46.5	12	10	Included (C566)
C031	Culture Vessel, 32 oz Glass Jar	Round	Glass	Y	N	Y	85 x 174	56.7	20	16	C029, C566
C607	Culture Vessel, 32 oz Glass Jar	Round	Glass	Y	N	Y	89 x 170	62.2	12	9	Included (C579)
C930	Culture Tubes, Round Bottom	Round	Glass	Y	N	Y	25 x 150	4.9	–	–	C069, C909, C945
C935	Culture Tubes, Flat Bottom	Round	Glass	Y	N	Y	25 x 95	4.9	–	–	C069, C909, C945
D965	Petri Dish, Clear Glass, 100 mm x 15 mm	Round	Glass	Y	N	Y	100 x 15	78.5	12	9	Included
C1775	PTcon-11W	Round	CL-PP	Y	N	Y	120 x 104	113	8	4	Included
C1765	PTcon-12	Round	CL-PP	Y	N	Y	89 x 113	62.2	15	9	Included
C1755	PTcon-7	Round	CL-PP	Y	N	Y	89 x 64	62.2	15	9	Included
C209	*Phyto*Con™-8 Culture Vessel, 8 oz	Round	PP	Y	N	Y	115 (rim) x 40 90 (base) x 40	63.5	9	7	Included
C215	*Phyto*Con™-16 Culture Vessel, 16 oz	Round	PP	Y	N	Y	115 (rim) x 80 90 (base) x 80	63.5	9	7	Included
C221	*Phyto*Con™-32 Culture Vessel, 32 oz	Round	PP	Y	N	Y	115 (rim) x 135 90 (base) x 135	63.5	9	7	Included
C1898	Culture Tube, Flip-Cap	Round	PP	Y*	Y	Y	44 x 97	15.1	–	36	Attached
D940	Petri Dish, 100 mm x 15 mm	Round	PS	N	Y	N	100 x 15	78.5	12	9	Included
D942	Petri Dish, 100 mm x 20 mm	Round	PS	N	Y	N	100 x 20	78.5	12	9	Included
D943	Petri Dish, 100 mm x 25 mm	Round	PS	N	Y	N	100 x 25	78.5	12	9	Included
D678	Petri Dish, 60 mm x 15 mm	Round	PS	N	Y	N	60 x 15	28.3	35	25	Included

*Containers are sterile if they have not been opened prior to initial use in sterile conditions. If autoclaving, leave the lid slightly ajar for ventilation and to prevent container damage. PS = Polystyrene PP = Polypropylene CL-PP = Clarified Polypropylene HC-PS = High Clarity Polystyrene

Useful Guides

Figure 36. Imperial (US) to Metric Conversions

US Weight	Metric Weight	US Volume	Metric Volume
¼ tsp	0.4 g	1 tsp	5 mL
1¼ tsp	2 g	1 fl oz	30 mL
3 tsp (1Tbs)	5 g	1 pint (16 fl oz)	473 mL
1 oz	28 g	34 fl oz	1 L
1 lb	454 g	1 gal	3.8 L

Figure 37. Metric to Imperial (US) Conversions

US Weight	Metric Weight	US Volume	Metric Volume
$3.5x10^{-5}$ oz	1 mg	0.033 oz	1 mL
0.035 oz	1 g	3.381 oz	100 mL
3.5274 oz	100 g	0.132 gal	500 mL
1.102 lb	500 g	0.264 gal	1 L
2.204 lb	1 Kg	2.641 gal	10 L

Figure 38. Flasks Stopper Chart

Flask/Container		Stopper	
Size	Product Number	Size	Product Number
125 mL	F934	No. 6½	S981
250 mL	F979	No. 8	S983
300 mL	F938	No. 8	S983
500 mL	F980	No. 10	S984

Figure 39. Tris Buffer Preparation Guide

Dissolve Tris HCl & Base in deionized water.

g/L for 50 mM Solution		pH at Temperature	
Tris HCl	Tris Base	5°C	25°C
7.02	0.67	7.76	7.20
6.85	0.80	7.89	7.30
6.61	0.97	7.97	7.40
6.35	1.18	8.07	7.50
6.06	1.39	8.18	7.60
5.72	1.66	8.26	7.70
5.32	1.97	8.37	7.80
4.88	2.3	8.48	7.90
4.44	2.65	8.58	8.0
4.02	2.97	8.68	8.10
3.54	3.34	8.78	8.20
3.07	3.70	8.88	8.30
2.64	4.03	8.98	8.40
2.21	4.36	9.09	8.50
1.83	4.65	9.18	8.60
1.50	4.90	9.28	8.70
1.23	5.13	9.36	8.80
0.96	5.32	9.47	8.90
0.76	5.47	9.56	9.0

Figure 40. Scalpel Handle & Blade Compatibility Chart

Scalpel Handle & Blade Compatibility Chart			
Scalpel Handle	Handle Type	Blade Compatibility by Product Number	Blade Compatibility by Blade Types
S963	No. 3	S970, S971, S975	No. 10, No. 11, No. 15
S973	No. 3L	S970, S971, S975	No. 10, No. 11, No. 15
S967	No. 7	S970, S971, S975	No. 10, No. 11, No. 15
S094	No. 4	S075	No. 23
S648	No. 4L	S075	No. 23
S653	No. 4L Angular	S075	No. 23

©2014 PhytoTechnology Laboratories®

Glossary

Adventitious – Developing from unusual points of origin, such as shoot or root tissues, from callus or embryos, from sources other than zygotes.
Agar – A polysaccharide powder derived from algae used to gel a medium. Agar is generally used at a concentration of 6-12 g/L.
Aseptic – Free of microorganisms.
Aseptic Technique – Procedures used to prevent the introduction of fungi, bacteria, viruses, mycoplasma or other microorganisms into cultures.
Autoclave – A machine capable of sterilizing wet or dry items with steam under pressure. Pressure cookers are a type of autoclave.
Auxin – A group of plant growth regulators that promotes callus growth, cell division, cell enlargement, adventitious buds, and lateral rooting. Indole-3-acetic (IAA) is a naturally occurring auxin. Examples of synthetic auxins included 2,4-Dichlorophenoxyacetic acid (2,4-D), Indole-3-Butyric acid (IBA), α-Naphthaleneacetic acid (NAA), and 4-Chlorophenoxyacetic acid (CPA).
Callus – An unorganized, proliferate mass of differentiated plant cells, a wound response.
Chemically Defined Medium – A nutritive solution for culturing cells in which each component is specifiable and ideally of known chemical structure.
Clone – Plants produced asexually from a single source plant.
Clonal Propagation – Asexual reproduction of plants that are considered to be genetically uniform and originated from a single individual or explant.
Contamination – Being infested with unwanted microorganisms such as bacteria or fungi.
Culture – A plant growing *in vitro*.
Cytokinin – A group of plant growth regulators that regulate growth and morphogenesis and stimulate cell division. Endogenous cytokinins: internal cytokinins that occur naturally, including timentin, zeatin and 6-γ,γ-dimethylallylaminopurine (2iP). Exogenous cytokinins: cytokinins that are applied, including natural ones and synthetic ones such as: 6-furfurylaminopurine (kinetin) and 6-benzylaminopurine (BA).
Differentiated – Cells that maintain, in culture, all or much of the specialized structure and function typical of the cell type in vivo. Modifications of new cells to form tissues or organs with a specific function.
Explant – Tissue taken from its original site and transferred to an artificial medium for growth or maintenance.
Gibberellins – A plant growth regulator that influences cell enlargement, promotes shoot elongation, and releases seeds and buds from dormancy. The most commonly used form of gibberellin is Gibberellic Acid (GA3).
Horizontal laminar flow unit – An enclosed work area that has sterile air moving across it. The air moves with uniform velocity along parallel flow lines. Room air is pulled into the unit and forced through a HEPA (High Efficiency Particulate Air) filter, which removes particles 0.3 μm and larger.
Hormones – Naturally occurring plant growth regulators that affect plant growth and development in very low concentrations. (i.e., cytokinins, auxins, and gibberellins). They can be endogenous (internal, produced by the plant) or exogenous (exteranally applied).
Internode – The space between two nodes on a stem.
In vitro **–** To be grown in glass (Latin). Propagation of plants in a controlled, artificial environment using plastic or glass culture vessels, aseptic techniques, and a defined growing medium.
In vivo – To be grown naturally (Latin)
Media – Plural of medium
Medium – A nutritive solution, solid or liquid, for culturing cells.
Micropropagation – *In vitro* clonal propagation of plants from shoot tips or nodal explants, usually with an accelerated proliferation of shoots during subcultures.
Node – A part of the plant stem from which a leaf, shoot or flower originates.
Passage – The transfer or transplantation of cells or tissues with or without dilution or division, form one culture vessel to another.
Passage Number – The number of times the cells or tissues in culture have been subcultured or passaged.
Pathogen – A disease-causing organism.
Pathogenic – Capable of causing a disease.
Petiole – A leaf stalk; the portion of the plant that attaches the leaf blade to the node of the stem.
Plant Tissue Culture – The growth or maintenance of plant cells, tissues, organs or whole plants *in vitro*.
Regeneration – In plant cultures, a morphogenetic response to a stimulus that results in the products of organs, embryos, or whole plants.
Shoot Apical Meristem – Undifferentiated tissue, located within the shoot tip, generally appearing as a shiny dome-like structure, distal to the youngest leaf primordium and measuring less that 0.1 mm in length when excised.
Somaclonal Variation – Phenotypic variation, either genetic or epigenetic in origin, displayed among somaclones.
Somaclones – Plants derived from any form of cell culture involving the use of somatic plant cells.
Stage I – A step in *in vitro* propagation characterized by the establishment of an aseptic tissue culture of a plant.
Stage II – A step in *in vitro* propagation characterized by the rapid numerical increase of organs or other structures.
Stage III – A step in *in vitro* propagation characterized by preparation of propagules for successful transfer to soil, a process involving rooting of shoot cuttings, hardening of plants, and initiating the change from the heterotrophic to the autotrophic state.
Stage IV – A step in *in vitro* plant propagation characterized by the establishment in soil of a tissue culture derived plant, either after undergoing a Stage III pretransplant treatment, or in certain species, after the direct transfer of plants from Stage II into soil.
Sterile – (A) Without life. (B) Inability of an organism to produce functional gametes. (C) A culture that is free of viable microbes.
Sterile Techniques – The practice of working with cultures in an environment free from microorganisms.
Subculture – See "Passage". With plant cultures, this is the process by which the tissue or explant is first subdivided, then transferred into fresh culture medium.
Tissue Culture – The maintenance or growth of tissue, *in vitro*, in a way that may allow differentiation and preservation of their function.
Totipotency – A cell characteristic in which the potential for forming all the cell types in the adult organism are retained, thus theoretically able to reproduce the entire organism from one cell.
Undifferentiated – With plant cells, existing in a state of cell development characterized by isodiametric cell shape, very little or no vacuole, a large nucleus, and exemplified by cells comprising an apical meristem or embryo.

Bibliography

Adaoha Mbanaso, E.N. and D.H. Roscoe, Plant Sci. Lett. 25, 61-66 (1982).

Anderson, W.C., Acta Hort., 112:13-20 (1980).

Anderson, W.C., *In Vitro*, 14:334 (1978).

Bertani, G. J Bacteriol. 62: 293-300 (1951)

Blaydes, D.F., Physiol. Plant., 19:748-753 (1966).

Burger, D., HortSci., 23:1066-1068 (1988).

Chee, R. and R.M. Pool, Sci. Hort., 32:85 (1987).

Chee, R. and D.J. Cantliffe, *In Vitro* Cell. Develop. Biol., 25:757-760 (1989).

Chu C.C., C.C. Wang, C.S. Sun, C. Hsu, K.C. Yin, C.Y. Chu and F.Y. Bi., Sci. Sinic., 18:659-668 (1975).

Coke, J.E., U.S. Patent 5,534,433. (1996a).

Coke, J.E., U.S. Patent 5,534,434. (1996b).

Dalton, C.C., K. Kqbal and D.A Turner, Physiol. Plant., 57:472-476 (1983).

Draget, K.I., S. Myhre, G. Skjåk-Bræk, and K. Østgaard, Plant Physiol., 132:552-556 (1988)

Driver, J.A. and A.H. Kuniyuki, HortSci., 19:507-509 (1984).

Economou, A.S. and P.E. Read. HortSci., 19(1): 60-61, (1984).

Ericksson, T., Physiol. Plant., 18:976-993 (1965).

Gamborg, O.L., R.A. Miller, and K. Ojima, Exp. Cell Res., 50:151-158 (1968).

Gamborg, O.L., Can. J. Biochem., 44:791-799 (1966).

Gresshoff, P.M. and C.H. Doy, Z. Pflanzenphysiol., 37:132-141 (1974).

Gorman, D.S. and R.P. Levine. Proc. Natl. Acad. Sci. USA 54: 1665-1669 (1965)

Guillard R.R.L and J.H. Ryther. Canadian J. of Microbiol. 8: 229-239 (1962)

Gupta, P.K. and K.J. Durzan, Plant Cell Rep., 4:177-179 (1985).

Hanahan, D. J. Mol. Biol. 166: 557-580 (1983)

Hartman, et al. (Personal Communication).

Heller, R., Ann. Sci. Nat. Bot. Biol. Beg. 11th Ser., 14:1-223 (1953).

Herman, E.B. Agricell Rep. 9: 33-37 (1987)

Hickok L.G., T. Warne, and R.S. Fribourg, Int. J. Plant Sci., 156: 332-345 (1995)

Hoagland, D.R. and D.I. Arnon, Circular 347, California Agr. Exp. Stat., Berkeley (1950).

Ichihashi, S., Abstr. of IPPS Toyohashi 98 (1992).

Jefferson, RA. Assaying Chimeric Genes in Plants: The GUS Gene Fusion System. Plant Molecular Biology Report, 5:387-405(1987).

Kane, M.E., In: Trigiano, R.N. and D.J. Gray, Editors, Plant Tissue Culture Concepts and Laboratory Exercises, 2nd Edition. CRC Press, Boca Raton, pp 427-431 (2000).

Kao, K.N. and M.R. Michayluk, Planta, 126:105-110 (1975).

Kawanishi T, et al. PLoS ONE 6(1) (2011)

Kawanishi T, T Shiraishi, Y Okano, K Sugawara, M Hashimoto, K Maejima, K Komatsu, S Kakizawa, Y Yamaji, H Hamamoto, K Oshima, S Namba (2011) New Detection Systems of Bacteria Using Highly Selective Media Designed by SMART: Selective Medium-Design Algorithm Restricted by Two Constraints. PLoS ONE Volume 6, Issue 1.

Knudson, L., Amer. Orchid Soc. Bull., 15:214-217 (1946).

Larkin P.J., P.A. Davies, and G.J. Tanner, Plant Sci., 58:203-210 (1988).

Leifert, C. and W.M. Waites, J. Appl. Bacteriol., 72:460-466 (1992).

Lennox, E. S. Virol. 1:190-206 (1955)

Lindemann, E.G.P., J.E. Gunckel, and O.W. Davison, Amer. Orchid Soc. Bull., 39:1002-1004 (1970).

Linsmaier, E.M. and F. Skoog, Physiol. Plant., 18:100-127 (1965).

Lichter, R., Z. Pflanzenphysiol. 105:427 (1982).

Litvay, J.D., M.A. Johnson, D.C. Verma, D. Einspahr, and K. Weyrauch, Conifer suspension suclture medium development using analytical data from developing seeds. Inst. Paper Chemistry, IPC Tech Paper Ser No 115. Appleton, WI (1981).

Lloyd, G. and B.H. McCown, Proc. Int. Plant Prop. Soc., 30:421-427 (1981).

Lojda, Z. Indigogenic Methods for Glycosidases. II an Improved Method for 3-d-glactosidase and Its Application to Localization Studies of the Enzymes in the Intestine and Other Tissue. Histochemie 23:266-287 (1970).

Lucke, E., Die Orchidee 22(2):62-65 (1971).

Luria, S. E. and J. W. Burrows. J Bacteriol. 74: 461-476 (1955)

Malmgren, S., In: Allen, C., Editor, North American Native Terrestrial Orchids. Propagation and Production. Conf. Proc., pp 63-71 (1996).

McGranahan, G.H., J.A. Driver and W. Tulecke, In: Bonga, J.B. and D.J. Durzan, Editors, Cell and Tissue Culture in Forestry, Vol. 3. Martinus Nijhoff, Dordrecht, pp 261-271 (1987).

Miller, C. and F. Skoog, Amer. J. Bot. 40: 768–773 (1953).

Morel, G.M., Cymbid. Soc. News, 20(7):3-11 (1965).

Murashige, T. and F. Skoog, Physiol. Plant., 15:473-497 (1962).

Nichols, H.W. and H.C.Bold J. Phycology 1: 34-38 (1965)

Nitsch, J.P. and C. Nitsch, Science, 163:85-87 (1969).

Quoirin, M. and P. Lepoivre, Acta Hort., 78:437-442 (1977).

Quoirin, M., P. Lepoivre and P. Boxus, Compte rendu des recherches, Station des Cultures Fruitieres et Maraicheres de Gembloux pp 93-117 (1977).

Sambrook, T., E. E. Fritsch and T. Maniatis. Molecular Cloning: A Laboratory Manual 2nd Edition. Cold Spring Harbor, New York (1989)

Schaad, N.W. and R.L. Forster. Phytopathology 75: 260-263 (1985)

Schenk, R.U. and A.C. Hildebrandt, Can. J. Bot., 50:199-204 (1972).

Stanier R.Y.et al. Bacteriol. Rev. 35:171-205 (1971)

Steele, W.K., In: Allen, C., Editor, North American Native Terrestrial Orchids. Propagation and Production. Conf. Proc., pp 11-26 (1996).

Thom, C. and M. B. Church. The Aspergilli. Williams & Wilkins Co. Baltimore (1926)

Thomas, P., Current Science 87(1):67-72 (2004).

Tisserat, B., D. Jones, and P.D. Galletta, HortSci., 27(4):358-361.

Torres, K.C. Tissue Culture Techniques for Horticultural Crops. AVI Books, New York (1989).

Vacin, E.F. and E.W. Went, Bot. Gaz., 110:605-613 (1949).

Viss, P.R., E.M. Brooks, and J.A. Driver, *In Vitro* Cell. Dev. Biol. Plant, 27P: 42 (1991).

Vuylsteke, D.R., Shoot-tip culture for the propagation, conservation, and distribution of Musa germplasm, 73 pp, Int. Inst. Tropical Agric. (1998).

White, P.R., The Cultivation of Animal and Plant Cells, 2nd edition, Ronald Press, New York (1963).

Wilkens, T.D. and S. Chalgren, Antimicrob. Agents Chemother., 10:926 (1976).

Youssef, E.M.A. and G.A. Amin, Acta Hort., 560:513-516.

©2014 PhytoTechnology Laboratories®

Media Formulations A-C

▼Product Numbers▶		A267	B144	B514	B1396	C167	C206	C212	C216	C222
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Anderson Basal Salt Mixture	Banana AGS Basal Medium	Blaydes Medium	Broadleaf Tree Basal Medium	Chu's N6 Basal Medium with Vitamins	Cape Sundew/Venus Fly Trap Multiplication Medium	Carrot Callus Initiation Basal Medium	Cape Sundew/Venus Fly Trap Pretransplant Basal Medium	Carrot Shoot Development Basal Medium
A300	Ammonium Nitrate	400	1650	1000	82.5		400		825	
A305	Ammonium Sulfate				120	463		134		134
B210	Boric Acid	6.2	6.2	1.6	1.55	1.6	6.2	3	3.1	3
C266	Calcium Chloride, Anhydrous	332.2	333		16.6	125.33	332.2	113.24	166.5	113.24
C180	Calcium Nitrate, Dried			241.1	222					
C350	Cobalt Chloride Hexahydrate	0.025	0.025		0.005		0.025	0.025	0.0125	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025		0.0625		0.025	0.025	0.0125	0.025
E410	EDTA, Disodium Salt	74.5		74.5	9.325	37.25	74.5	37.26		37.26
E676	Ferric Sodium EDTA		36.7						18.35	
F263	Ferrous Sulfate, Heptahydrate	55.7		55.7	6.95	27.85	55.7	27.8		27.8
M150	Magnesium Sulfate, Anhydrous	180.7	181	17.1	90	90.37	180.7	122.09	90.5	122.09
M250	Manganese Sulfate	16.9	16.9	4.4	4.225	3.3	16.9	10	8.45	10
P704	Potassium Chloride			100						
P840	Potassium Iodide	0.3	0.83	0.8	0.0375	0.8		0.75	0.415	0.75
P100	Potassium Nitrate	480	1900	65	95	2830	480	2500	950	2500
P846	Potassium Phosphate, Monobasic, Anhydrous		170	300	85	400			85	
P854	Potassium Sulfate, Anhydrous				430					
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25		0.0625		0.25	0.25	0.125	0.25
S515	Sodium Phosphate, Monobasic	330.6	295				380	150		150
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	1.5	2.15	1.5	8.6	2	4.3	2
A545	Adenine Hemisulfate						80			
D525	6-γ,γ-Dimethylallylaminopurine (2iP)		10				1			
n/a	2,4-Dichlorophenoxyacetic Acid							1		
I885	Indole-3-acetic Acid		1							
K750	Kinetin									0.2
G503	Glycine			2		2				
I703	*myo*-Inositol		100		50		100	100	50	100
N765	Nicotinic Acid				0.25	0.5		1		1
P866	Pyridoxine HCl					0.5		1		1
T390	Thiamine HCl		0.4	0.1	0.5	1	0.4	10	0.2	10
S391	D-Sucrose			30000						
	Grams of powder to prepare 1 L	1.89	4.71	31.86	1.21	3.99	2.12	3.21	2.2	3.21

Media Formulations C-D

▼Product Numbers▶		C287	C416	C1935	D146	D189	D190	D191	D2206	D2470
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Chee & Pool C2D Vitis Medium	Chu's N6 Basal Salt Mixture	Carnivorous Plant (Nepenthes) Basal Salt Mixture	DCR Basal Salt Mixture	DKW Basal Medium with 30 g/L Sucrose	DKW Basal Salt Mixture	DKW Basal Medium with 10 g/L Sucrose	De Greef & Jacobs Medium	DKW Medium with Vitamins
A300	Ammonium Nitrate	1650		160.1	400	1416	1416	1416		1416
A305	Ammonium Sulfate		463						400	
B210	Boric Acid	6.2	1.6	9.2745	6.2	4.8	4.8	4.8	10.62	4.8
C266	Calcium Chloride, Anhydrous		125.33	33.94	64.14	112.5	112.5	112.5	226.5	112.5
C180	Calcium Nitrate, Dried	492.3			386.31	1367	1367	1367		1367
C350	Cobalt Chloride Hexahydrate	0.025		0.02378	0.025				0.0025	
C375	Cupric Sulfate Pentahydrate	0.025		0.02497	0.25	0.25	0.25	0.25	0.0025	0.25
E410	EDTA, Disodium Salt	37.3	37.25		37.3	45.4	45.4	45.4	37.26	45.4
E676	Ferric Sodium EDTA			36.702						
F263	Ferrous Sulfate, Heptahydrate	27.8	27.85		27.8	33.8	33.8	33.8	27.8	33.8
M150	Magnesium Sulfate, Anhydrous	180.6	90.37	36.11	180.7	361.49	361.49	361.49	244.33	361.49
M250	Manganese Sulfate	0.845	3.3	16.9	22.3	33.5	33.5	33.5	1.68	33.5
N478	Nickel Chloride Hexahydrate				0.025					
N458	Nickel Sulfate Hexahydrate					0.005	0.005	0.005		0.005
P704	Potassium Chloride								600	
P840	Potassium Iodide		0.8	0.83	0.83				1.583	
P100	Potassium Nitrate	1900	2830	202.2	340				2000	
P846	Potassium Phosphate, Monobasic, Anhydrous	170	400		170	265	265	265		265
P854	Potassium Sulfate, Anhydrous					1559	1559	1559		1559
M651	Sodium Molybdate (VI), Dihydrate	0.25		0.24195	0.25	0.39	0.39	0.39	0.0025	0.39
S515	Sodium Phosphate, Monobasic			138.01					250	
Z897	Zinc Nitrate, Hexahydrate					17	17	17		17
Z101	Zinc Sulfate, Heptahydrate	8.6	1.5	11.5016	8.6				1.06	
I703	*myo*-Inositol	10							100	100
N765	Nicotinic Acid	1							1	1
P866	Pyridoxine HCl	1							1	
T390	Thiamine HCl	1							10	2
S391	D-Sucrose					30,000		10,000		
	Grams of powder to prepare 1 L	4.49	4	0.65	1.64	35.22	5.22	15.22	3.91	5.32

©2014 PhytoTechnology Laboratories®

Media Formulations E-H

▼Product Numbers▶		E333	E337	E575	G371	G398	G768	H353	H393	H396
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	EXS III Basal Salt Mixture with Adenine	EXS III Basal Salt Mixture without Adenine	Economou & Read Medium	Gresshoff & Doy Basal Medium	Gamborg B-5 Basal Medium	Gamborg Basal Salt Mixture	Hoagland Modified Basal Salt Mixture	Heller Basal Salt Mixture	Heller & White Modified Basal Salt Mixture
A127	Aluminum Chloride, Heptahydrate	Proprietary Formula	Proprietary Formula						0.0543	0.03
A300	Ammonium Nitrate			400	1000					
A113	Ammonium Phosphate							115.03		
A305	Ammonium Sulfate			132		134	134			
B210	Boric Acid			6.2	0.3	3	3	2.86	1	1.24
C266	Calcium Chloride, Anhydrous			332.2		113.24	113.24		56.7	
C180	Calcium Nitrate, Dried				241.2			656.4		300
C350	Cobalt Chloride Hexahydrate			0.025	0.025	0.025	0.025			
C375	Cupric Sulfate Pentahydrate			0.025	0.025	0.025	0.025	0.08	0.03	0.03
E410	EDTA, Disodium Salt				37.25	37.26	37.26	3.5334		
F383	Ferric Chloride								1	
F388	Ferric Sulfate, Hydrate									25
F263	Ferrous Sulfate, Heptahydrate				27.85	27.8	27.8	2.502		
I331	Iron Chelate, Sequestrene 330			56						
M150	Magnesium Sulfate, Anhydrous			180.7	17.099	122.09	122.09	240.76	122.1	351.63
M455	Manganese Chloride							1.81		
M250	Manganese Sulfate			16.9	1	10	10		0.0758	0.01
M488	Molybdenum Trioxide							0.016		
N478	Nickel Chloride Hexahydrate								0.03	0.03
P704	Potassium Chloride				65				750	65
P840	Potassium Iodide				0.8	0.75	0.75		0.01	0.01
P100	Potassium Nitrate			202	1000	2500	2500	606.6		80
P846	Potassium Phosphate, Monobasic, Anhydrous			408	300					
M651	Sodium Molybdate (VI), Dihydrate			0.25	0.025	0.25	0.25			
S802	Sodium Nitrate								600	
S515	Sodium Phosphate, Monobasic					150	150		108.75	16.5
S843	Sodium Sulfate, Anhydrous									200
Z101	Zinc Sulfate, Heptahydrate			8.6	0.3	2	2	0.22	1	1
G503	Glycine				4					
B140	D-Biotin				0.2					
I703	*myo*-Inositol			100	10	100				
N765	Nicotinic Acid				0.1	1				
P866	Pyridoxine HCl				0.1	1				
T390	Thiamine HCl			0.4	1	10				
	Grams of powder to prepare 1 L	3.95	3.87	1.84	2.71	3.21	3.1	1.63	1.64	1.04

Media Formulations H-L

▼Product Numbers▶		H435	H436	H437	H3959	K413	K427	L154	L444	L449
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Hosta Initiation/ Multiplication Medium	Hosta Mulitplication Medium	Hosta Rooting Medium	Hosta Initiation/ Multiplication Medium II	Kao & Michayluk Basal Salt Mixture	Kao & Michayluk Modified Basal Salt Medium	Lloyd & McCown Woody Plant Basal Mixture	Lloyd & McCown Modified Basal Salts	Lloyd & McCown Woody Plant Medium with Vitamins
A300	Ammonium Nitrate	1650	1650	1650	1650	600	600	400		400
B210	Boric Acid	6.2	6.2	6.2	6.2	3	3	6.2	6.2	6.2
C266	Calcium Chloride, Anhydrous	332.2	332.2	332.2	332.2	453	453	72.5	72.5	72.5
C180	Calcium Nitrate, Dried							386		386
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.025	0.025	0.025	0.025			
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.025	0.025	0.025	0.025	0.25	0.25	0.25
E410	EDTA, Disodium Salt	37.26	37.26	37.26	37.26	37.26	37.26	37.3	37.3	37.3
F263	Ferrous Sulfate, Heptahydrate	27.8	27.8	27.8	27.8	27.85	27.85	27.9	27.85	27.9
M150	Magnesium Sulfate, Anhydrous	180.7	180.7	180.7	180.7	146.55	146.55	180.7	180.7	180.7
M250	Manganese Sulfate, Monohydrate	16.9	16.9	16.9	16.9	10	10	22.3	22.3	22.3
P704	Potassium Chloride					300	300			
P840	Potassium Iodide	0.83	0.83	0.83	0.83	0.75	0.75			
P100	Potassium Nitrate	1900	1900	1900	1900	1900	1900			
P846	Potassium Phosphate, Monobasic, Anhydrous	300	300	300	300	170	170	170	170	170
P854	Potassium Sulfate, Anhydrous							990		990
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
S515	Sodium Phosphate, Monobasic	170	170	170	170					
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	8.6	2	2	8.6	8.6	8.6
A545	Adenine Hemisulfate	160	160		160					
B800	6-Benzylaminopurine (6-BA)	2	0.1	0.1	2					
N600	a-Naphthaleneacetic Acid	0.5	0.5	0.5	0.02					
G503	Glycine	2	2		2					2
A103	p-Aminobenzoic Acid						0.02			
A106	L-Ascorbic Acid						2			
B140	D-Biotin						0.01			
C186	Calcium Pantothenate						1			
V883	Cholecalciferol, Vitamin D3						0.01			
C232	Choline Chloride						1			
C242	Cyanocobalamin, Vitamin B12						0.02			
F430	Folic Acid						0.4			
I703	*myo*-Inositol	100	100	100	100		100			100
N609	Niacinamide						1			
N765	Nicotinic Acid									0.5
P866	Pyridoxine HCl						1			0.5
n/a	Retinol, Vitamin A						0.01			
R779	Riboflavin, Vitamin B2						0.2			
T390	Thiamine HCl	0.4	0.4	0.4	0.4		1			1
S391	D-Sucrose	30000	30000	30000	30000					
A111	Agar	8000	8000	8000	8000					
C184	Casein Hydrolysate	500	500	500	500					
C277	Citric Acid, Anyhdrous						40			
F356	Fumaric Acid						40			
M5536	DL-Malic Acid						40			
n/a	Pyruvic Acid, Potassium Salt						20			
	Grams of powder to prepare 1 L	43.4	43.39	43.23	43.4	3.65	3.9	2.3	0.53	2.41

©2014 PhytoTechnology Laboratories®

Media Formulations L-M

▼Product Numbers▶		L452	L467	L473	L477	L546	L689	M153	M290	M401
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Linsmaier & Skoog Basal Medium with Sucrose & Agar, pH Adjusted & Buffered	Linsmaier & Skoog Basal Medium with Sucrose & Agar	Linsmaier & Skoog Modified Basal Medium with Sucrose pH Buffered and Adjusted	Linsmaier & Skoog Modified Basal Medium pH Buffered and Adjusted	Litvay Basal Salt Mixture	Linsmaier & Skoog Basal Medium	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Modified Basal Medium
A300	Ammonium Nitrate	1650	1650	1650	1650	1650	1650	825	825	1650
B210	Boric Acid	6.2	6.2	6.2	6.2	31	6.2	3.1	6.2	6.2
C266	Calcium Chloride, Anhydrous	332.2	332.2	332.2	332.2	16.61	332.2	166.1	166.1	332.2
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.025	0.025	0.125	0.025	0.0125	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.025	0.025	0.5	0.025	0.0125	0.025	0.025
E410	EDTA, Disodium Salt	37.26	37.26	37.26	37.26		37.26	18.63	37.26	37.26
E676	Ferric Sodium EDTA					36.7				
F263	Ferrous Sulfate, Heptahydrate	27.8	27.8	27.8	27.8		27.8	13.9	27.8	27.8
M150	Magnesium Sulfate, Anhydrous	180.7	180.7	180.7	180.7	903.38	180.7	90.35	180.7	180.7
M250	Manganese Sulfate	16.9	16.9	16.9	16.9	21	16.9	8.45	16.9	16.9
P672	Potassium Hydroxide	100		100	100					
P840	Potassium Iodide	0.83	0.83	0.83	0.83	4.15	0.83	0.415	0.83	0.83
P100	Potassium Nitrate	1900	1900	1900	1900	1900	1900	950	950	1900
P846	Potassium Phosphate, Monobasic, Anhydrous	170	170	170	170	340	170	85	170	170
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.25	0.25	1.25	0.25	0.125	0.25	0.25
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	8.6	43	8.6	4.3	8.6	8.6
B800	6-Benzylaminopurine (6-BA)									1
N600	α-Naphthaleneacetic Acid									0.1
G503	Glycine									2
I703	*myo*-Inositol	100	100	100	100		100			100
N765	Nicotinic Acid									0.5
P866	Pyridoxine HCl									0.5
T390	Thiamine HCl	0.4	0.4	0.4	0.4		0.4			0.4
S391	D-Sucrose	30000	30000	30000						30000
A111	Agar	7000	7000							
M825	MES, Free Acid	1000		1000	1000					
	Grams of powder to prepare 1 L	42.53	41.43	35.53	5.53	4.95	4.43	2.17	2.39	34.44

Media Formulations M

▼Product Numbers▶		M404	M407	M419	M462	M491	M499	M502	M504	M508
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige & Skoog Basal Medium with Gamborg Vitamins	Murashige & Skoog Modified Basal Salt Mixture	MG Basal Salt Medium	Musa (Banana) Multiplication Medium	Murashige Shoot Multiplication Medium	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Macronutrient Salt Base	Murashige & Skoog Basal Salt Mixture, Finer & Nagaswa Modification	Murashige Fern Multiplication Medium
A300	Ammonium Nitrate	1650			1650	1650	1650	1650	825	1650
A305	Ammonium Sulfate			33.5						
B210	Boric Acid	6.2	6.2	2.3	6.2	6.2	6.2		6.2	6.2
C266	Calcium Chloride, Anhydrous	332.2	332.2	111.36	332.2	333	333	332.2	332.2	333
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.0125	0.025	0.025	0.025		0.025	0.025
C193	Cobalt Nitrate									
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.0125	0.025	0.025	0.025		0.025	0.025
E410	EDTA, Disodium Salt	37.26	37.26	18.64	37.25					
E676	Ferric Sodium EDTA					36.7	36.7		36.7	36.7
F263	Ferrous Sulfate, Heptahydrate	27.8	27.8	13.9	27.85					
M150	Magnesium Sulfate, Anhydrous	180.7	180.7	75.7	180.74	181	181	180.7	180.54	181
M250	Manganese Sulfate	16.9	16.9	6.7	16.9	16.9	16.9		16.9	16.9
P840	Potassium Iodide	0.83	0.83	0.4	0.83	0.83	0.83		0.83	0.83
P100	Potassium Nitrate	1900		1100	1900	1900	1900	1900	3030	1900
P846	Potassium Phosphate, Monobasic, Anhydrous	170		42.5	170	170	170	170	170	170
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.125	0.25	0.25	0.25		0.25	0.25
S802	Sodium Nitrate			437.8						
S515	Sodium Phosphate, Monobasic			32.6		170				255
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	2.7	8.6	8.6	8.6		8.6	8.6
A545	Adenine Hemisulfate					80				
B800	6-Benzylaminopurine (6-BA)				4.5					
D525	6-γ,γ-Dimethylallylaminopurine (2iP)					30				
I885	Indole-3-acetic Acid				0.175	0.3				
K750	Kinetin									2
N600	α-Naphthaleneacetic Acid									0.1
G229	L-Glutamine				2000					
G503	Glycine				2					
A106	L-Ascorbic Acid				20					
I703	*myo*-Inositol	100				100				100
N765	Nicotinic Acid	1			0.5					
P866	Pyridoxine HCl	1			0.5					
T390	Thiamine HCl	10			0.4	0.4				0.4
S391	D-Sucrose				30000					
	Grams of powder to prepare 1 L	4.44	0.61	1.88	36.36	4.68	4.3	4.23	4.61	4.66

©2014 PhytoTechnology Laboratories®

Media Formulations M

▼Product Numbers▶		M509	M510	M511	M512	M516	M517	M518	M519	M524
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige Gerbera Multiplication Medium	Murashige Gerbera Pretransplant Medium	Murashige Kalanchoe Multiplication Medium	Murashige Kalanchoe Pretransplant Medium	Murashige & Skoog BC Potato Medium	Murashige African Violet/ Gloxinia Multiplication Medium	Murashige African Violet/ Gloxinia Pretransplant Medium	Murashige & Skoog Basal Medium with Vitamins	Murashige & Skoog Basal Salt Mixture
A300	Ammonium Nitrate	1650	1650	1650	1650	1650	1650	1650	1650	1650
B210	Boric Acid	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
C266	Calcium Chloride, Anhydrous	333	333	333	333	333	333	333	332.2	332.2
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
E410	EDTA, Disodium Salt								37.26	37.26
E676	Ferric Sodium EDTA	36.7	36.7	36.7	36.7	36.7	36.7	36.7		
F263	Ferrous Sulfate, Heptahydrate								27.8	27.8
M150	Magnesium Sulfate, Anhydrous	181	181	181	181	181	181	181	180.7	180.7
M250	Manganese Sulfate	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
P840	Potassium Iodide	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
P100	Potassium Nitrate	1900	1900	1900	1900	1900	1900	1900	1900	1900
P846	Potassium Phosphate, Monobasic, Anhydrous	170	170	170	170	170	170	170	170	170
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
S515	Sodium Phosphate, Monobasic	85	85				170			
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
A545	Adenine Hemisulfate	80					80			
D525	6-γ,γ-Dimethylallylaminopurine (2iP)			3						
I885	Indole-3-acetic Acid	0.5	10		3		2	1		
K750	Kinetin	10				0.04	2			
G503	Glycine					2			2	
T873	L-Tyrosine	100	100							
I703	*myo*-Inositol	100	100	100	100	100	100	100	100	
N765	Nicotinic Acid	10	10			0.5			0.5	
P866	Pyridoxine HCl	1	1			0.5			0.5	
T390	Thiamine HCl	30	30	0.4	0.4	0.4	0.4	0.4	0.1	
	Grams of powder to prepare 1 L	4.72	4.64	4.41	4.41	4.41	4.66	4.4	4.43	4.33

Media Formulations M

▼Product Numbers▶		M527	M529	M530	M531	M535	M536	M541	M550	M554
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige Modified Multiplication Medium	Murashige & Skoog Micronutrient Stock Solution (10x)	Murashige & Skoog Modified Basal Medium	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Modified Basal Medium	Murashige Modified Basal Multiplication Medium	Murashige & Skoog Modified Basal Medium	Murashige & Skoog Modified Basal Medium	Murashige & Skoog Micronutrient Salt Base
A300	Ammonium Nitrate	1650		1650		1650	1650	1650	1650	
B210	Boric Acid	6.2	62	6.2	6.2	6.2	6.2	6.2	6.2	6.2
C266	Calcium Chloride, Anhydrous	333		332.2	332.2	332.2	332.2	332.2	332.2	
C350	Cobalt Chloride Hexahydrate	0.025	0.25	0.025	0.025	0.025	0.025	0.025	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.25	0.025	0.025	0.025	0.025	0.025	0.025	0.025
E410	EDTA, Disodium Salt		373	37.26	37.26	37.26	37.26		37.26	37.26
E676	Ferric Sodium EDTA	36.7						36.7		
F263	Ferrous Sulfate, Heptahydrate		278	27.8	27.8	27.8	27.8		27.8	27.8
M150	Magnesium Sulfate, Anhydrous	181		180.7	180.7	180.7	180.7	180.7	180.7	
M250	Manganese Sulfate	16.9	169	16.9	16.9	16.9	16.9	16.9	16.9	16.9
P840	Potassium Iodide	0.83	8.3	0.83	0.83	0.83	0.83	0.83	0.83	0.83
P100	Potassium Nitrate	1900		1900		1900	1900	1900	1900	
P846	Potassium Phosphate, Monobasic, Anhydrous	170		170	170	170	170		170	
M651	Sodium Molybdate (VI), Dihydrate	0.25	2.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25
S515	Sodium Phosphate, Monobasic					170	170	300		
Z101	Zinc Sulfate, Heptahydrate	8.6	86	8.6	8.6	8.6	8.6	8.6	8.6	8.6
A545	Adenine Hemisulfate					80	80	150		
n/a	2,4-Dichlorophenoxyacetic Acid								2	
I885	Indole-3-acetic Acid	0.3								
K750	Kinetin	1							0.05	
G503	Glycine			2		2	2	2		
I703	*myo*-Inositol	100		100		100	100	100	100	
N765	Nicotinic Acid			0.5		0.5	0.5	5	1	
P866	Pyridoxine HCl			0.5		0.5	0.5	1	1	
T390	Thiamine HCl	0.4		0.1		0.4	0.4	0.5	10	
S391	D-Sucrose								20000	
C184	Casein Hydrolysate							1000		
M825	MES, Free Acid			1000						
	Grams of powder to prepare 1 L	4.41	n/a	5.43	0.78	4.68	4.68	5.69	24.44	0.1

©2014 PhytoTechnology Laboratories®

Media Formulations M

▼Product Numbers▶		M555	M561	M571	M576	M654	M701	M702	M5501	M5530
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige & Skoog Modified Multiplication Medium	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Modified Basal Salt Mixture	Murashige & Skoog Basal Salt Concentration (20x)	Murashige & Skoog Macronutrient Stock Solution (10x)	Murashige & Skoog Modified Basal Medium	Murashige & Skoog Modified Basal Medium	Murashige & Skoog Basal Medium with Vitamins & Sucrose	Murashige & Skoog Basal Medium Solution with Vitamins & Sucrose (1x)
A300	Ammonium Nitrate	1650	825		33000	16500	1650	1650	1650	1650
B210	Boric Acid	6.2	6.2	6.2	124		6.2	6.2	6.2	6.2
C266	Calcium Chloride, Anhydrous	332.2	332.2	332.2	6644	3322	333	332.2	332.2	332.2
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.025	0.5		0.025	0.025	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.025	0.5		0.025	0.025	0.025	0.025
E410	EDTA, Disodium Salt	37.26	37.26	37.26	745.2			37.26	37.26	37.26
E676	Ferric Sodium EDTA						36.7			
F263	Ferrous Sulfate, Heptahydrate	27.8	27.8	27.8	556			27.8	27.8	27.8
M150	Magnesium Sulfate, Anhydrous	180.7	180.7	180.7	3614	1810	181	180.7	180.7	180.7
M250	Manganese Sulfate, Monohydrate	16.9	16.9	16.9	338		16.9	16.9	16.9	16.9
P840	Potassium Iodide	0.83	0.83	0.83	16.6		0.83	0.83	0.83	0.83
P100	Potassium Nitrate	1900	950	1900	38000	19000	1900	1900	1900	1900
P846	Potassium Phosphate, Monobasic, Anhydrous	170	170	170	3400	1700	170	170	170	170
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.25	5		0.25	0.25	0.25	0.25
S515	Sodium Phosphate, Monobasic	148						148		
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	172		8.6	8.6	8.6	8.6
A545	Adenine Hemisulfate	80					30	80		
D525	6-γ,γ-Dimethylallylaminopurine (2iP)						10	30		
I885	Indole-3-acetic Acid						1	0.3		
K750	Kinetin	1								
N600	a-Naphthaleneacetic Acid	0.1								
G503	Glycine								2	2
I703	*myo*-Inositol	100					100	100	100	100
N765	Nicotinic Acid								0.5	0.5
P866	Pyridoxine HCl								0.5	0.5
T390	Thiamine HCl	0.4					0.4	0.4	0.1	0.1
S391	D-Sucrose	30000						30000	30,000	30,000
	Grams of powder to prepare 1 L	34.66	2.56	2.68	n/a	n/a	4.44	34.69	34.43	n/a

Media Formulations M-N

▼Product Numbers▶		M5541	M5615	M5642	M5707	M5800	M5825	N492	N479
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige & Skoog Basal Salt Mixture, van der Salm Modification	Murashige & Skoog Basal Medium Solution with Vitamins, Glucose & Sucrose (1x)	Murashige & Skoog Basal Salt Medium with Vitamins, van der Salm Modification	Murashige & Skoog Medium with Vitamins, Sucrose, & Glucose	Murashige & Skoog Basal Medium with FeNa-EDTA	Murashige & Skoog Basal Medium with Vitamins, Sucrose & Gelzan	NB Basal Medium	NLN Basal Medium
A300	Ammonium Nitrate	1650	1650	1650	1650	1650	1650		
A305	Ammonium Sulfate							463	
B210	Boric Acid	6.2	6.2	6.2	6.2	6.2	6.2	3	10
C266	Calcium Chloride, Anhydrous	332.2	332.2	332.2	332.2	332.2	332.2	125.33	
C180	Calcium Nitrate, Dried								345
C350	Cobalt Chloride Hexahydrate	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
E410	EDTA, Disodium Salt		37.26		37.26		37.26	37.26	
E349	FeNa-EDDHA	96		96					
E676	Ferric Sodium EDTA					36.7			36.7
F263	Ferrous Sulfate, Heptahydrate		27.8		27.8		27.8	27.8	
M150	Magnesium Sulfate, Anhydrous	180.7	180.7	180.7	180.7	180.7	180.7	90.37	61
M250	Manganese Sulfate, Monohydrate	16.9	16.9	16.9	16.9	16.9	16.9	10	18.95
P840	Potassium Iodide	0.83	0.83	0.83	0.83	0.83	0.83	0.75	
P100	Potassium Nitrate	1900	1900	1900	1900	1900	1900	2830	125
P846	Potassium Phosphate, Monobasic, Anhydrous	170	170	170	170	170	170	400	125
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	8.6	8.6	8.6	2	10
G229	L-Glutamine								800
G503	Glycine		2	2	2	2	2		2
S807	L-Serine								100
B140	D-Biotin								0.05
F430	Folic Acid								0.5
I703	*myo*-Inositol		100	100	100	100	100	100	100
N765	Nicotinic Acid		0.5	0.5	0.5	0.5	0.5	1	5
P866	Pyridoxine HCl		0.5	0.5	0.5	0.5	0.5	1	0.5
T390	Thiamine HCl		0.1	0.1	0.1	0.1	0.1	10	0.5
G386	D-Glucose, Anhydrous		15,000		20,000				
S391	D-Sucrose		15,000		10,000		30,000		
G3251	Gelzan						2000		
n/a	Glutathione (Reduced), Sodium Salt								30
	Grams of powder to prepare 1 L	4.36	n/a	4.46	34.43	4.406	36.43	4.1	1.77

©2014 PhytoTechnology Laboratories®

Media Formulations N-R

▼Product Numbers▶		N613	N616	P713	P6647	Q673	R756	R757	R758	R7100
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Nitsch & Nitsch Basal Salt Mixture	Nitsch & Nitsch Basal Medium with Vitamins	Parker Thompson Fern Basal Salt Mixture	*Phyto*Tech™ Spathiphyllum Medium	Quoirin & Lepoivre Basal Salt Mixture	Rose Initiation Medium	Rose Modified Multiplication Basal Medium	Rose Modified Rooting Basal Medium	Rugini Olive Medium
A112	Ammonium Molybdate			0.037						
A300	Ammonium Nitrate	720	720	125		400	1650	1650	412.5	412
B210	Boric Acid	10	10	1.86		6.2	6.2	6.2	1.55	12.4
C266	Calcium Chloride, Anhydrous	166	166	19.628			333	333	83.25	332.16
C180	Calcium Nitrate, Dried					833.77				416.941
C350	Cobalt Chloride Hexahydrate					0.025	0.025	0.025	0.00625	0.025
C375	Cupric Sulfate Pentahydrate	0.025	0.025	0.37		0.025	0.025	0.025	0.00625	0.25
E410	EDTA, Disodium Salt	37.26	37.26	37.3		37.3				37.5
E676	Ferric Sodium EDTA						36.7	36.7	9.175	
F263	Ferrous Sulfate, Heptahydrate	27.8	27.8	27.8		27.8				27.8
M150	Magnesium Sulfate, Anhydrous	90.372	90.372	58.565		175.79	181	181	45.25	732.534
M250	Manganese Sulfate, Monohydrate	18.9	18.9	0.25		0.76	16.9	16.9	4.225	16.9
P704	Potassium Chloride									500
P840	Potassium Iodide					0.08	0.83	0.83	0.2075	0.83
P100	Potassium Nitrate	950	950			1800	1900	1900	475	1100
P846	Potassium Phosphate, Monobasic, Anhydrous	68	68	500		270	170	170	42.5	340
M651	Sodium Molybdate (VI), Dihydrate	0.25	0.25			0.25	0.25	0.25	0.0625	0.25
Z101	Zinc Sulfate, Heptahydrate	10	10	0.52		8.6	8.6	8.6	2.15	14.3
B800	6-Benzylaminopurine (6-BA)						2	3		
I885	Indole-3-acetic Acid						0.3	0.3		
N600	a-Naphthaleneacetic Acid								0.03	
G503	Glycine		2				2	2	2	2
A106	L-Ascorbic Acid						50	50		
B140	D-Biotin		0.05							0.05
F430	Folic Acid		0.5							0.5
I703	*myo*-Inositol		100				100	100	100	100
N765	Nicotinic Acid		5				0.5	0.5	0.5	5
P866	Pyridoxine HCl		0.5				0.5	0.5	0.5	0.5
T390	Thiamine HCl		0.5				0.4	0.4	0.4	0.5
C277	Citric Acid, Anyhdrous						50	50		
	Grams of powder to prepare 1 L	2.1	2.21	0.77	33.85	3.56	4.51	4.51	1.18	4.05

Proprietary Formula

Media Formulations S-T

▼Product Numbers▶		S806	S808	S811	S813	S816	T856	T861	T864	T867
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Schenk & Hildebrandt Modified Basal Salt Mixture	Schenk & Hildebrandt Modified Basal Medium	Schenk & Hildebrandt Modified Basal Medium without Vitamins	Schenk & Hildebrandt Basal Medium	Schenk & Hildebrandt Basal Salt Mixture	Tobacco Modified Callus Initiation Medium	Tobacco Modified Root Initiation Medium	Tobacco Modified Shoot Multiplication Basal Medium	Tobacco Modified Shoot & Root Medium
A300	Ammonium Nitrate						1650	1650	1650	1650
A113	Ammonium Phosphate, Monobasic	300	150	300	300	300				
A305	Ammonium Sulfate									
B210	Boric Acid	5	2.5	5	5	5	6.2	6.2	6.2	6.2
C266	Calcium Chloride, Anhydrous		75.5	151	151	151	333	333	333	333
C350	Cobalt Chloride Hexahydrate	0.1	0.05	0.1	0.1	0.1	0.025	0.025	0.025	0.025
C375	Cupric Sulfate Pentahydrate	0.2	0.1	0.2	0.2	0.2	0.025	0.025	0.025	0.025
E410	EDTA, Disodium Salt	20	10	20	20	20				
E676	Ferric Sodium EDTA						36.7	36.7	36.7	36.7
F263	Ferrous Sulfate, Heptahydrate	15	7.5	15	15	15				
M150	Magnesium Sulfate, Anhydrous	195.4	97.7	195.4	195.4	195.4	181	181	181	181
M250	Manganese Sulfate, Monohydrate	10	5	10	10	10	16.9	16.9	16.9	16.9
P840	Potassium Iodide	1	0.5	1	1	1	0.83	0.83	0.83	0.83
P100	Potassium Nitrate	2500	1250	2500	2500	2500	1900	1900	1900	1900
P846	Potassium Phosphate, Monobasic, Anhydrous						170	170	170	170
M651	Sodium Molybdate (VI), Dihydrate	0.1	0.05	0.1	0.1	0.1	0.25	0.25	0.25	0.25
Z101	Zinc Sulfate, Heptahydrate	1	0.5	1	1	1	8.6	8.6	8.6	8.6
I885	Indole-3-acetic Acid						2	3		0.03
K750	Kinetin						0.2		1	1
G503	Glycine						2	2	2	2
I703	*myo*-Inositol		500		1000		100	100	100	100
N765	Nicotinic Acid		2.5		5		0.5	0.5	0.5	0.5
P866	Pyridoxine HCl		0.25		0.5		0.5	0.5	0.5	0.5
T390	Thiamine HCl		2.5		5		0.4	0.4	0.4	0.4
S391	D-Sucrose		10000	10000	10000					
C184	Casein Hydrolysate						1000	1000	1000	1000
	Grams of powder to prepare 1 L	3.05	12.1	13.2	14.21	3.2	5.41	5.41	5.41	5.41

©2014 PhytoTechnology Laboratories®

Media Formulations T-W

▼Product Numbers▶		T7954	T8024	W863	W865	W898
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	TM4 Basal Medium	TM4 Basal Salt Mixture	Westvaco WV3 Basal Medium	Westvaco WV5 Basal Medium	White Basal Salt Mixture
A300	Ammonium Nitrate	320	320		700	
A113	Ammonium Phosphate, Monobasic	230	230			
A305	Ammonium Sulfate	134	134			
B210	Boric Acid	6.2	6.2	31	31	1.5
C266	Calcium Chloride, Anhydrous	113.25	113.25	452.88	452.88	
C180	Calcium Nitrate, Dried					208.5
C350	Cobalt Chloride Hexahydrate	0.0025	0.0025	0.025	0.025	
C375	Cupric Sulfate Pentahydrate	0.0025	0.0025	0.25	0.25	0.001
E410	EDTA, Disodium Salt	18.5	18.5			
E676	Ferric Sodium EDTA			36.7	36.7	
F263	Ferrous Sulfate, Heptahydrate	13.9	13.9			2.5
M150	Magnesium Sulfate, Anhydrous	122.12	122.12	903.79	903.79	351.62
M250	Manganese Sulfate, Monohydrate	16.9	16.9	15.16	15.16	5.31
M488	Molybdenum Trioxide					0.001
P704	Potassium Chloride			656.79	718.67	65
P840	Potassium Iodide	0.83	0.83	0.83	0.83	0.75
P100	Potassium Nitrate	1900	1900	910.06	1084.06	80
P846	Potassium Phosphate, Monobasic, Anhydrous			270	270	
M651	Sodium Molybdate (VI), Dihydrate			0.25	0.25	
S802	Sodium Nitrate					16.5
S515	Sodium Phosphate, Monobasic					200
Z101	Zinc Sulfate, Heptahydrate	8.6	8.6	8.6	8.6	3
G503	Glycine	2.5				
B140	D-Biotin	0.05				
C232	Choline Chloride	0.1				
F430	Folic Acid	0.5				
I703	*myo*-Inositol	100		1000	1000	
N765	Nicotinic Acid	5				
P866	Pyridoxine HCl	0.5				
T390	Thiamine HCl	0.5		0.4	0.4	
	Grams of powder to prepare 1 L	2.99	2.88	4.29	5.22	0.93

Orchid Media Formulations A-L

▼Product Numbers▶		B138	B141	B142	B470	F522	I365	K400	K425	L472
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	BM-1 Terrestrial Orchid Medium without Agar	BM-1 Terrestrial Orchid Medium with Agar	BM-2 Terrestrial Orchid Medium with Agar	BM-2 Terrestrial Orchid Medium without Agar	Fast Orchid Medium	Ichihashi (NP) Medium	Knudson C Orchid Medium	Knudson C Modified Plus Orchid Medium	Lindemann Orchid Basal Medium
A127	Aluminum Chloride, Heptahydrate					0.030			Proprietary Formulation	0.056
A300	Ammonium Nitrate					167.0	82.0	500.0		
A305	Ammonium Sulfate						303.900	500.000		1,000
B210	Boric Acid	10.000	10.000	10.000	10.000	1.000	3.100			1.014
C180	Calcium Nitrate					40.100	637.600	347.200		347.200
C350	Cobalt Chloride Hexahydrate	0.0250	0.0250	0.0250	0.0250		0.0125			
C375	Cupric Sulfate Pentahydrate	0.0250	0.0250	0.0250	0.0250	0.0300	0.0125			0.0190
E410	EDTA, Disodium Salt	37.250	37.250	37.250	37.250		37.300			
F383	Ferric Chloride					1.000				
F352	Ferric Citrate									4.400
E676	Ferric Sodium EDTA					17.000				
F263	Ferrous Sulfate, Heptahydrate	27.850	27.850	27.850	27.850		27.800	25.000		
M542	Magnesium Nitrate						256.400			
M150	Magnesium Sulfate, Anhydrous	100.000	100.000	100.000	100.000	19.800		122.125		58.620
M250	Manganese Sulfate	25.000	25.000	25.000	25.000	0.800	11.200	5.682		0.052
N478	Nickel Chloride Hexahydrate					0.030				0.031
P704	Potassium Chloride					167.000		250.000		1,050.0
P840	Potassium Iodide					0.0100	0.4150			0.0990
P100	Potassium Nitrate						424.0			
P705	Potassium Phosphate, Dibasic					83.0				
P846	Potassium Phosphate, Monobasic, Anhydrous	300.00	300.00	300.00	300.00		462.70	250.00		135.00
M651	Sodium Molybdate (VI), Dihydrate	0.2500	0.2500	0.2500	0.2500		0.1250			
Z101	Zinc Sulfate, Heptahydrate	10.000	10.000	10.000	10.000	1.000	4.300			0.565
B800	6-Benzylaminopurine (6-BA)			0.200	0.200					
G229	L-Glutamine	100.000	100.000	100.000	100.000					
G503	Glycine	2.000	2.000	2.000	2.000		2.000			2.000
B140	D-Biotin	0.050	0.050	0.050	0.050	0.010				
F430	Folic Acid	0.500	0.500	0.500	0.500					
I703	*myo*-Inositol	100.00	100.00	100.00	100.00		100.00			100.00
N765	Nicotinic Acid	5.000	5.000	5.000	5.000	0.100	0.500			1.000
P866	Pyridoxine HCl	0.500	0.500	0.500	0.500		0.500			1.000
T390	Thiamine HCl	0.500	0.500	0.500	0.500		0.100			10.000
F563	D-Fructose					5,000.0				
S391	D-Sucrose	20,000	20,000	20,000	20,000	11,670	20,000	20,000		20,000
A111	Agar		5,000.0	6,000.0		7,000.0				
G434	Gellan Gum (CultureGel™)						3,000			
C184	Casein Hydrolysate	500.000	500.000	500.000	500.000					
P775	Peptone from Meat					1,670.0				
Y892	Yeast Extract					2,000.0				
	Grams of powder to prepare 1 Liter	21.22	26.22	27.22	21.22	27.84	25.35	22.0	79.11	22.71

©2014 PhytoTechnology Laboratories®

Orchid Media Formulations M-O

▼Product Numbers▶		M482	M507	M534	M551	M579	O139	O156	O612	O622
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Malmgren Modified Terrestrial Orchid Medium	Murashige Cattleya Orchid Multiplication Medium	Malmgren Modified Terrestrial Orchid Medium	Malmgren Orchid Medium	Mitra Replate/ Maintenance Medium	Orchid Maintenance/ Replate Medium without Charcoal & Agar	Orchid Maint/Replate Medium with Banana & Charcoal, without Agar	H1 Oat Medium	H2 Oat Medium
A300	Ammonium Nitrate		1650.0				825.0	825.0		
A305	Ammonium Sulfate					100.000				
B210	Boric Acid		6.200			0.600	3.100	3.100		
C266	Calcium Chloride, Anhydrous		333.000				166.000	166.000		
C180	Calcium Nitrate					100.000			96.600	96.600
C274	Calcium Phosphate	75.000		75.000	75.000					
C350	Cobalt Chloride Hexahydrate		0.0250				0.0125	0.0125		
C193	Cobalt Nitrate					0.0500				
C375	Cupric Sulfate Pentahydrate		0.0250			0.0500	0.0125	0.0125		
E410	EDTA, Disodium Salt	37.260		37.260	37.260	22.300	37.300	37.300		
E676	Ferric Sodium EDTA		36.700							
F263	Ferrous Sulfate, Heptahydrate	27.800		27.800	27.800	16.700	27.850	27.850		
M150	Magnesium Sulfate, Anhydrous	97.676	181.000	97.676	97.676	250.000	90.350	90.350	23.900	23.900
M455	Manganese Chloride					0.400				
M250	Manganese Sulfate	1.540	16.900	1.540	1.540		8.450	8.450		
P704	Potassium Chloride								100.000	100.000
P840	Potassium Iodide		0.8300			0.0300	0.4150	0.4150		
P100	Potassium Nitrate		1900.0			180.0	950.0	950.0		
P846	Potassium Phosphate, Monobasic, Anhydrous	75.00	170.00	75.00	75.00		85.00	85.00	200.00	200.00
M651	Sodium Molybdate (VI), Dihydrate		0.2500			0.0500	0.1250	0.1250		
S515	Sodium Phosphate, Monobasic					150.00				
Z101	Zinc Sulfate, Heptahydrate		8.600			0.050	5.300	5.300		
I885	Indole-3-acetic Acid		0.300							
I538	Indole-3-butyric Acid		1.750							
N600	α-Naphthaleneacetic Acid		1.750							
G503	Glycine	2.000	2.000	2.000	2.000					
B140	D-Biotin	0.050		0.050	0.050	0.050				
F430	Folic Acid	0.500		0.500	0.500	0.300				
I703	*myo*-Inositol	100.00	100.00	100.00	100.00		100.00	100.00		
N765	Nicotinic Acid	5.000	0.500	5.000	5.000	1.250	1.000	1.000		
P866	Pyridoxine HCl	5.000	0.500	5.000	5.000	0.300	1.000	1.000		
R779	Riboflavin, Vitamin B2					0.050				
T390	Thiamine HCl	10.000	10.000	10.000	10.000	0.300	10.000	10.000		
G386	D-Glucose, Anhydrous									2,000.0
S391	D-Sucrose		20,000			20,000	20,000	20,000	2,000.0	
A111	Agar				7,000.0	7,000.0			7,000.0	7,000.0
B852	Banana Powder							30,000		
C184	Casein Hydrolysate	400.0		400.0	400.0					
C325	Activated Charcoal	1,000.0		1,000.0	1,000.0	2,000.0		2,000.0		
C277	Citric Acid, Anyhdrous		150.000							
M825	MES, Free Acid						1000.0	1000.0		
n/a	Oats, Rolled								3,000	3,000
P862	Pineapple Powder			20,000	20,000					
P775	Peptone from Meat						2,000.0	2,000.0		
Y892	Yeast Extract								100.000	100.000
	Grams of powder to prepare 1 Liter	1.84	24.57	21.84	28.84	29.82	25.31	57.31	12.52	12.52

Orchid Media Formulations O-P

▼Product Numbers▶		O753	P656	P658	P668	P723	P727	P748	P781	P782
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Orchid Multiplication Medium	*Phyto*Tech™ *Phalaenopsis* Replate Medium	Orchid Maintenance Medium with Charcoal & Agar	Orchid Maintenance Medium with Charcoal, without Agar	Orchid Seed Sowing Medium	Orchid Seed Sowing Medium II	Orchid Maintenance/Replate Medium with Banana, Charcoal, & Agar	*Phyto*Tech™ Orchid Replate Medium with Sucrose	*Phyto*Tech™ Orchid Replate Medium with Sucrose & Gelling Agent
A300	Ammonium Nitrate	825.0	Proprietary Formulation	825.0	825.0	412.5	412.5	825.0	Proprietary Formulation	Proprietary Formulation
B210	Boric Acid	3.100		3.100	3.100	1.650	1.650	3.100		
C266	Calcium Chloride, Anhydrous	166.000		166.000	166.000	83.000	83.000	166.000		
C350	Cobalt Chloride Hexahydrate	0.0125		0.0125	0.0125	0.0063	0.0063	0.0125		
C375	Cupric Sulfate Pentahydrate	0.0125		0.0125	0.0125	0.0063	0.0063	0.0125		
E410	EDTA, Disodium Salt	37.300		37.300	37.300	18.650	18.650	37.300		
F263	Ferrous Sulfate, Heptahydrate	27.850		27.850	27.850	13.930	13.930	27.850		
M150	Magnesium Sulfate, Anhydrous	90.350		90.350	90.350	75.180	75.180	90.350		
M250	Manganese Sulfate	8.450		8.450	8.450	4.230	4.230	8.450		
P840	Potassium Iodide	0.4150		0.4150	0.4150	0.2075	0.2075	0.4150		
P100	Potassium Nitrate	950.0		950.0	950.0	475.0	475.0	950.0		
P846	Potassium Phosphate, Monobasic, Anhydrous	85.00		85.00	85.00	42.50	42.50	85.00		
M651	Sodium Molybdate (VI), Dihydrate	0.1250		0.1250	0.1250	0.0625	0.0625	0.1250		
Z101	Zinc Sulfate, Heptahydrate	5.300		5.300	5.300	2.650	2.650	5.300		
B800	6-Benzylaminopurine (6-BA)	2.000								
N600	α-Naphthaleneacetic Acid	0.500								
I703	*myo*-Inositol	100.00		100.00	100.00	100.00	100.00	100.00		
N765	Nicotinic Acid	0.500		1.000	1.000	1.000	1.000	1.000		
P866	Pyridoxine HCl	0.500		1.000	1.000	1.000	1.000	1.000		
T390	Thiamine HCl	1.000		10.000	10.000	10.000	10.000	10.000		
S391	D-Sucrose	20,000		20,000	20,000	20,000	20,000	20,000		
A111	Agar	7,000		8,000		8,000	8,000	7,000		
B852	Banana Powder							30,000		
C325	Activated Charcoal			2,000.0	2,000.0	1,000.0		2,000.0		
M825	MES, Free Acid	1000.0		1000.0	1000.0	500.0	500.0	1000.0		
P775	Peptone from Meat	2,000.0		2,000.0	2,000.0	2,000.0	2,000.0	2,000.0		
	Grams of powder to prepare 1 Liter	32.30	61.31	35.31	27.31	32.74	31.74	64.31	35.81	43.81

©2014 PhytoTechnology Laboratories®

Orchid Media Formulations P-V

▼Product Numbers▶		P785	P793	T839	T842	T849	V505	V882	V891	V895
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	*Phyto*Tech™ Orchid Replate Medium with Sucrose, Banana, & Gelling Agent	Orchid Multiplication Medium without Charcoal & Agar	Terrestrial (Cypripedium) Orchid Medium, 400 mg/L Calcium Nitrate & 400 mg/L Casein	Terrestrial (Cypripedium) Orchid Medium, 600 mg/L Calcium Nitrate & 200 mg/L Casein	Terrestrial (Cypripedium) Orchid Medium, 400 mg/L Calcium Nitrate, without Casein	Vacin & Went Modified Orchid Basal Salt Mixture	Vacin & Went Modified Orchid Medium without Sucrose	Vacin & Went Orchid Medium with Sucrose	Vacin & Went Modified Orchid Medium with Agar & Sucrose
A114	Ammonium Citrate, Dibasic	Proprietary Formulation		19.000	19.000	19.000				
A300	Ammonium Nitrate		825.0			1400.0				
B210	Boric Acid		3.100	0.500	0.500	0.500	500.000	500.000	500.000	500.000
C266	Calcium Chloride, Anhydrous		166.000							
C180	Calcium Nitrate			400.000	600.000	400.000				
C274	Calcium Phosphate						200.000	200.000	200.000	200.000
C350	Cobalt Chloride Hexahydrate		0.0125							
C375	Cupric Sulfate Pentahydrate		0.0125	0.0250	0.0250	0.0250				
E410	EDTA, Disodium Salt		37.300				37.260	37.260	37.260	37.260
F374	Ferric Ammonium Citrate			25.000	25.000	25.000				
F263	Ferrous Sulfate, Heptahydrate		27.850				27.800	27.800	27.800	27.800
M150	Magnesium Sulfate, Anhydrous		90.350	97.699	97.699	97.699	122.100	122.100	122.100	122.100
M250	Manganese Sulfate		8.450	1.540	1.540	1.540	5.600	5.600	5.600	5.600
P704	Potassium Chloride			100.000	100.000	100.000				
P840	Potassium Iodide		0.4150	0.1000	0.1000	0.1000				
P100	Potassium Nitrate		950.0	200.0	200.0	200.0	525.0	525.0	525.0	525.0
P846	Potassium Phosphate, Monobasic, Anhydrous		85.00	200.00	200.00	200.00	250.00	250.00	250.00	250.00
M651	Sodium Molybdate (VI), Dihydrate		0.1250	0.0200	0.0200	0.0200				
Z101	Zinc Sulfate, Heptahydrate		5.300	0.500	0.500	0.500				
B800	6-Benzylaminopurine (6-BA)		2.000							
N600	α-Naphthaleneacetic Acid		0.500							
I703	*myo*-Inositol		100.00							
N765	Nicotinic Acid		0.500							
P866	Pyridoxine HCl		0.500							
T390	Thiamine HCl		1.000					0.400	0.400	0.400
G386	D-Glucose, Anhydrous			20,000	20,000	20,000				
S391	D-Sucrose		20,000						20,000	20,000
A111	Agar			6,000.0	6,000.0	6,000.0				7,000.0
C184	Casein Hydrolysate			400.000	200.000					
M825	MES, Free Acid		1000.0							
P775	Peptone from Meat		2,000.0							
	Grams of powder to prepare 1 Liter	65.79	25.30	27.44	27.44	28.44	1.67	1.67	21.67	28.67

Vitamin Formulations C-M

▼Product Numbers▶		C149	E330	G249	G219	K421	M587	M592	M547
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Chu's N6 Vitamin Solution (1000x)	Eriksson Vitamin Solution (1000x)	Gamborg Vitamin Powder (1000x)	Gamborg Vitamin Solution (1000x)	Kao & Michayluk Vitamin Solution (100x)	Morel & Martin Vitamin Solution (100x)	Morel & Wetmore Vitamin Solution (100x)	Murashige & Skoog Modified Vitamin Powder (1000x)
G503	Glycine	2,000.0	2,000.0						2,000.0
A103	p-Aminobenzoic Acid					2.0			
A106	L-Ascorbic Acid					200.0			
B140	D-Biotin					1.0	1.0	1.0	
C186	Calcium Pantothenate					100.0	100.0	100.0	
C232	Choline Chloride					100.0			
C242	Cyanocobalamin, Vitamin B12					2.0			
F430	Folic Acid					40.0			
I703	*myo*-Inositol			100,000	100,000	10,000.0	10,000.0	10,000.0	100,000
N609	Niacinamide					100.0			
N765	Nicotinic Acid	500.0	500.0	1,000.0	1,000.0		100.0	100.0	500.0
P866	Pyridoxine HCl	500.0	500.0	1,000.0	1,000.0	100.0	100.0	100.0	500.0
n/a	Retinol, Vitamin A					1.0			
R779	Riboflavin, Vitamin B2					20.0			
T390	Thiamine HCl	1,000.0	500.0	10,000.0	10,000.0	100.0		100.0	1,000.0
	Grams of powder to prepare 1 Liter	n/a	n/a	11.2	n/a	n/a	n/a	n/a	104

Vitamin Formulations M-S

▼Product Numbers▶		M557	M533	M553	N608	N603	S826	S743
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Murashige & Skoog Modified Vitamin Solution (1000x)	Murashige & Skoog Vitamin Powder (1000x)	Murashige & Skoog Vitamin Solution (1000x)	Nitsch & Nitsch Vitamin Powder (1000x)	Nitsch & Nitsch Vitamin Solution (1000x)	Schenk & Hildebrandt Vitamin Powder (100x)	Staba Modified Vitamin Solution (100x)
G503	Glycine	2,000.0	2,000.0	2,000.0	2,000.0	2,000.0		
A103	p-Aminobenzoic Acid							50.0
B140	D-Biotin				50.0	50.0		100.0
C186	Calcium Pantothenate							100.0
C232	Choline Chloride							100.0
C242	Cyanocobalamin, Vitamin B12							0.150
F430	Folic Acid				500.0	500.0		50.0
I703	*myo*-Inositol	100,000	100,000	100,000	100,000.0	100,000.0	100,000.0	10,000.0
N609	Niacinamide							200.0
N765	Nicotinic Acid	500.0	500.0	500.0	5,000.0	5,000.0	500.0	
P866	Pyridoxine HCl	500.0	500.0	500.0	500.0	500.0	50.0	200.0
R779	Riboflavin, Vitamin B2							50.0
T390	Thiamine HCl	1,000.0	100.0	100.0	500.0	500.0	500.0	100.0
	Grams of powder to prepare 1 Liter	n/a	103.1	n/a	108.6	n/a	101.05	n/a

©2014 PhytoTechnology Laboratories®

Microbiology Formulations B-L

▼Product Numbers▶		B129	C442	C443	C506	H289	L301	L465	L475	L476
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Bacteria Screening Medium 523	Corn Meal Agar	Czapek-Dox Broth	Czapek-Dox Agar	Hanahan's Broth	LB Broth Solution, Miller Modification	LB Agar, Miller Modification	LB Broth, Miller Modification	L&W Sterility Test Medium
A300	Ammonium Nitrate									825.00
B210	Boric Acid									3.10
C266	Calcium Chloride, Anhydrous									166.10
C350	Cobalt Chloride Hexahydrate									0.01
C375	Cupric Sulfate Pentahydrate									0.01
E410	EDTA, Disodium Salt									18.63
F263	Ferrous Sulfate			10.00	10.00					13.90
M150	Magnesium Sulfate, Anhydrous			500.00	500.00	2,400				90.35
M200	Magnesium Sulfate, Heptahydrate	150.00								
M250	Manganese Sulfate									8.45
M651	Sodium Molybdate (VI), Dihydrate									0.13
P704	Potassium Chloride			500.00	500.00	186.00				
P840	Potassium Iodide									0.42
P100	Potassium Nitrate									950.00
P705	Potassium Phosphate, Dibasic			1,000	1,000					
P846	Potassium Phosphate, Monobasic, Anhydrous	2,000								85.00
S624	Sodium Chloride					500.00	10,000	10,000	10,000	2,000
S802	Sodium Nitrate			3,000	3,000					
Z101	Zinc Sulfate Heptahydrate									4.30
A111	Agar	8,000	7,000		15,000			12,000		
C184	Casein Hydrolysate	8000.00								
n/a	Corn Meal, Yellow		15,000							
G386	D-Glucose, Anhydrous									5000.00
G503	Glycine									1.00
M567	Meat Extract									7000.00
I703	*myo*-Inositol									50.00
N765	Nicotinic Acid									0.25
P775	Peptone from Meat									4000.00
P866	Pyridoxine HCl									0.25
S391	D-Sucrose	10,000		30,000	30,000					15000
T390	Thiamine HCl									0.05
T832	Tryptone					20,000	10,000	10,000	10,000	
Y892	Yeast Extract	4000.00				5000.00	5000.00	5000.00	5000.00	10000
	Grams of powder to prepare 1 Liter	32.15	22.00	35.01	50.01	28.09	25.00	37.00	25.00	45.22

Microbiology Formulations L-M

▼Product Numbers▶		L5128	L5138	L5190	L585	L591	M484	M498	M580	M5506
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	LB Agar, Lennox L Modification	LB Broth, Lennox L Modification	LB Broth, Lennox L Modification (ADP Free)	LB Broth Solution, Lennox L Modification	LB Broth Solution with Glycerol, Lennox L Modification	Malt Extract Broth	Malt Extract Agar	Melin-Norkran's Modified Medium	Malt Extract Agar with Glucose & Maltose
A113	Ammonium Phosphate								184.70	
C266	Calcium Chloride, Anhydrous								50.00	
E676	Ferric Sodium EDTA								20.00	
M150	Magnesium Sulfate, Anhydrous								35.80	
P846	Potassium Phosphate, Monobasic, Anhydrous								500.00	
S624	Sodium Chloride	5,000	5,000	5,000	5,000	5,000			25.00	
A111	Agar							15,000	7,000	15,000
G386	D-Glucose, Anhydrous									6000
G381	Glycerol (mL) Density = 1.261 g/mL					4.00				
M474	Malt Extract						17,000	30,000	3000	6000
M588	D-Maltose									1800
P775	Peptone from Meat						3000	3000		
P721	Peptone from Soymeal			14000						
S391	D-Sucrose								10,000	
T390	Thiamine HCl								0.10	
T832	Tryptone	10,000	10,000		10,000	10,000				
Y892	Yeast Extract	5000	5000	5000	5000	5000				1200
	Grams of powder to prepare 1 Liter	20.00	20.00	24.00	n/a	n/a	20.00	48.00	20.82	30.00

©2014 PhytoTechnology Laboratories®

Microbiology Formulations N-S

▼Product Numbers▶		N601	N611	O606	P632	P732	P762	P772	S657	S7478	S7536
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Nutrient Agar	Nutrient Broth	Oatmeal Agar	Peptone Water	Peptone Water, Buffered	Potato Dextrose Broth	Potato Dextrose Agar	SOC Medium Solution	Sordaria Crossing Agar	Sabouraud Dextrose Broth
M150	Magnesium Sulfate, Anhydrous								2,400		
P704	Potassium Chloride								186		
P846	Potassium Phosphate, Monobasic, Anhydrous					1,500				100	
S624	Sodium Chloride				5,000	5,000			500		
S745	Sodium Phosphate, Dibasic					3,500					
A111	Agar	15,000		7,000				15,000		15,000	
n/a	Corn Meal, Yellow									2000	
G386	D-Glucose, Anhydrous						20,000	20,000	3600	7000	10,000
M567	Meat Extract	3000	3000								
n/a	Oats, Rolled			3500							
P775	Peptone from Meat	5000	5000		15,000	10,000					10,000
n/a	Potato Infusion						4000	4000			
S391	D-Sucrose									10,000	
T832	Tryptone								20,000		
Y892	Yeast Extract								5,000	1000	
	Grams of powder to prepare 1 Liter	23.00	8.00	10.50	20.00	20.00	24.00	39.00	n/a	35.10	20.00

Microbiology Formulations T-Y

▼Product Numbers▶		T754	T760	T7900	T8000	W887	Y8480	Y8488	Y8565	Y889	Y893
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	Terrific Broth Solution with Glycerol	Terrific Broth	Tryptic Soy Broth	Tryptic Soy Broth, Type II	Wilkins Chalgren Agar	YEP Medium (ADP Free)	Yeast Malt Broth	YEP Broth	YEP Medium	YMB Medium
M150	Magnesium Sulfate, Anhydrous										200
P705	Potassium Phosphate, Dibasic	9,400	9,400		2,500						500
P846	Potassium Phosphate, Monobasic, Anhydrous	2,200	2,200								
S624	Sodium Chloride			5,000	5,000	5,000	5,000		5,000	5,000	100
A111	Agar					10,000	15,000			15,000	15,000
A143	L-Arginine, Free Base					1,000					
G386	D-Glucose, Anhydrous				2500	1000		10,000			
G381	Glycerol (mL)	4									
n/a	Haemin					5					
M474	Malt Extract							3000			
M562	D-Mannitol										10,000
n/a	Menadione					0.50					
P775	Peptone from Meat							5000	10,000	10,000	
P780	Peptone, Glysate					10,000					
P721	Peptone from Soymeal			5000	3000		15,000				
n/a	Pyruvic Acid, Potassium Salt					1000					
T832	Tryptone	11,800	11,800	15,000	17,000	10,000					
Y892	Yeast Extract	23,600	23,600			5000	10,000	3000	10,000	10,000	400
	Grams of powder to prepare 1 Liter	n/a	47	25	30	43.01	45	21	25	40	26.20

©2014 PhytoTechnology Laboratories®

Phycology Formulations

▼Product Numbers▶		B1411	B1511	B1650	B1675	F3222	G3454	S7668	T8050	T8224
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	BG-11 (Blue-green) Medium Solution 50x	BG-11 (Blue-green) Medium	Bold's Basal Medium (BBM) Solution 50x	Bold's Basal Medium (BBM)	f/2 Guillard's Marine Enriched Seawater	f/2 Guillard's Marine Enriched Seawater without Silicate	Sueoka's High Salt Medium	Tris-Acetate-Phosphate (TAP) Medium Solution (1x)	Tris-Acetate-Phosphate (TAP) Medium
A109	Ammonium Chloride							500.00	400.00	400.00
A112	Ammonium Molybdate, Tetrahydrate							1.10	1.10	1.10
B210	Boric Acid	143	2.86	571	11.42			11.40	11.40	11.40
C266	Calcium Chloride, Anhydrous	1359	27.18	943.5	18.87			7.55	37.74	37.74
C350	Cobalt Chloride Hexahydrate					0.01	0.01	1.61	1.61	1.61
C193	Cobalt Nitrate	2.45	0.049	24.5	0.49					
C375	Cupric Sulfate Pentahydrate	3.95	0.079	78.5	1.57	0.01	0.01	1.57	1.57	1.57
E410	EDTA, Disodium Salt	50	1	3184.5	63.69	4.36	4.36	50.00	50.00	50.00
F374	Ferric Ammonium Citrate	300	6							
F383	Ferric Chloride					1.9	1.9			
F388	Ferric Sulfate, Septahydrate			249	4.98					
F263	Ferrous Sulfate*7H2O							4.99	4.99	4.99
M150	Magnesium Sulfate, Anhydrous			1831.5	36.63			9.77		48.84
M200	Magnesium Sulfate, Heptahydrate	3750	75						100.00	
M455	Manganese Chloride	90.5	1.81	72	1.44	0.18	0.18	5.06	5.06	5.06
M651	Sodium Molybdate (VI), Dihydrate	19.5	0.39	59.5	1.19	0.006	0.006			
P672	Potassium Hydroxide			1550	31					
P705	Potassium Phosphate, Dibasic	2000	40	3750	75			1440	108.00	108.00
P846	Potassium Phosphate, Monobasic, Anhydrous			8750	175			720	54.00	54.00
S624	Sodium Chloride			1250	25					
S7550	Sodium Carbonate Anhydrous	1000	20							
n/a	Sodium Metasilicate, Anhydrous					12.94				
S802	Sodium Nitrate	75,000	1500	12500	250	75	75			
S515	Sodium Phosphate, Monobasic					5	5			
Z101	Zinc Sulfate Heptahydrate	11.1	0.222	441	8.82	0.022	0.022	22.00	22.00	22.00
B140	D-Biotin					0.0005	0.0005			
C277	Citric Acid, Anyhdrous	300	6							
C242	Cyanocobalamin, Vitamin B12					0.0005	0.0005			
T390	Thiamine HCl					0.1	0.1			
T838	Tris-Base								2420.00	2420.00
	Grams of powder to prepare 1 Liter	n/a	1.68	n/a	0.705	0.10	0.09	2.78	n/a	3.17

Seed Testing Formulations

▼Product Numbers▶		K5013	M5516	P6800	X8454
	Media Names are listed to the right▶ ▼Component Descriptions are listed below All components are expressed in mg/L unless otherwise noted in the component description.	King's B Medium	mD5A Medium	*Phyto*Select Basal Medium	XTS Medium
A109	Ammonium Chloride		1000	1000	
F263	Ferrous Sulfate			9	
M150	Magnesium Sulfate, Anhydrous	730		250	
M200	Magnesium Sulfate, Heptahydrate		300		
P705	Potassium Phosphate, Dibasic	1500	3000		
P846	Potassium Phosphate, Monobasic, Anhydrous			3000	
S515	Sodium Phosphate, Monobasic		1150	5665	
A111	Agar	15000	15000	15000	15000
G386	D-Glucose, Anhydrous				5000
M567	Meat Extract				3000
P775	Peptone from Meat	20000			5000
C1830	Crystal Violet			3	
	Grams of powder to prepare 1 Liter	37.23		24.93	28.00

©2014 PhytoTechnology Laboratories®

PhytoTechnology Laboratories Product Index

All Products Listed Alphabetically A-Z

A

A102 - (+/-)-Abscisic Acid 17
A256 - Acetic Acid, Glacial 17
A104 - Acetosyringone 131
A1104 - Acetosyringone 100 mM Solution 131
A118 - Acetylsalicylic Acid 17
A120 - Adenine 17
A545 - Adenine Hemisulfate 17
A137 - African Violet Multiplication Kit 176
A296 - Agar, Plant TC, Micropropagation Grade - Gelidium 17
A111 - Agar, Plant TC, Micropropagation Grade - Gracilaria 17
A175 - Agar, TC; Purified Grade - Gelidium 18
A133 - Agargellan™ 18
A110 - Agarose 18
A1050 - LE Agarose 131
A1315 - Agarose, Low Gelling Temp, SeaPlaque® 18
A105 - Agarose, Low Gelling Temperature 18
A121 - L-Alanine 18
A1286 - Alcian Blue 162
A108 - Alginic Acid, Sodium Salt 18
A127 - Aluminum Chloride Hexahydrate 19
A103 - p-Aminobenzoic Acid 19
A109 - Ammonium Chloride 19
A114 - Ammonium Citrate, Dibasic 19
A112 - Ammonium Molybdate (VI) Tetrahydrate 19
A300 - Ammonium Nitrate 19
A113 - Ammonium Phosphate, Monobasic 19
A305 - Ammonium Sulfate 19
A122 - Amoxicillin Trihydrate 131
A119 - Amphotericin B 131
A1116 - Ampicillin Solution (100 mg/mL) 131
A116 - Ampicillin, Sodium Salt 131
A123 - Ancymidol 20
A267 - Anderson Basal Salt Mixture 58
A1272 - Aniline Blue 162
A126 - Antioxidant Mixture 20
W598 - Antistatic Pour Boats 213
W578 - Antistatic Pour Boats 213
W568 - Antistatic Pour Boats 213
A124 - Apple Powder 20
A143 - L-Arginine, Free Base 20
A106 - L-Ascorbic Acid 20
A107 - L-Asparagine 20
A117 - L-Aspartic Acid, Free Acid 20
T789 - Autoclave Indicator Tape 210
T998 - Autoclave Indicator Tape 210
A147 - Auxindole™ 21

B

B132 - Bacitracin Zinc 132
B129 - Bacteria Screening Medium 523 150
B129 - Bacteria Screening Medium 523 158
B999 - Bags, Resealable 185
B798 - Balance, Electronic, 200 g x 0.01 g 185
B929 - Balance, Electronic, Ohaus 186
B936 - Balance, Electronic, Ohaus 186
B809 - Balance, Electronic, Ohaus, 220 V 185
B901 - Balance, Electronic, Portable/ Economy Model 185
B817 - Balance, Triple Beam with Tare, Salter Brecknell 186
B144 - Banana AGS Basal Medium 58
B852 - Banana Powder 21
B910 - Beakers, Graduated, Polymethyl Pentene 186
B931 - Beakers, Graduated, Polymethyl Pentene 186
B939 - Beakers, Graduated, Polymethyl Pentene 186
B960 - Beakers, Graduated, Polymethyl Pentene 186
B161 - Beakers, Graduated, Polypropylene 187
B188 - Beakers, Graduated, Polypropylene 187
B192 - Beakers, Graduated, Polypropylene 187
B199 - Beakers, Graduated, Polypropylene 187
B265 - Beakers, Griffin, Polypropylene 187
B310 - Beakers, Griffin, Polypropylene 187
B220 - Beakers, Tri-Pour, Graduated 187
B223 - Beakers, Tri-Pour, Graduated 187
B225 - Beakers, Tri-Pour, Graduated 187
B439 - Beard Cover, 18 in 187
B151 - N6-Benzoyladenine 21
B202 - N-Benzyl-9-(2-tetrahydropyranyl) Adenine 22
B800 - 6-Benzylaminopurine 21
B130 - 6-Benzylaminopurine Solution (1 mg/mL) 21
B131 - Bialaphos 132
B1730 - Bialaphos Solution (1mg/mL) 132
B162 - BIS-TRIS 132
B514 - Blaydes Basal Medium 59
X884 - Blue-Gal 132
B1511 - Blue-Green Medium (BG-11) 170
B1411 - Blue-Green Medium (BG-11) 50x Concentrate Solution 170
B141 - BM-1 Terrestrial Orchid Medium With Agar 60
B138 - BM-1 Terrestrial Orchid Medium Without Agar 59
B142 - BM-2 Terrestrial Orchid Medium With Agar 61
B470 - BM-2 Terrestrial Orchid Medium Without Agar 60
B1675 - Bold's Basal Medium (BBM) 171
B1650 - Bold's Basal Medium (BBM) 50x Concentrate Solution 171
B693 - Book, Orchid Seed Germination Media 188
B059 - Book, Orchids to Know & Grow 188
B050 - Book, Plant Tissue Culture Concepts & Laboratory Exercises 189
B051 - Book, Plants from Test Tubes 189
B023 - Book, The Color Encyclopedia of Daylilies 188
B044 - Book, The Illustrated Encyclopedia of Orchids 188
B210 - Boric Acid 22
B619 - Boric Acid, USP Grade 22
B027 - Bottle, Laboratory Wash Solution 189
B063 - Bottle, Laboratory Wash Solution 189
B974 - Bottle, Laboratory Wash Solution 189

B987 - Bottle, Laboratory Wash Solution 189
B441 - Bradford Reagent 132
B1396 - Broadleaf Tree Basal Medium 61
B148 - 4-Bromophenoxyacetic Acid 22
B1714 - Bromothymol Blue 162
B155 - Bromoxynil 22
B237 - Buffer Solution, pH Reference Standard, pH 10.0 ± 0.02 at 25 °C 23
B235 - Buffer Solution, pH Reference Standard, pH 4.0 ± 0.02 at 25 °C 22
B236 - Buffer Solution, pH Reference Standard, pH 7.0 ± 0.02 at 25 °C 22
B966 - Bunsen Burner 190
B876 - Burner, Alcohol 189

C

C266 - Calcium Chloride Anhydrous 23
C625 - Calcium Chloride Anhydrous 23
C135 - Calcium Chloride Dihydrate 23
C231 - Calcium Gluconate Monohydrate 23
C180 - Calcium Nitrate 23
C186 - Calcium Pantothenate 23
C274 - Calcium Phosphate, Tribasic 23
C134 - Calcium Silicate 24
C1933 - Calcofluor White M2R 24
C1835 - Cape Sundew & Venus Flytrap Tissue Culture Kit 177
C206 - Cape SundewithVenus Flytrap Multiplication Basal Medium 62
C216 - Cape SundewithVenus Flytrap Pretransplant Basal Medium 62
C1888 - Carbendazim 132
C540 - Carbenicillin Solution (100 mg/mL) 133
C2046 - Carbenicillin Solution (250 mg/mL) 133
C346 - Carbenicillin, Disodium Salt 132
C1935 - Carnivorous Plant (Nepenthes) Basal Salt Mixture 63
C257 - Carrageenan 24
C2000 - Carrageenan, High Clarity 24
C212 - Carrot Callus Initiation Basal Medium 63
C222 - Carrot Shoot Development Basal Medium 64
C1955 - Carrot Tissue Culture Kit 177
C184 - Casein, Enzymatic Hydrolysate 24
C537 - Cefotaxime Solution (100 mg/mL) 133
C1880 - Cefotaxime Solution (250 mg/mL) 133
C380 - Cefotaxime, Sodium Salt 133
C1842 - Cellobiose 162
C224 - Cellulase, Onozuka R-10 24
C214 - Cellulase, Onozuka RS 24
C201 - Centrifuge, Micro 190
C251 - Centrifuge, Micro-Digital 190
C1970 - Cephalexin Monohydrate 162
C2112 - Cephalexin Solution (100 mg/mL) 163
C526 - CHAPS 133
C325 - Charcoal, Activated 25
C287 - Chee & Pool C2d Vitis Basal Medium 64
C252 - Chloramphenicol 134
C2010 - Chloramphenicol Solution (10 mg/mL) 134
C207 - Chlormequat Chloride 25
C213 - p-Chlorophenoxyacetic Acid 25
V883 - Cholecalciferol 25
C232 - Choline Chloride 25
C167 - Chu N6 Basal Medium with Vitamins 65
C416 - Chu N6 Basal Salt Mixture 65
C149 - Chu N6 Vitamin Solution (1000x) 64
C283 - trans-Cinnamic Acid 25
C277 - Citric Acid Anhydrous 25
C152 - Closure, Silicone Sponge 192
C164 - Closure, Silicone Sponge 192
C450 - Closure, Silicone Sponge 192
C945 - Closures, Culture Tube, Bellco® 191
C069 - Closures, Culture Tube, Kim-Kap™ 191
C163 - Closures, Culture Tube, Kim-Kap™ 191
C070 - Closures, *Phyto*Cap™ 191
C176 - Closures, *Phyto*Cap™ 191
C203 - Closures, *Phyto*Con™-L, Round, Replacement Lid 191
C174 - Closures, *Phyto*Con™-L, Round, Replacement Lid 191
C1820 - Closures, Round, 120 mm, Vented 192
C566 - Closures, Round, 70 mm Screw Cap 192
C170 - Closures, Round, 70 mm Screw Cap 192
C579 - Closures, Round, 89 mm Screw Cap 192
C2055 - Closures, Round, 89 mm Screw Cap 192
C350 - Cobalt Chloride Hexahydrate 26
C193 - Cobalt Nitrate Hexahydrate 26
C2124 - Cobalt Sulfate, Heptahydrate 171
C187 - Coconut Powder 26
C195 - Coconut Water 26
C226 - Colchicine 26
C466 - Copper(II) Sulfate Solution (4%) 134
C442 - Corn Meal Agar 158
C238 - Coveralls, Disposable 193
C239 - Coveralls, Disposable 193
C240 - Coveralls, Disposable 193
C440 - Coveralls, Disposable 193
C279 - 4-CPPU 26
C1830 - Crystal Violet 163
H276 - CTAB 134
H3818 - CTAB Solution (100 mg/mL) 134
C1898 - Culture Tube, Flip-Cap, Sterile 194
C930 - Culture Tubes, Borosilicate Glass 194
C935 - Culture Tubes, Borosilicate Glass 194
C1770 - Culture Vessel, Baby Food Jar 193
C2099 - Culture Vessel, Baby Food Jar Sample Pack 193
C2125 - Culture Vessel, PTcon™ Sample Pack 195
C209 - Culture Vessels, *Phyto*Con™ 194
C215 - Culture Vessels, *Phyto*Con™ 194
C221 - Culture Vessels, *Phyto*Con™ 194
C1755 - Culture Vessels, PTcon™ 194
C1765 - Culture Vessels, PTcon™ 194
C1775 - Culture Vessels, PTcon™ 194
C583 - Culture Vessels, Round, Glass Jar 195
C590 - Culture Vessels, Round, Glass Jar 195
C597 - Culture Vessels, Round, Glass Jar 195
C031 - Culture Vessels, Round, Glass Jar 195
C607 - Culture Vessels, Round, Glass Jar 195

©2014 PhytoTechnology Laboratories®

C1958 - Culture Vessels, SteriCon™ 195
C2118 - Culture Vessels, SteriCon™ 195
C1932 - Culture Vessels, SteriCon™ 195
C085 - Cup, Measuring, Graduated 195
C375 - Cupric Sulfate 26
C628 - Cupric Sulfate Pentahydrate, USP Grade 27
C242 - Cyanocobalamin 27
C1989 - Cycloheximide 134
C1796 - Cycloheximide Solution (100 mg/mL) 135
C962 - Cylinders, Graduated, Polymethyl Pentene 196
C964 - Cylinders, Graduated, Polymethyl Pentene 196
C968 - Cylinders, Graduated, Polymethyl Pentene 196
C972 - Cylinders, Graduated, Polymethyl Pentene 196
C204 - L-Cysteine, Free Base 27
C248 - L-Cystine, Free Base 27
C506 - Czapek–Dox Agar 158
C443 - Czapek–Dox Broth 159

D

D2362 - DAPI 27
B140 - D-Biotin 21
D146 - DCR Basal Salt Mixture 65
D2206 - De Greef & Jacobs Medium 66
D308 - Dextran Sulfate, Sodium Salt 27
S7484 - Diack® Sterilization Monitor 209
D159 - Dicamba 27
D165 - Dicamba Solution (1 mg/mL) 28
D253 - Dichloroisocyanuric Acid, Sodium Salt 28
D295 - 2,4-Dichlorophenoxyacetic Acid Solution (1 mg/mL) 28
D309 - 2,4-Dichlorophenoxyacetic Acid Solution (10 mg/mL) 28
D297 - Dikegulac 28
D241 - Dimethyl Sulfoxide 135
D525 - 6-(γ,γ-Dimethylallylamino)purine 28
D341 - 6-(γ,γ-Dimethylallylamino)purine Dihydrochloride 28
D217 - 6-(γ,γ-Dimethylallylamino)purine Solution (1 mg/mL) 29
D259 - Dithiothreitol 29
D191 - DKW Basal Medium 66
D189 - DKW Basal Medium 67
D2470 - DKW Basal Medium with Vitamins 68
D190 - DKW Basal Salt Mixture 67
M5536 - DL-Malic Acid 37
G523 - DL-Phosphinothricin Solution (1 mg/mL) 135
P679 - DL-Phosphinothricin, Monoammonium Salt 135
M588 - D-Maltose Monohydrate 37
M562 - D-Mannitol 38
D548 - DNA Denaturing Solution 135
D2251 - DNA Extraction System for Plant Genomic DNA 136
D2275 - DNA Extraction System for Plant Genomic DNA 136
D2126 - DNA Extraction System for Plasmid DNA 136
D2179 - DNA Extraction System for Plasmid DNA 136
D2231 - DNA Extraction System for Plasmid DNA 136
D2300 - DNA Ladders, Viogene® VioEasy™ 137
D2450 - DNA Ladders, Viogene® VioEasy™ 137
D544 - DNA Neutralizing Solution, pH 7.4 137

E

E575 - Economou & Read Basal Medium 68
E582 - EDTA Solution 0.5 M, pH 8.0 137
E244 - 2,4-Epibrassinolide 29
O799 - Epiphytic Orchid Seed Sowing Kit 180
E330 - Eriksson Vitamin Solution (1000x) 68
E344 - Erythromycin 137
E349 - Ethylenediamine Bis(2-hydroxyphenylacetic Acid), Ferric-Sodium Salt 29
E410 - Ethylenediaminetetraacetic Acid, Disodium Salt 29
E676 - Ethylenediaminetetraacetic Acid, Ferric-Sodium Salt 29
E316 - Ethylenediaminetetraacetic Acid, Free Acid 137
E2799 - Evans Blue 30
E333 - EXS IIIa™ Basal Medium with Adenine 69
E337 - EXS III™ Basal Medium without Adenine 69

F

F3222 - f/2 Guillard's Marine Enriched Seawater 172
G3454 - f/2 Guillard's Marine Enriched Seawater without Silicate 172
F3178 - Fast Green (FCF) 163
F522 - Fast Terrestrial Orchid Medium 69
F354 - Fern Multiplication Kit 178
F374 - Ferric Ammonium Citrate 30
F3138 - Ferric Ammonium Sulfate 172
F2876 - Ferric Chloride, Anhydrous 173
F383 - Ferric Chloride, Hexahydrate 30
F352 - Ferric Citrate 30
F388 - Ferric Sulfate Hydrate 30
F263 - Ferrous Sulfate Heptahydrate 30
F629 - Ferrous Sulfate Heptahydrate 31
F318 - Ferrous Sulfate/Chelate Solution (100x) 30
F934 - Flasks, Erlenmeyer 196
F938 - Flasks, Erlenmeyer 196
F979 - Flasks, Erlenmeyer 196
F980 - Flasks, Erlenmeyer 196
F985 - Flasks, Erlenmeyer 196
F986 - Flasks, Erlenmeyer 196
F2950 - Fluorescein Diacetate (FDA) 31
F357 - Fluridone 31
F376 - Flurprimidol 31
F041 - Foil, Aluminum 196
F035 - Foil, Aluminum 196
F430 - Folic Acid 31
F303 - Forceps, Bayonet, Miltex® 196
F312 - Forceps, Bayonet, Miltex® 196
F633 - Forceps, Bayonet, Miltex® 196
F639 - Forceps, Bayonet, Miltex® 196
F315 - Forceps, Bayonet, Miltex® 196
F083 - Forceps, Bayonet, Utility Grade 196
F081 - Forceps, Bayonet, Utility Grade 196
F957 - Forceps, Bayonet, Utility Grade 196
F955 - Forceps, Curved, Utility Grade 197
F956 - Forceps, Curved, Utility Grade 197
F292 - Forceps, Dressing, 10 in, Tungsten Carbide 197
F178 - Forceps, Dressing, Fine Point, Miltex® 197
F208 - Forceps, Dressing, Fine Point, Miltex® 197

F246 - Forceps, Dressing, Miltex® 197
F228 - Forceps, Dressing, Miltex® 197
F268 - Forceps, Dressing, Miltex® 197
F261 - Forceps, Dressing, Miltex® 197
F3158 - Forceps, Dressing, Miltex® 197
F272 - Forceps, Dressing, Miltex® 197
F950 - Forceps, Dressing, Utility Grade 197
F951 - Forceps, Dressing, Utility Grade 197
F952 - Forceps, Dressing, Utility Grade 197
F953 - Forceps, Dressing, Utility Grade 197
F328 - Forceps, Dressing, Utility Grade 197
F347 - Forceps, Dressing, Utility Grade 197
F343 - Forceps, Fine Point, Utility Grade 197
F340 - Forceps, Fine Point, Utility Grade 197
F086 - Forceps, Fine Point, Utility Grade 197
F335 - Forceps, Fine Point, Utility Grade 197
F028 - Forceps, Fine Point, Utility Grade 197
F091 - Forceps, Fine Point, Utility Grade 197
F563 - D-(-)-Fructose 31
F356 - Fumaric Acid, Free Acid 31

G

G810 - G418 Sulfate 138
G398 - Gamborg B-5 Basal Medium 70
G768 - Gamborg Basal Salt Mixture (B-5 Salts) 70
G249 - Gamborg Vitamin Powder (1000x) 70
G219 - Gamborg Vitamin Solution (1000x) 71
G434 - Gellan Gum Powder 32
G3251 - Gelzan™ 32
G3410 - Gentamicin Solution (100 mg/mL) 138
G3350 - Gentamicin Solution (50 mg/mL) 138
G570 - Gentamicin Sulfate 138
G500 - Gibberellic Acid 32
G198 - Gibberellic Acid Solution (1 mg/mL) 32
G362 - Gibberellic Acid Solution (13 mg/mL)(13,000 ppm) 32
G358 - Gibberellins A4 + A7 32
S638 - Glass Beads 209
C284 - Glassware Cleaner/Detergent 190
G368 - Glove Dispenser 198
G092 - Gloves, Autoclave 197
G089 - Gloves, Autoclave 197
G405 - Gloves, Latex, Low Powder 198
G406 - Gloves, Latex, Low Powder 198
G408 - Gloves, Latex, Low Powder 198
G412 - Gloves, Latex, Low Powder 198
G414 - Gloves, Latex, Powder Free 198
G415 - Gloves, Latex, Powder Free 198
G417 - Gloves, Latex, Powder Free 198
G418 - Gloves, Latex, Powder Free 198
G3314 - Gloves, Nitrile, Black, Powder Free 199
G453 - Gloves, Nitrile, Low Powder 198
G454 - Gloves, Nitrile, Low Powder 198
G456 - Gloves, Nitrile, Low Powder 198
G457 - Gloves, Nitrile, Low Powder 198
G941 - Gloves, Nitrile, Powder Free 198
G946 - Gloves, Nitrile, Powder Free 198
G948 - Gloves, Nitrile, Powder Free 198
G949 - Gloves, Nitrile, Powder Free 198
G361 - Gloves, PVC Vinyl, Light Powder 199
G366 - Gloves, PVC Vinyl, Light Powder 199
G367 - Gloves, PVC Vinyl, Light Powder 199
G377 - Gloves, PVC Vinyl, Light Powder 199
G317 - Gloves, PVC Vinyl, Powder Free 199
G319 - Gloves, PVC Vinyl, Powder Free 199
G324 - Gloves, PVC Vinyl, Powder Free 199
G327 - Gloves, PVC Vinyl, Powder Free 199
G386 - D-(+)-Glucose Anhydrous 32
G360 - D-(+)-Glucose Monohydrate 33
G399 - L-Glutamic Acid 33
G229 - L-Glutamine 33
G3399 - Glutathione (Reduced), Free Acid 33
G381 - Glycerol 33
G503 - Glycine 33
G345 - Glyphosate 33
G371 - Gresshoff & Doy Basal Medium 71
G3574 - Guaiacol 164
G3300 - Guanidine Thiocyanate 138

H

O612 - H1 Oat Medium 72
O622 - H2 Oat Medium 72
H332 - Hairnets, Spunbound Polypropylene 199
H336 - Hairnets, Spunbound Polypropylene 199
H289 - Hanahan's Broth 150
H049 - Heat Sealer 199
H393 - Heller Basal Salt Mixture 72
H396 - Heller/White Modified Basal Salt Mixture 72
H326 - HEPES, Free Acid 139
H353 - Hoagland Modified Basal Salt Mixture 73
H291 - Homogenizer, Variable Speed 200
H293 - Homogenizer/Grinding Tubes 200
H435 - Hosta Initiation/Multiplication Medium 74
H3959 - Hosta Initiation/Multiplication Medium II 73
H411 - Hosta Initiation-Multiplication Kit 178
H436 - Hosta Multiplication Medium 74
H437 - Hosta Rooting Medium 75
H042 - Hot Hand Protector 200
H926 - Hot Plate/Stirrer 200
H947 - Hot Plate/Stirrer 200
H372 - Hot Plate/Stirrer Heater Element 200
H387 - Hot Plate/Stirrer Heater Element 200
H245 - Hydrochloric Acid Solution 1.0 N 139
H397 - Hygromycin B 139
H385 - Hygromycin B Solution, 100 mg/mL in Distilled Water 139
H370 - Hygromycin B Solution, 50 mg/mL in PBS Buffer 139

I

I365 - Ichihashi New *Phalaenopsis* (NP) Medium 75
I4068 - Indigo Carmine 164
I885 - Indole-3-Acetic Acid 34
I364 - Indole-3-Acetic Acid Solution (1 mg/mL) 34
I538 - Indole-3-Butyric Acid 34
I460 - Indole-3-Butyric Acid Solution (1 mg/mL) 34

©2014 PhytoTechnology Laboratories®

I560 - Indole-3-Butyric Acid, Potassium Salt....34
I409 - Indole-3-Propionic Acid 34
I382 - Innoculating Loops....201
I395 - Innoculating Loops....201
I703 - myo-Inositol 35
I556 - Instrument Rest, Horizontal....201
I4013 - Instrument Rest, Horizontal Bar....201
I623 - Instrument Rest, Vertical....201
I331 - Iron Chelate 35
I373 - Isopropyl-β-D-thiogalactopyranoside 139

K

K378 - Kanamycin Monosulfate 140
K4751 - Kanamycin Monosulfate Solution (100 mg/mL) 140
K586 - Kanamycin Monosulfate Solution (50 mg/mL) 140
K413 - Kao & Michayluk Basal Salt Mixture 76
K427 - Kao & Michayluk Modified Basal Medium....76
K421 - Kao & Michayluk Vitamin Solution (100x) 77
K559 - Kasugamycin Hydrochloride Monohydrate 140
K424 - Keiki Paste 35
K750 - Kinetin 35
K483 - Kinetin Solution (1 mg/mL) 35
K5013 - King's B Medium 164
K425 - Knudson C Modified Plus Orchid Medium 77
K400 - Knudson C Orchid Medium Morel Modification 77

L

C459 - Lab Coats - American Standard....193
C461 - Lab Coats - American Standard....193
C463 - Lab Coats - American Standard....193
C243 - Lab Coats - American Standard....193
L451 - Lanolin....35
L5128 - LB Agar, Lennox L Modification 150
L465 - LB Agar, Miller Modification....151
L591 - LB Broth Solution with Glycerol 152
L585 - LB Broth Solution, Lennox L Modification (1x)....151
L301 - LB Broth Solution, Miller Modification (1x) 152
L5190 - LB Broth, Lennox L Modification (ADP Free)....151
L5138 - LB Broth, Lennox L Modification 151
L475 - LB Broth, Miller Modification....151
L476 - Leifert & Waites Sterility Test Medium....159
L574 - L-Leucine 35
L577 - Lily Multiplicaton Kit....179
L472 - Lindemann Orchid Basal Medium....78
L689 - Linsmaier & Skoog Basal Medium....80
L477 - Linsmaier & Skoog Modified Basal Medium 81
L452 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose & 7 g/L Agar....79
L467 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose & 7 g/L Agar....79
L473 - Linsmaier & Skoog Modified Basal Medium with 30 g/L Sucrose....80
L546 - Litvay Basal Salt Mixture 81
L449 - Lloyd & McCown Woody Plant Basal Medium with Vitamins....82
L154 - Lloyd & McCown Woody Plant Basal Salt Mixture....78
L444 - Lloyd & McCown Woody Plant Micronutrient Mixture ..82
L594 - L-Lysine Monohydrochloride....36

M

M481 - Macerozyme R-10 36
M521 - Magnesium Chloride Hexahydrate....36
M542 - Magnesium Nitrate Hexahydrate....36
M150 - Magnesium Sulfate Anhydrous....36
M635 - Magnesium Sulfate Anhydrous....36
M200 - Magnesium Sulfate Heptahydrate....36
M655 - Magnetic Mixer-Stirrers....201
M659 - Magnetic Mixer-Stirrers....201
M573 - Malachite Green Oxalate....36
M471 - L-Maleic Acid 37
M494 - Maleic Acid Hydrazide....37
M534 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose & Agar....83
M551 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose 83
M482 - Malmgren Modified Terrestrial Orchid Medium Without Sucrose, Agar, & Pineapple Powder....84
M474 - Malt Extract 37
M498 - Malt Extract Agar....152
M5506 - Malt Extract Agar with Glucose and Maltose....152
M484 - Malt Extract Broth 152
M455 - Manganese Chloride Tetrahydrate 37
M250 - Manganese Sulfate Monohydrate....37
M637 - Manganese Sulfate Monohydrate....37
M486 - D-(+)-Mannose 38
M480 - Mask, Face 202
M487 - Mask, Face 202
M493 - Mat, Floor....202
M5516 - mD5A Medium 164
M567 - Meat Extract 38
M5856 - Media Coloration Sampler 38
F322 - Media Dye, Blue....38
F320 - Media Dye, Green 38
F323 - Media Dye, Red....38
F321 - Media Dye, Yellow 39
M649 - ß-Mercaptoethanol....140
M825 - MES, Monohydrate....140
M539 - L-Methionine 39
M5781 - Methylene Blue....164
M419 - MG Basal Salt Mixture....84
M579 - Mitra Maintenance/Replate Medium 85
M580 - Modified Melin-Norkrans Medium....153
M488 - Molybdenum Trioxide 39
M631 - MOPS, Free Acid....141
M572 - MOPS-EDTA-Sodium Acetate Buffer Solution (10x) ..141
M587 - Morel & Martin Vitamin Solution (100x)....85
M565 - MTT....141
M569 - MUG 141
M5800 - Murashige & Skoog Basal Medium with EDTA Ferric-Sodium Salt....86
M519 - Murashige & Skoog Basal Medium with Vitamins 86
M5501 - Murashige & Skoog Basal Medium with Vitamins and Sucrose....87
M5530 - Murashige & Skoog Basal Medium with Vitamins and Sucrose Solution (1x)....87

M5615 - Murashige & Skoog Basal Medium with Vitamins, Glucose and Sucrose Solution (1x) 88
M5707 - Murashige & Skoog Basal Medium with Vitamins, Glucose, and Sucrose 88
M5825 - Murashige & Skoog Basal Medium with Vitamins, Sucrose and Gelzan 89
M5642 - Murashige & Skoog Basal Medium, Van Der Salm Modification 89
M576 - Murashige & Skoog Basal Salt Concentrate (20x) 90
M524 - Murashige & Skoog Basal Salt Mixture 91
M5541 - Murashige & Skoog Basal Salt Mixture Van der Salm Modification 90
M502 - Murashige & Skoog Macronutrient Salt Base 91
M654 - Murashige & Skoog Macronutrient Stock Solution (10x) 91
M5531 - Murashige & Skoog Medium with 1g/L MES 92
M554 - Murashige & Skoog Micronutrient Salt Base 91
M535 - Murashige & Skoog Modified Basal Medium 92
M541 - Murashige & Skoog Modified Basal Medium 93
M701 - Murashige & Skoog Modified Basal Medium 93
M401 - Murashige & Skoog Modified Basal Medium 94
M404 - Murashige & Skoog Modified Basal Medium with Gamborg Vitamins 94
M153 - Murashige & Skoog Modified Basal Salt Mixture (½x Macros & Micros) 96
M290 - Murashige & Skoog Modified Basal Salt Mixture (½x Nitrates & ½x Calcium) 96
M561 - Murashige & Skoog Modified Basal Salt Mixture (½x Nitrates) 97
M571 - Murashige & Skoog Modified Basal Salt Mixture (Without NH4NO3) 98
M531 - Murashige & Skoog Modified Basal Salt Mixture (Without Nitrogen) 97
M407 - Murashige & Skoog Modified Basal Salt Mixture (Without Nitrogen, Phosphorous, and Potassium) 98
M499 - Murashige & Skoog Modified Basal Salt Mixture 95
M504 - Murashige & Skoog Modified Basal Salt Mixture 95
M516 - Murashige & Skoog Modified BC Potato Basal Medium 99
M702 - Murashige & Skoog Modified Medium 99
M550 - Murashige & Skoog Modified Medium Arabidopsis Culture Medium 100
M555 - Murashige & Skoog Modified Multiplication Medium 100
M547 - Murashige & Skoog Modified Vitamin Powder (1000x) 101
M557 - Murashige & Skoog Modified Vitamin Solution (1000x) 101
M553 - Murashige & Skoog Vitamin Solution (1000x) 101
M517 - Murashige Modified African Violet/ Gloxinia Multiplication Basal Medium 102
M518 - Murashige Modified African Violet/ Gloxinia Pretransplant Basal Medium 102
M507 - Murashige Modified Cattleya Orchid Multiplication Medium 103
M508 - Murashige Modified Fern Multiplication Basal Medium 103
M509 - Murashige Modified Gerbera Multiplication Basal Medium 104
M510 - Murashige Modified Gerbera Pretransplant Basal Medium 104
M511 - Murashige Modified Kalanchoe Multiplication Basal Medium 105
M512 - Murashige Modified Kalanchoe Pretransplant Basal Medium 105
M527 - Murashige Modified Multiplication Basal Medium 106
M536 - Murashige Modified Multiplication Basal Medium 106
M491 - Murashige Modified Shoot Multiplication Basal Medium 107
M462 - Musa (Banana) Multiplication Medium 107

N

N600 - α-Naphthaleneacetic Acid 39
N605 - α-Naphthaleneacetic Acid Solution (1 mg/mL) 39
N610 - α-Naphthaleneacetic Acid, Potassium Salt 39
N6179 - 1-Naphthol 40
N564 - β-Naphthoxyacetic Acid 40
N492 - NB Basal Medium 108
N5967 - Neomycin Solution (50 mg/mL) 141
N584 - Neomycin Sulfate 141
N609 - Niacinamide 40
N478 - Nickel (II) Chloride Hexahydrate 40
N458 - Nickel (II) Sulfate Hexahydrate 40
N765 - Nicotinic Acid 40
N617 - Nitric Acid Solution 1.0 N 40
N602 - Nitroblue Tetrazolium 40
N604 - 2-Nitrophenyl-β-D-galactopyranoside 141
N618 - 4-Nitrophenyl-β-D-glucuronide 141
N616 - Nitsch & Nitsch Basal Medium with Vitamins 108
N613 - Nitsch & Nitsch Basal Salt Mixture 109
N608 - Nitsch & Nitsch Vitamin Powder (1000x) 109
N603 - Nitsch & Nitsch Vitamin Solution (1000x) 109
N479 - NLN Basal Medium 110
N601 - Nutrient Agar 153
N611 - Nutrient Broth 153
N581 - Nystatin 142

O

O606 - Oat Meal Agar 153
O606 - Oat Meal Agar 160
O6350 - Orange G 41
P658 - Orchid Maintenance Medium 112
P668 - Orchid Maintenance Medium 112
O139 - Orchid Maintenance/Replate Medium 110
O156 - Orchid Maintenance/Replate Medium 111
P748 - Orchid Maintenance/Replate Medium 111
O753 - Orchid Multiplication Medium 113
P793 - Orchid Multiplication Medium 113
P723 - Orchid Seed Sowing Medium 114
P727 - Orchid Seed Sowing Medium II 114
O755 - Orchid Stem Propagation Kit 179
O626 - L-Ornithine Hydrochloride 41
O630 - Oryzalin 41

©2014 PHYTOTECHNOLOGY LABORATORIES®

P

P687 - Paclobutrazol 41
P713 - Parker Thompson Fern Basal Salt Mixture 115
P710 - Paromomycin Sulfate 142
P686 - Pectolyase Y-23 41
P6767 - Penicillin G Solution (10 mg/mL) 165
P777 - Penicillin G, Sodium Salt 165
P6737 - Pentachloronitrobenzene (PCNB) 165
P632 - Peptone Water 153
P732 - Peptone Water, Buffered (1x) 153
P721 - Peptone, From Soymeal 42
P780 - Peptone, Glysate 41
P775 - Peptone, Type 1, Peptic Digest of Meat 41
P621 - Percoll® 142
D824 - Petri Dish Sterilizing Canister 203
D678 - Petri Dish, 60 x 15mm 202
D965 - Petri Dish, Glass 203
D940 - Petri Dishes, Sterile, Polystyrene 202
D942 - Petri Dishes, Sterile, Polystyrene 202
D943 - Petri Dishes, Sterile, Polystyrene 202
P958 - pH Indicator Strips 203
P959 - pH Indicator Strips 203
P6930 - pH Meter 203
P084 - pH Meter Electrode, Replacement, Jenco®, VisionPlus pH 630 203
P329 - pH Paper 204
P334 - pH Paper 204
P778 - L-Phenylalanine 42
P694 - Phloroglucinol 42
P6800 - *Phyto*Select Basal Medium 165
P781 - *Phyto*Tech™ Orchid Replate Medium 115
P782 - *Phyto*Tech™ Orchid Replate Medium 115
P785 - *Phyto*Tech™ Orchid Replate Medium II 115
P656 - *Phyto*Tech™ *Phalaenopsis* Replate Medium 115
P6647 - *Phyto*Tech™ Spathiphyllum Multiplication Medium 116
P717 - Picloram 42
P862 - Pineapple Powder 42
P711 - PIPES 142
P6996 - Pipette Cans 205
P815 - Pipette Cans 205
P922 - Pipette Pumps 204
P923 - Pipette Pumps 204
P924 - Pipette Pumps 204
P302 - Pipette Pumps, Handle with Thumbwheel 204
P304 - Pipette Pumps, Handle with Thumbwheel 204
P306 - Pipette Pumps, Handle with Thumbwheel 204
P790 - Pipette Pumps, Quick-release 204
P791 - Pipette Pumps, Quick-release 204
P792 - Pipette Pumps, Quick-release 204
P067 - Pipette, Transfer 205
P990 - Pipettes, Serological 204
P992 - Pipettes, Serological 204
P993 - Pipettes, Serological 204
P994 - Pipettes, Serological 204
P995 - Pipettes, Serological 204
P996 - Pipettes, Serological 204
P6715 - Pipettor, Serological 205
D2251 - Plant Genomic DNA Extraction Systems, Viogene® 135
D2275 - Plant Genomic DNA Extraction Systems, Viogene® 135
D2126 - Plasmid DNA Extraction Systems, Viogene® 136
D2179 - Plasmid DNA Extraction Systems, Viogene® 136
D2231 - Plasmid DNA Extraction Systems, Viogene® 136
P770 - Pluronic® F-68 42
P725 - Polyethylene Glycol , PEG-1500 43
P714 - Polyethylene Glycol, PEG-3350 42
P741 - Polyethylene Glycol, PEG-8000 43
P6719 - Polymyxin B Solution (10 mg/mL) 166
P6809 - Polymyxin B Sulfate 165
P720 - Polyoxyethylenesorbitan Monolaurate 43
P738 - Polyoxyethylenesorbitan Monooleate 43
P728 - Polyvinylpyrrolidone 43
P661 - Potassium Acetate 43
P671 - Potassium Acetate Solution 3.0 M, pH 5.0 142
P6905 - Potassium Bromide 44
P614 - Potassium Carbonate 44
P704 - Potassium Chloride 44
P730 - Potassium Chloride Solution 3.0 M 142
P729 - Potassium Citrate Monohydrate 44
P6626 - Potassium Ferricyanide 143
P6826 - Potassium Ferrocyanide 143
P672 - Potassium Hydroxide 44
P682 - Potassium Hydroxide Solution 1.0 N 44
P640 - Potassium Iodide 44
P840 - Potassium Iodide 44
P100 - Potassium Nitrate 45
P705 - Potassium Phosphate, Dibasic Anhydrous 45
P846 - Potassium Phosphate, Monobasic Anhydrous 45
P6780 - Potassium Sodium Tartrate 166
P854 - Potassium Sulfate, Anhydrous 45
P772 - Potato Dextrose Agar 160
P762 - Potato Dextrose Broth 160
P6963 - Potato Tissue Culture Kit 181
P692 - Potato Powder 45
S736 - Pressure Cooker, Saniclave 100 205
P698 - L-Proline 45
P6698 - L-Proline 2.5 M Solution 45
P733 - Putrescine Dihydrochloride 46
P866 - Pyridoxine Hydrochloride 46
P684 - Pyruvic Acid, Potassium Salt 46

Q-R

Q673 - Quoirin & Lepoivre Basal Salt Mixture 116
R7228 - Rhodamine B 46
R795 - Ribavirin 46
R779 - Riboflavin 46
R501 - Rifampicin 143
R7153 - Plant RNA Extraction System 143
R7171 - Rose Bengal 166
R756 - Rose Modified Initiation Basal Medium 116
R757 - Rose Modified Multiplication Basal Medium 117
R758 - Rose Modified Rooting Basal Medium 117
R7100 - Rugini Olive Medium 118
R7278 - Ruthenium Red 166

S

S7536 - Sabouraud Dextrose Broth 154
S7400 - Safranin O 47
S7775 - Saline Solution (0.85%) 166
B004 - Scalpel Blade Remover 206
S970 - Scalpel Blades, Carbon Steel 206
S971 - Scalpel Blades, Carbon Steel 206
S975 - Scalpel Blades, Carbon Steel 206
S075 - Scalpel Blades, Carbon Steel 206
S963 - Scalpel Handles, Stainless Steel 206
S973 - Scalpel Handles, Stainless Steel 206
S967 - Scalpel Handles, Stainless Steel 206
S648 - Scalpel Handles, Stainless Steel 206
S094 - Scalpel Handles, Stainless Steel 206
S653 - Scalpel Handles, Stainless Steel 206
S813 - Schenk & Hildebrandt Basal Medium 118
S816 - Schenk & Hildebrandt Basal Salt Mixture 120
S808 - Schenk & Hildebrandt Modified Basal Medium (½x) 119
S811 - Schenk & Hildebrandt Modified Basal Medium 119
S806 - Schenk & Hildebrandt Modified Basal Salt Mixture Without Calcium 120
S826 - Schenk & Hildebrandt Vitamin Powder (100x) 118
S087 - Scissors, Economical Grade 207
S836 - Scissors, Economical Grade 207
S988 - Scissors, Economical Grade 207
S989 - Scissors, Economical Grade 207
S641 - Scissors, Miltex® 206
S644 - Scissors, Miltex® 206
S652 - Scissors, Miltex® 206
S008 - Scoops/Transfer Tools 207
S009 - Scoops/Transfer Tools 207
A003 - Sealing Film 207
S801 - Sealing Film, Parafilm® 207
S823 - Sealing Film, Parafilm® 207
S911 - Sealing Film, Parafilm® 207
S7650 - Seawater 173
P6635 - Seed Testing Papers, Round 167
P6645 - Seed Testing Papers, Round 167
S807 - L-Serine 47
S819 - Shoe Cover, Non-Skid 208
S169 - Silver Nitrate 47
S657 - SOC Medium Solution 154
S7478 - Sodaria Crossing Agar 154
S803 - Sodium Bicarbonate 47
S7550 - Sodium Carbonate 173
S624 - Sodium Chloride 47
S663 - Sodium Citrate Dihydrate 47
S844 - Sodium Dodecyl Sulfate 143
S845 - Sodium Hydroxide 48
S835 - Sodium Hydroxide Solution 1.0 N 48
S7834 - Sodium Metasilicate, Anhydrous 173
M651 - Sodium Molybdate (VI) Dihydrate 48
S802 - Sodium Nitrate 48
S745 - Sodium Phosphate, Dibasic Heptahydrate 48
S515 - Sodium Phosphate, Monobasic Monohydrate 48
S843 - Sodium Sulfate Anhydrous 48
S620 - Sodium Thiosulfate, Anhydrous 49
S744 - D-Sorbitol 49
S830 - Spatula 208
S977 - Spatulas, Stainless Steel 208
S978 - Spatulas, Stainless Steel 208
S742 - Spectinomycin Dihydrochloride 143
S837 - Spermidine, Free Base 49
S014 - Spoon / Microspoons 208
S018 - Spoon / Microspoons 208
S716 - SSC Buffer Solution (20x), pH 7.0 144
S677 - SSPE Buffer Solution (20x) 144
S743 - Staba Modified Vitamin Solution (100x) 120
S787 - Sterilization Indicators 208
S991 - Sterilization Indicators 208
S7510 - Sterilizer, ErgoSteri™ VT Glass Bead 209
S7520 - Sterilizer, ErgoSteri™ VT Glass Bead 209
B016 - Stir Bar Retriever, Magnetic 210
B010 - Stir Bars, Magnetic 209
B011 - Stir Bars, Magnetic 209
B012 - Stir Bars, Magnetic 209
B013 - Stir Bars, Magnetic 209
B015 - Stir Bars, Magnetic 209
B017 - Stir Bars, Magnetic 209
S981 - Stoppers, Black Rubber 210
S982 - Stoppers, Black Rubber 210
S983 - Stoppers, Black Rubber 210
S984 - Stoppers, Black Rubber 210
S739 - Streptomycin Sulfate 144
S7739 - Streptomycin Sulfate Solution (250 mg/mL) 144
S746 - Succinic Acid 2,2-Dimethylhydrazide 49
S391 - D-Sucrose 49
S829 - D-Sucrose, Ultra-Pure 50
S7750 - Sudan IV 49
S7668 - Sueoka's High Salt Medium (HSM) 173
S804 - Sulfuric Acid Solution 1.0 N 50
S7664 - Sulfuric Acid, 0.1% Solution 174

T

T690 - Tape, Label 210
T695 - Tape, Label 210
T696 - Tape, Label 210
T697 - Tape, Label 210
T699 - Tape, Label 210
T706 - Tape, Label 210
T7939 - Tape, Label, Wide 211
T969 - Tape, Micropore, Surgical 211
T839 - Terrestrial (Cypripedium) Orchid Medium 121
T849 - Terrestrial (Cypripedium) Orchid Medium 121
T842 - Terrestrial (Cypripedium) Orchid Medium 122
O788 - Terrestrial Orchid Seed Sowing Kit 180
T760 - Terrific Broth 154
T754 - Terrific Broth Solution with Glycerol (1x) 155
T719 - Test Tube Basket 211
T171 - Test Tube Rack, Stainless Steel 212
R662 - Test Tube Racks, Autoclavable Polypropylene 211
T078 - Test Tube Racks, Autoclavable Polypropylene 211
R664 - Test Tube Racks, Epoxy-coated Wire, Stainless Steel 212

©2014 PhytoTechnology Laboratories®

R666 - Test Tube Racks, Epoxy-coated Wire, Stainless Steel 212
T859 - Tetracycline Hydrochloride 144
T7859 - Tetracycline Hydrochloride Solution (10 mg/mL) 144
T8199 - Tetrazolium Blue 50
T786 - Thermometer, Digital 212
T390 - Thiamine Hydrochloride 50
T888 - Thidiazuron 50
T438 - Thidiazuron (95%) 50
T7982 - Thiourea 167
T857 - L-Threonine, Methyl Ester, Hydrochloride 51
T869 - Timentin 145
T767 - Timentin Solution (100 mg/mL) 145
T7869 - Timentin Solution (50 mg/mL) 145
T7954 - TM4 Basal Medium 122
T8024 - TM4 Basal Salt Mixture 123
T868 - TM4G Basal Medium 123
T853 - TM4G Basal Salt Mixture 124
T856 - Tobacco Modified Callus Initiation Basal Medium 124
T861 - Tobacco Modified Root Initiation Basal Medium 126
T867 - Tobacco Modified Shoot & Root Basal Medium 125
T864 - Tobacco Modified Shoot Multiplication Basal Medium 125
T834 - Tobramycin Sulfate 145
T8092 - Toluidine Blue O 167
T872 - Tomato Powder 51
T841 - meta-Topolin 51
T7885 - meta-Topolin Solution (1mg/mL) 51
T8077 - Tray 212
T7968 - Trehalose Dihydrate 167
T818 - 1-Triacontanol 51
T828 - Trifluralin 51
T850 - 2,3,5-Triiodobenzoic Acid 51
T761 - Trinexapac-Ethyl 52
T8164 - Triphenyl Tetrazolium Chloride (TTC) 167
T769 - Tris Acetate EDTA Buffer Solution (50x), pH 8.1 ± 0.1 145
T8224 - Tris Acetate Phosphate (TAP) 174
T8050 - Tris Acetate Phosphate (TAP) 1x Solution 174
T838 - Tris Base 145
T831 - Tris Borate EDTA Buffer 146
T774 - Tris Borate EDTA Buffer Solution (10x) 146
T773 - Tris Borate EDTA Buffer Solution (5x) 146
T752 - Tris EDTA Buffer Solution (10X), pH 8.0 146
T821 - Tris Glycine SDS Buffer 146
T764 - Tris HCl Solution 1.0 M, pH 7.5 147
T858 - Tris Hydrochloride 147
T855 - Tris-EDTA Buffer 146
T814 - Tris-Glycine Buffer 146
T749 - Tris-Glycine-SDS Buffer Solution (10x) 147
T8100 - Triton X-100 147
T7900 - Tryptic Soy Broth 155
T8000 - Tryptic Soy Broth, Type II 155
T832 - Tryptone 52
T851 - L-Tryptophan 52
T848 - Tryptose 52
T873 - L-Tyrosine, Free Base 52
T8110 - Tyrothricin 168
T8020 - Tyrothricin Solution (10 mg/mL) 168

U-V

U890 - Urea 53
V882 - Vacin & Went Modified Orchid Basal Medium 126
V505 - Vacin & Went Modified Orchid Basal Salt Mixture 126
V891 - Vacin & Went Modified Orchid Medium 127
V895 - Vacin & Went Modified Orchid Medium 127
V878 - L-Valine 53
V870 - Vancomycin Hydrochloride 147
V8370 - Vancomycin Hydrochloride Solution (100 mg/mL) 147
V886 - Vinegar, White Distilled 53

W

W1933 - Water Bath 212
W783 - Water, Plant Tissue Culture Grade 147
W879 - Weigh Boats 213
W880 - Weigh Boats 213
W881 - Weigh Boats 213
W917 - Weigh Paper 213
W921 - Weigh Paper 213
W925 - Weigh Paper 213
W863 - Westvaco WV3 Basal Medium 127
W865 - Westvaco WV5 Basal Medium 128
W898 - White Basal Salt Mixture 128
W887 - Wilkins-Chalgren Agar 155

X-Z

X874 - X-Gal 148
X8451 - X-Gluc Stock Solution (20 mg/mL) 148
X877 - X-Gluc, Monocyclohexyl Ammonium Salt 148
X871 - X-Gluc, Sodium Salt 148
X8454 - XTS Medium 168
Y892 - Yeast Extract 53
Y8488 - Yeast Malt Broth 156
Y8565 - YEP Broth 156
Y8480 - YEP Medium (ADP Free) 156
Y889 - YEP Medium 156
Y893 - YMB Medium 156
Z875 - Zeatin Riboside Solution (1 mg/mL), trans Isomer 53
Z899 - Zeatin Riboside, trans Isomer 54
Z860 - Zeatin Solution (1 mg/mL), trans Isomer 54
Z125 - Zeatin, trans Isomer 53
Z897 - Zinc Nitrate Hexahydrate 54
Z101 - Zinc Sulfate Heptahydrate 54

PhytoTechnology Laboratories Technical Tables & Figures Index

Tables and Figures listed Alphabetically

Antibiotics/Antimycotics/Selection Agent Guide.....253

Autoclaving Times by Volume.....224

Basic Steps to Preparing 1 Liter of Medium.....229

Choosing a Carbohydrate.....234

Culture Vessel Selection Guide.....261

Epiphytic Orchid Media Selection Guide.....245

Epiphytic Orchid Media Selection Guide by Genus.....247

Examples of Media Designed for a Specific Stage of Growth.....227

Explanation of *Phyto*Tech™ Quality Control Process.....228

Flasks Stopper Chart.....262

GUS Gene Staining Solution Formulation.....255

Imperial (US) to Metric Conversions.....262

In Vitro Stages of Growth Flowchart.....226

List of Amino Acids by Type & *Phyto*Tech™ Product Numbers.....236

List of Carbohydrate Types & *Phyto*Tech™ Product Numbers.....234

List of Common Undefined Organic Supplements & *Phyto*Tech™ Product Numbers.....236

List of Macronutrient Sources & *Phyto*Tech™ Product Numbers.....232

List of Micronutrient Sources & *Phyto*Tech™ Product Numbers.....233

List of Vitamins used in plant tissue culture & *Phyto*Tech™ Product Numbers.....235

Media Type by Components Flowchart.....231

Media Used in Indexing Explants.....239

Metric to Imperial (US) Conversions.....262

Orchid Maturation Chart.....248

Orchid Media Family Relations.....247

Orchid Media Selection Guide by Procedure.....251

Other Products for Orchid Cultures.....250

Phytopathology and Microbiology media available from *Phyto*Tech Labs™.....256

Phytopathology and Microbiology media available from *Phyto*Tech Labs™.....257

Plant Growth Regulators functions in Plant Tissue Culture.....242

Plant Growth Regulators Usage and Storage Chart.....243

Recommended Basic Laboratory Equipment.....218

Scalpel Handle & Blade Compatibility Chart.....262

Stains & Dyes Usage Table.....259

Stock Solution Dilution Chart.....241

Terrestrial Orchid Media Selection Guide.....245

Terrestrial Orchid Media Selection Guide by Genus.....246

The Smart Media Formulation for Seed Testing.....258

Tris Buffer Preparation Guide.....262

Usage Guide for Gelling Agents.....237

Why Use Pre-Made Media?.....226

©2014 PhytoTechnology Laboratories®

Notes...

International Distributors

Argentina



Neolab Argentina
Buenos Aires
Attn: German Elbert
Email: ventas@neolab.com.ar
Phone number: (54 11) 4706 1692
Fax number: (54 11) 4706 1692
Website: www.neolab.com.ar

Australia



Austratec Pty Ltd
Bayswater, Victoria
Attn: Will Semmens
Email: sales@austratec.com.au
Phone Number: +61 3 9729 4528
Fax Number: +61 3 9729 4578
Website: www.austratec.com.au

Brazil



AX Lab's Inc
USA – Miami, Florida
Email: axlabsinc@gmail.com
Phone Number: 1-305-401-4172
Brazil – Rio de Janeiro
Attn: Claudio Reis
Email: comercial.diretoria@wlcom.com.br
Phone Number: 55 21 3271 1528
Phone Number: 55 21 3253 5500

LGC Biotecnologia
Cotia – Sao Paulo
Attn: Jacinto Place
Email: jacinto.place@lgcsci.com
Phone Number: 1-800-560-7471
Fax Number: 55-21-2583-4268

Chile



Gene X-Press
Santiago
Attn: Customer Service
Email: info@genex.cl
Phone Number: 56-2-2245 4805
Fax Number: 56-2-2245 4805 ext. 107
Website: www.genexpress.cl

China



QW Biosciences Incorporated
Beijing
Attn: Liu Gui-Shan
E-mail: qwbio@yahoo.com.cn
Phone Number: 86-10-82743160
Fax Number: 86-10-82743163
Website: www.qwbio.com

Seajet Scientific Inc
Website: www.seajetsci.com
Beijing Headquarter
Attn: Ketty Zhu
Email: info@seajetsci.com
Phone Number: 86-010-88597838
Fax Number: 86-010-88595011
Shanghai Branch
Attn: Yan Rong
Email: shanghai@seajetsci.com
Phone Number: 86-021-63599871
Fax Number: 86-021-63599872
Chengdu Office
Attn: Niki Yan
Email: chengdu@seajetsci.com
Phone Number: 86-028-64600404
Fax Number: 86-028-64600404
Guangzhou Office
Attn: Katherine Fang
Email: guangzhou@seajetsci.com
Phone Number: 86-4000-50-4006
Fax Number: 86-4000-50-4006

International Distributors

Colombia



Biopruebas
Bogota
Attn: Rafael Pineda Novella
Email: rpineda@biopruebas.com.co
Phone Number: 57-1-618-2431
Fax Number: 57-1-618-2431
Website: www.biopruebas.com.co

Ecuador



Labdin
Quito
Attn: Kleber Molina
E mail: kmolina@labdin.com.ec
Phone Number: 593 2556 134
Phone Number: 593 2522 554
Fax Number: 593-2503 594
Website: www.labdin.com.ec

European Union



***Phyto*Technology Laboratories®**
E mail: sales@phytotechlab.eu.com
Phone Number: 1.913.341.5343
Fax Number: 1.913.341.5442
Website: www.phytotechlab.eu.com

India



Joyvel Bioscience Pvt Ltd.
Ashok Nagar, Chennai
Attn: K.G. Narasimhan
Email: joyvelbio@gmail.com
Phone Number: 91 44 24895627
Phone Number: 91 44 23713027
Fax Number: 91 44 24712227
Website: www.joyvelgroup.com

Indonesia



PT. Intralab Ekatama
Bogor
Attn: Mr. Budy Sulistriono (Director)
Email: intralab@indo.net.id
Phone Number: +62 (251) 8359110
Phone Number: +62 (251) 8311662
Fax Number: +62 (251) 8315710
Website: www.intralab.co.id

Israel



Moshe Stauber Biotec Applications
Weizmann Science Park, Rehovot
Email: info@ms-biotec.co.il
Phone Number: 972-8-9367001
Mobile Number: 972-522-727738
Fax Number: 972-8-9367002
Website: www.ms-biotec.co.il

Malaysia



Euroscience
Pandan Indah Commercial Park - Kuala Lumpur
Attn: Nordin Atan
Email: caldinian84@gmail.com
Phone Number: ++60 3 4297 6849
Fax Number: ++60 3 4297 3819
Website: www.euroscience.com.my

©2014 PhytoTechnology Laboratories®

International Distributors

Mexico



Tropigen S.A. de C.V.
Irapuato, Guanajuato
Attn: Gabriela Meza-Almaguer
Email: tropigen@prodigy.net.mx
Phone Number: 52 (462) 624-6474
Fax Number: 52 (462) 625-5005
Website: www.tropigen.com.mx

Pakistan



The Worldwide Scientific
(Science & Technology Services)
Lahore
Attn: Mr. Moazzam Islam
Email: wws@brain.net.pk
Phone Number: 0092-42-37500016
Phone Number: 0092-42-37500017
Fax Number: 92-42-37553255
Website: www.wwspk.com

Qatar



Ali Alsuwidi Trading Establishment
Doha-Qatar
Attn: Osama Tag Elsir/Marketing Manager
E-mail: tag@suwaidi.com.qa
Phone Number: (+974) 44995121
Phone Number Direct: (+974) 44995126
Fax Number: (+974) 44995130

Singapore



BST Scientific Pte Ltd
Attn: Customer Service
Email: info@bstsci.com
Phone Number: +65 67772856
Fax Number: +65 67772372
Website: www.bstsci.com

South Korea



Engenbio
Jinju-City
Attn: Leeky/Import Department
Email: engenbio@hotmail.com
Phone Number: 82-55-763-2526
Phone Number: 82-70-8988-2526
Fax Number: 82-55-763-2526
Fax Number: 82-52-970-2526

PhileKorea Technology, Inc.
Attn: Minbong Park
E-mail: pioneer@philekorea.co.kr
Seoul
Phone Number: +82-2-2105-7020
Fax Number: +82-2-2105-7025
Daejeon
Phone Number: +82-42-862-9636
Fax Number: +82-42-862-9638
Website: www.philekorea.co.kr

Taiwan



A-Tech Bioscientific Co, Ltd
Neipu Township, Pingtung County
Email: kaiger@atechbios.com.tw
Phone Number: 886-8-7703496
Fax Number: 886-8-7707618
Website: www.atechbios.com.tw

Thailand



Pacific Science Co. Ltd.
Talingchan Bangkok
Attn: Sarayut Chirapongphattana
Email: pacscien@ksc.th.com
Phone Number: 66-2-880-8750
Fax Number: 66-2-880-8750

International Distributors

United Arab Emirates



Al Areesh Investments LLC
Al Barsha 1 - Dubai
Attn: Ms. Carol Sandoval
Email: info@alareeshinvestments.ae
Phone Number: +971 4 4472853
Fax Number: +971 4 4472852

Vietnam



BMN MSI Co, Lta
Trung Hoa Cau Giay, Hanoi
Attn: Nguyen Si Nguyen
E-Mail: nguyensinguyen76@gmail.com
Phone: (84) 4 62823268
Web: www.bmnmed.com

TBR Corporation
Ho Chi Minh City
Attn: Ms. Do Ngoc Diem Truc
Email: sales@tbr.vn
Phone Number: (84) 8 66 76 77 62
Mobile Phone: (84) 916 217 771
Fax Number: (84) 838 172 718
Website: www.tbr.vn

Follow *Phyto*Tech Labs™ On:

PHYTOTECHNOLOGY LABORATORIES®



Mailing Address:
PO Box 12205
Shawnee Mission, KS
66282-2205
United States of America

Contact Information:
Phone: 1.913.341.5343
1.888.749.8682 (US & Canada)
Fax: 1.913.341.5442
1.888.449.8682 (US & Canada)
Orders: **sales@phytotechlab.com**
Technical Info: **tech@phytotechlab.com**

"Helping to Build a Better Tomorrow Through Plant Science"™

www.phytotechlab.com