



BloomStudios

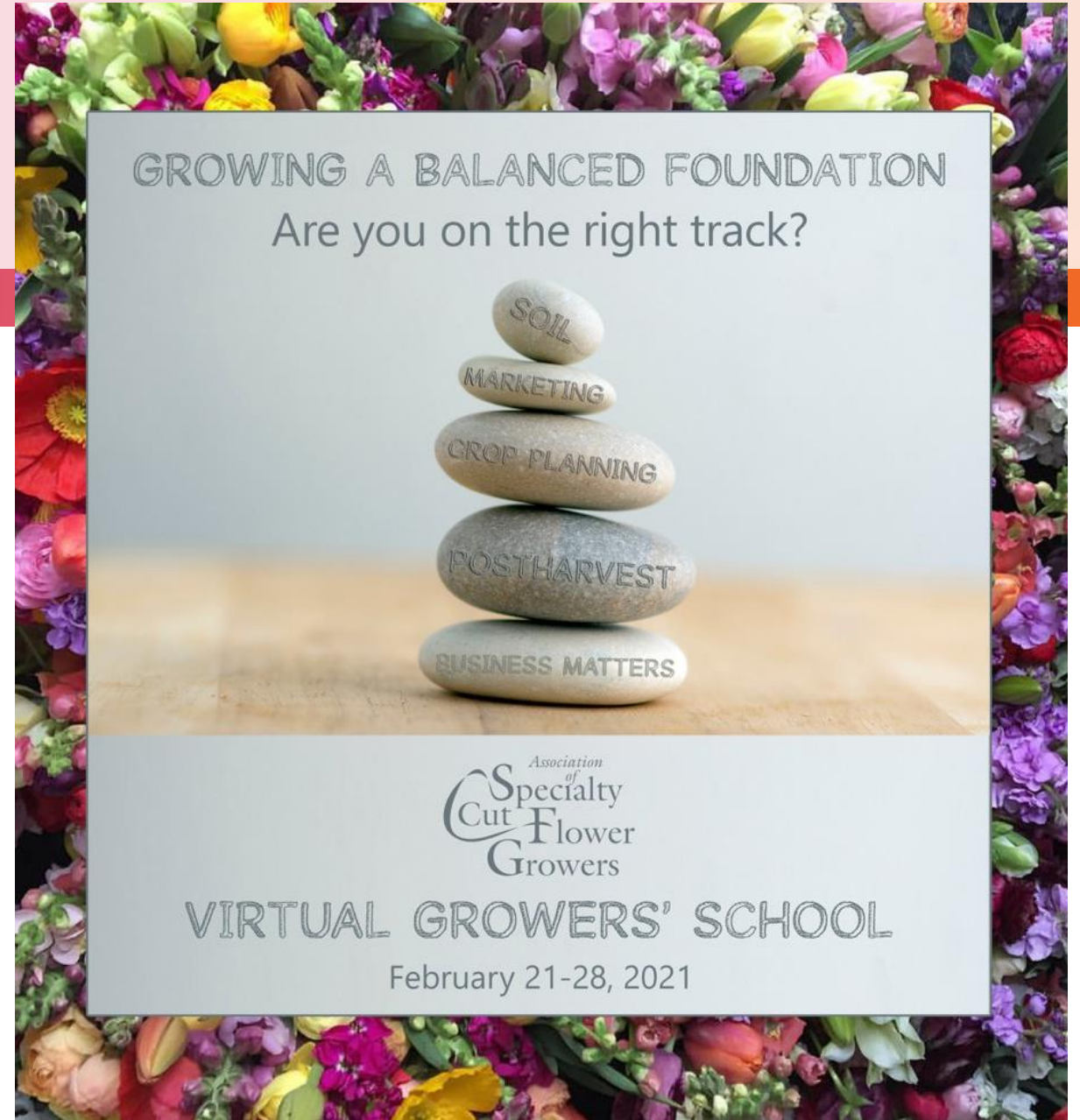
CUT FLOWER INNOVATIONS BY BALL

Seed Starting Best Practices

Scott Rusch

GM & Co-Founder

BloomStudios Cut Flowers





BloomStudios
CUT FLOWER INNOVATIONS BY BALL

Technical Resources



Common Terms



Common Terms – Seed Forms



- Raw Seed
 - Simplest, Natural
- Common crop examples:
 - Zinnia, Sunflower, Snapdragon, Gomphrena, Matthiola, Delphinium



- De-Tailed Seed
 - Dried petal end (the 'tail') is removed, easier to sow
- Common crop examples:
 - Marigold

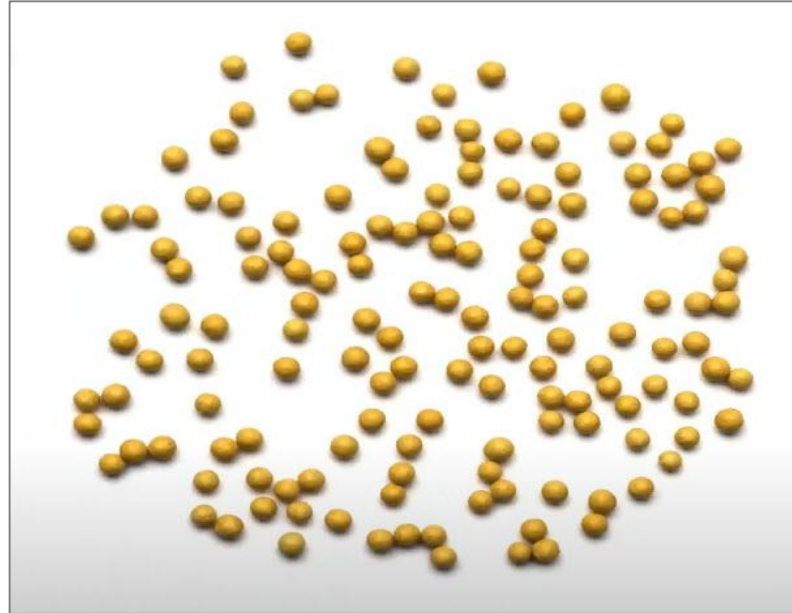


- Coated Seed
 - Easiest to sow, smooth; bright yellow color easy to see
- Common crop examples:
 - Marigold, Zinnia, Gomphrena

Common Terms – Seed Forms



- Treated Seed
 - Fungicide protectant and sealed for safety.
- Crop examples:
 - Sunflower

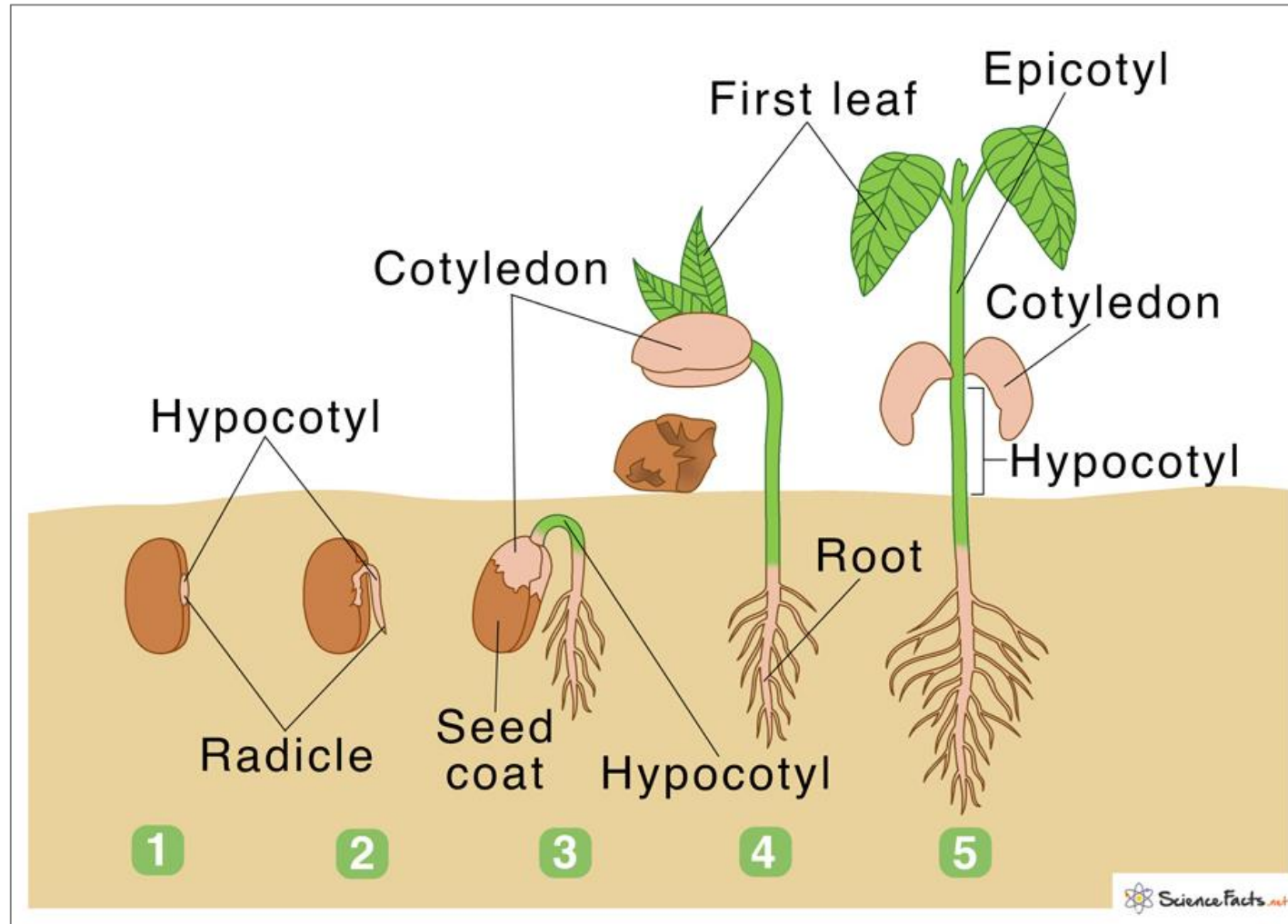


- Pelleted Seed
 - Makes small seed and odd seed shapes round and easier to sow. Yellow color easier to see.
- Crop examples:
 - Lisianthus, Celosia, Dianthus, Campanula, Matricaria, Trachelium



- Multi-Pelleted Seed
 - Multiple seeds in 1 pellet glued together. Easier to sow and yellow color is easier to see.
- Crop examples:
 - Panicum Frosted Explosion

Common Terms – Seedlings



Common Terms – Plug Stages

Stage	Plugs Stage 1	Plugs Stage 2	Plugs Stage 3	Plugs Stage 4
Plug Stage and Time	Germination to Radicle Emergence	Radicle Emergence to Cotyledon Expansion	Cotyledon Expansion to True Leaves	Pullable Plug
Photo				

- Many seed companies use these standard stages in their growing guides
- We recommend different conditions by crop at each stage for optimal growth

Plug Production				
	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3-4	Level 3-4	Level 3
Temperature	64-68°F (18-20°C)	65-70°F (18-21°C)	60-65°F (16-18°C)	55-60°F (13-16°C)
Light	Optional	5-8 mol·m ⁻² ·d ⁻¹	8-10 mol·m ⁻² ·d ⁻¹	10 mol·m ⁻² ·d ⁻¹
Fertilizer		Less than 100 ppm N (Less than 0.7 EC)	Less than 100 ppm N (Less than 0.7 EC)	175 to 225 ppm N (1.2 to 1.5 EC)



BloomStudios

CUT FLOWER INNOVATIONS BY BALL

4 Keys to Successful Germination



Water Management

Temperature, Cover & Days



Moisture Mgmt is Key on All Crops, two examples below:

Dianthus Sweet



Plug Production				
	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3-4	Level 3-4	Level 3
Temperature	64-68°F (18-20°C)	65-70°F (18-21°C)	60-65°F (16-18°C)	55-60°F (13-16°C)
Light	Optional	5-8 mol·m ⁻² ·d ⁻¹	8-10 mol·m ⁻² ·d ⁻¹	10 mol·m ⁻² ·d ⁻¹
Fertilizer		Less than 100 ppm N (Less than 0.7 EC)	Less than 100 ppm N (Less than 0.7 EC)	175 to 225 ppm N (1.2 to 1.5 EC)

Delphinium Guardian



Plug Production				
	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3	Level 2	Level 2
Temperature	65-70°F (18-21°C)	65-68°F (18-20°C)	60-65°F (16-18°C)	60-65°F (16-18°C)
Light	Optional	2,000-2,500 f.c. (21,500-26,900 Lux)	2,000-2,500 f.c. (21,500-26,900 Lux)	4,000-5,000 f.c. (43,100-53,800 Lux)
Fertilizer	Less than 100 ppm N (Less than 0.7 EC)	100 to 175 ppm N (0.7 to 1.2 EC)	100 to 175 ppm N (0.7 to 1.2 EC)	100 to 175 ppm N (0.7 to 1.2 EC)

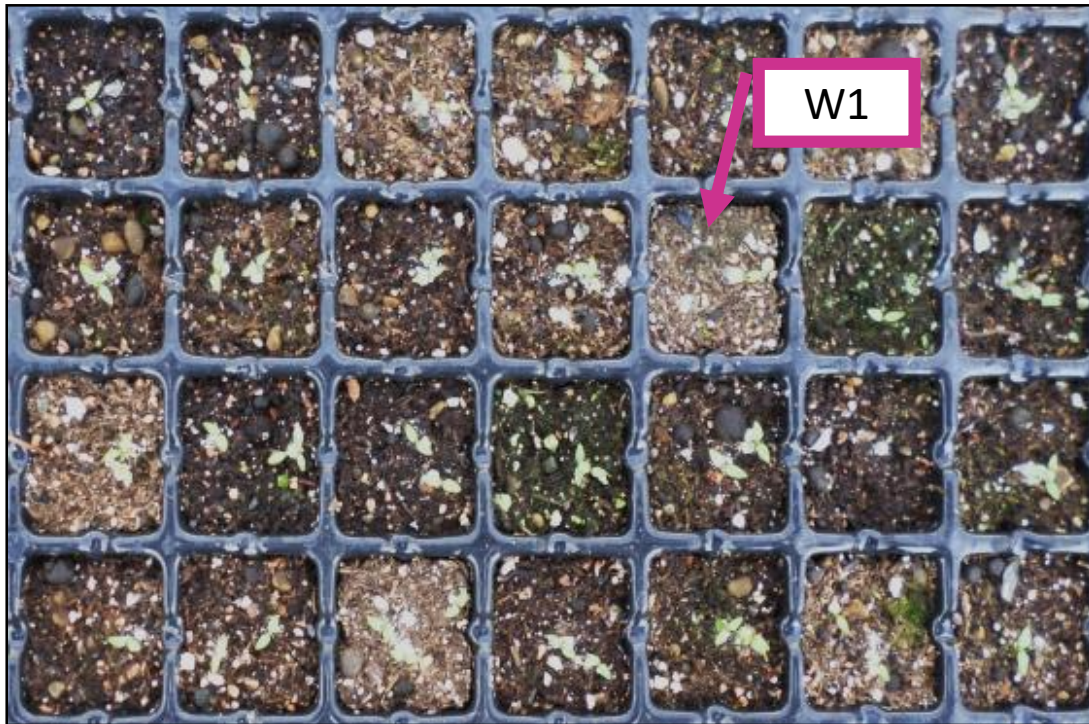
Moisture levels 1-5, visuals



Moisture levels 1-5, descriptions

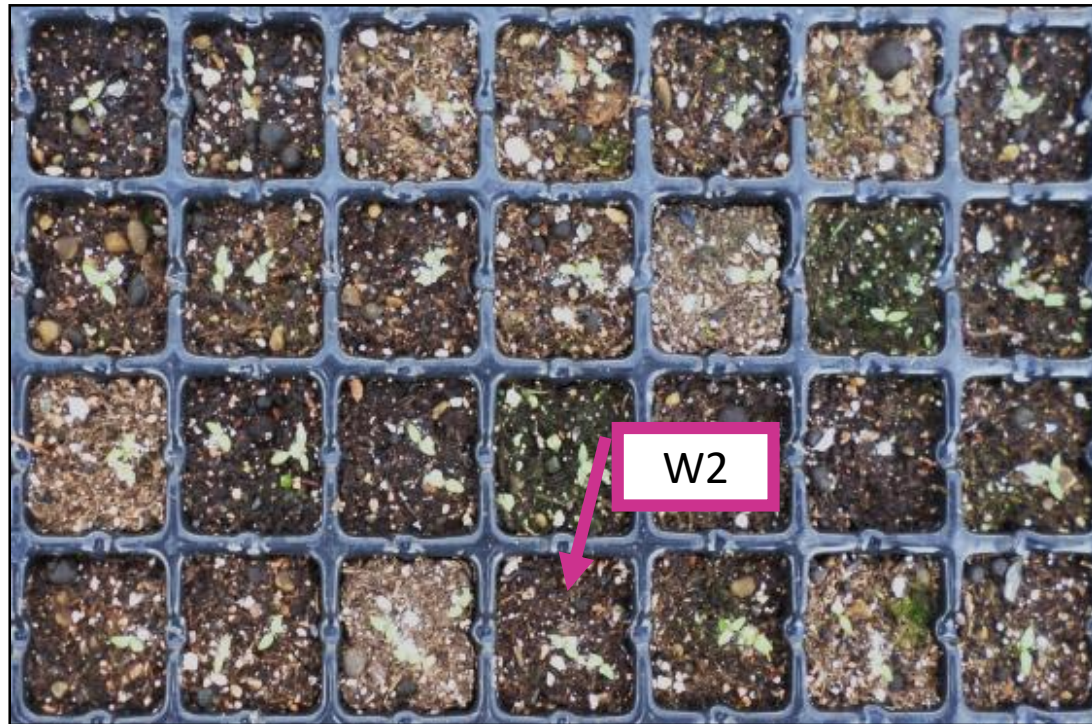
	Level 1 Dry	Level 2 M Dry	Level 3 Medium	Level 4 M Wet	Level 5 Wet
See	Tan	Light Brown	Tan-Dark Brown	Dark Brown	Black
Feel	None	Squeaky	Drop	Drip	Running
Shape	Dust	Crumble	Cracks	Clump	Tofu Jell-O

Moisture level 1 – dry



- Soil Is Tan to White
- Soil Crumbles to Dust
- Soil Does Not Stick
- Soil Shrinks From Wall

Moisture level 2 – Medium Dry



- Light Brown with No Free Water
- Soil is Squeaky
- Crumbles Apart

Moisture level 3 - Medium



- Soil is Brown
- Hard Squeeze Water
- Soil Cracks apart

Moisture level 4 - Medium Wet



- Soil is Dark Brown
- No Visible Water
- Easily Squeeze Water
- Soil Sticks Together

Moisture level 5 - Wet



- Black Color
- Free Water
- Soil is Saturated
- Pudding or Tofu!

Germination Quick Reference: Temp, Cover, Days

CROP	TEMP	COVER	DAYS
Ageratum	72-74 F	N	2-4
Ammi	65 F	Y, lightly	5
Anemone	67F	Y	10-14
Asclepias	68-72 F	Y, lightly	5-11
Bupleurum	65-70 F	Y	8
Campanula	65-72 F	N	6-9
Carthamus	54F, min nights	Y	Direct Sow in Field
Celosia	68-72 F	Y, lightly	3-4
Delphinium belladonna	68-72 F	Y	7-10
Delphinium elatum	65-70 F	Y	5-6
Dianthus	64-68 F	Y	3-4
Gomphrena	68-72 F	Y	2-3
Grass Panicum	65-68 F	Y, lightly	3-8
Limonium (Statice)	65-70 F	Y, lightly	3
Lisianthus	68-72 F	Y, lightly	9
Marigold (African types)	70-72 F	Y	2 or bench
Matricaria	64-68 F	N	3-5
Matthiola (Stock)	68-72 F	Y	3-4
Snapdragon	64-68 F	Y, lightly	4-5
Sunflower (Helianthus)	54F, min nights	Y	Direct Sow in Field
Sunflower (Helianthus)	72-74 F	Y	2 or bench
Trachelium	65-70 F	N	5-7
Zinnia	68-74 F	Y	2-3

- Germination Condition?
 - Chamber best for control
 - Trays, Stacked/wrapping in plastic
- Wherever you can best control humidity & temperature



Vermiculite: No Cover, Light Cover, Cover



No Cover



Light Cover



Covered



Be consistent, uniformity
helps get the best result!
Example of poor uniformity
of vermiculite covering

Key Recommendations: Lisianthus

Germination

Seed Form	Recommended Plug Size	Seeds/Cell	Plug Crop Weeks	Days to Germinate	Initial Media pH/EC	Cover Seed
PEL	406	1	8-10	8-12	5.8-6.2 pH 0.75 mmhos/cm	Light cover

Plug Production

	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3-4	Level 3-4	Level 3
Temperature	68-72°F (20-22°C)	68-72°F (20-22°C)	65-68°F (18-20°C)	62-65°F (17-18°C)
Light		1,000-2,500 f.c. (10,800-26,900 Lux)	1,000-2,500 f.c. (10,800-26,900 Lux)	2,500-5,000 f.c. (26,900-53,800 Lux)
Fertilizer	Less than 100 ppm N - Less than 0.7 EC	100 to 175 ppm N - 0.7 to 1.2 EC	100 to 175 ppm N - 0.7 to 1.2 EC	175 to 225 ppm N - 1.2 to 1.5 EC

Propagation Key Tips

Avoid high media temperature (>72°F/22°C) beginning in Stage 2, as it can induce rosetting in the seedling, which will cause stunting after the plugs are transplanted. Also, it is very important to establish a preventative disease and insect control practice for lisianthus production.

- Water/Mist until pellet dissolved
- High temps are bad! Can cause Rosetting-plants will not flower



Key Recommendations: Delphinium elatum

Germination

Seed Form	Recommended Plug Size	Seeds/Cell	Plug Crop Weeks	Days to Germinate	Initial Media pH/EC (1:2)	Cover Seed
RAW	288	1	5-6	5-6	5.8-6.2 pH 0.75 mmhos/cm	Yes

Plug Production

	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3	Level 2	Level 2
Temperature	65-70°F (18-21°C)	65-68°F (18-20°C)	60-65°F (16-18°C)	60-65°F (16-18°C)
Light	Optional	2,000-2,500 f.c. (21,500-26,900 Lux)	2,000-2,500 f.c. (21,500-26,900 Lux)	4,000-5,000 f.c. (43,100-53,800 Lux)
Fertilizer	Less than 100 ppm N (Less than 0.7 EC)	100 to 175 ppm N (0.7 to 1.2 EC)	100 to 175 ppm N (0.7 to 1.2 EC)	100 to 175 ppm N (0.7 to 1.2 EC)

Propagation Key Tips

Autumn: greenhouse 13 weeks, field 16 weeks. Spring: greenhouse 11 weeks, field 13 weeks. Treat cut stems with an ethylene-inhibiting agent. In temperate areas such as coastal California, plugs are generally transplanted into the field August through October, and February to early May. Autumn transplants will flower the following Spring (February onward); Spring transplants flower late Spring.

- Use F1 Hybrids!
 - Guardian, Aurora and other hybrids are best for seed quality, 90%+
- Fresh seed is best!
 - Over 12 months old? Don't sow, it's likely dead
- Moisture and Temperature are the two most critical things



Delphinium Guardian 4 weeks after sowing



BloomStudios

CUT FLOWER INNOVATIONS BY BALL

Equipment & Supplies



Ideas from our
research stations



Seed Starting Mixes

Sungro Propagation Mix



Ball Seed, BHC 18

BHC 18

BHC 18 is designed for the production of plugs and transplant. A blend of fine-fibered Canadian sphagnum peat moss, and fine perlite. The addition of both dolomitic and calcitic limestone for pH adjustment and a wetting agent for easy hydration. The Nature's Source starter charge which provides a well balanced charge of macro and micro nutrients with low EC provides the optimum mix for a uniform root development and a healthy start.

Components
Canadian sphagnum peat moss (80 - 90 %)
Horticultural perlite
Calcitic limestone
Dolomitic limestone
Wetting agent
Nature's Source starter charge

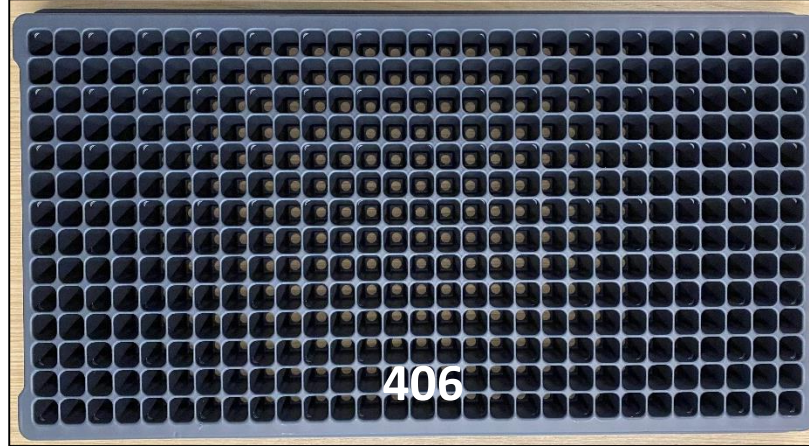
Size	Quantity
2.8 cu ft loose fill (79 L)	48 bags/pallet
74 cu ft loose fill (2095 L)	2 bags/pallet
3.8 cu ft compressed (107 L)	30 bags/pallet
55 cu ft compressed (1557 L)	2 bags/pallet
120 cu ft compressed (3400 L)	1 bag/pallet



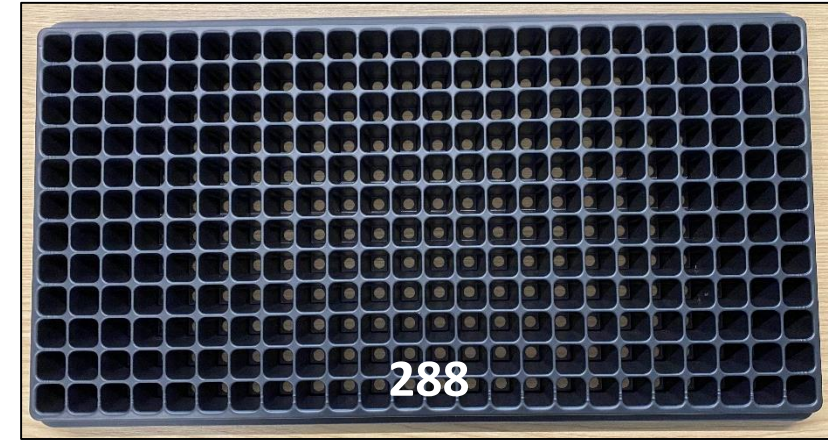
Plug Trays – some common sizes and uses



20 row seeder tray

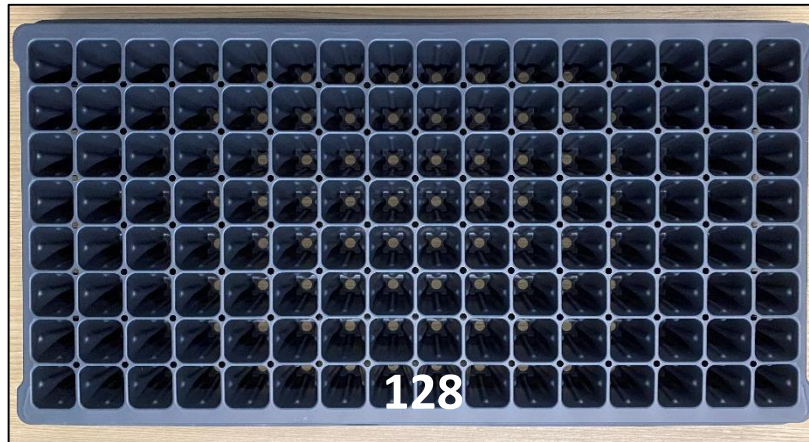


406



288

- Row trays
 - Small seeds & crops you'd like to maybe start and bump up into larger before the field.
 - Items with questionable germ or older seeds you're not sure will perform
- 406s (other small sizes too like 512s)
 - TP into Greenhouse
- 288s
 - **The standard for most** plug companies, versatile for most crops and uses (GH, Tunnel, Field)



128



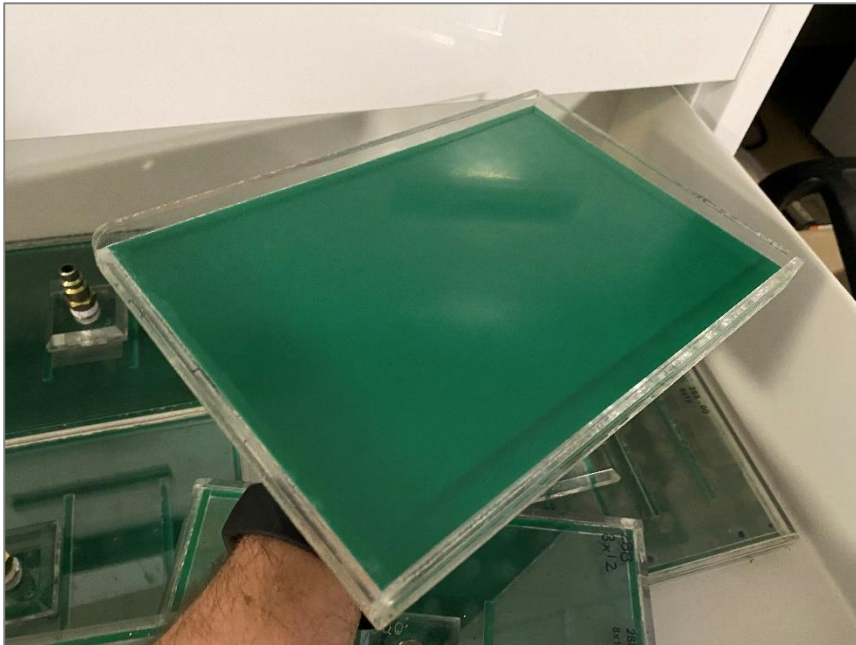
50

- 128s (or the 102/105, 100 size)
 - Good for field, larger seeded items
 - Tunnel/Field

- 50s (or 72 size)
 - Good for field, larger seeded items
 - Tunnel/Field

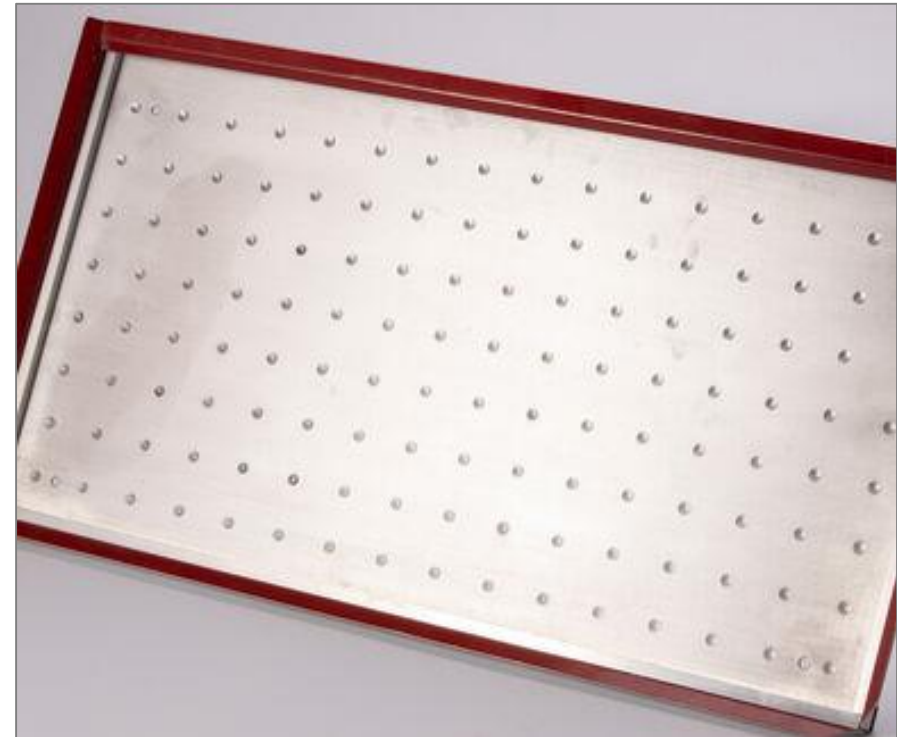
Vacuum seeder plates

Hoffman Manufacturing,
Seed Plates
Partial Trays



www.hoffmanmfg.com/products/vacuum-counting-heads/

Johnny's Seeds, Seed Plate
Common Sizes full trays



www.johnnyseeds.com/tools-supplies/seed-starting-supplies/seed-plate-d128-precision-vacuum-seeder-accessory-7206.html

Soil Blocking...I'm not an expert...but Johnny's is!

- Like with many things, Johnny's Select Seeds is a great resource
 - Equipment
 - Soil recipe/components
 - Best Practices
 - How to manage
- In my opinion, plug trays are best because they offer best moisture control
- But I've seen **some great crops** with soil blocks
 - Word of caution...never let your soil blocks dry out...hard to re-wet
 - Too wet...generally causes issues with algae



www.johnnyseeds.com/growers-library/tools-supplies/soil-block-makers-eliot-coleman.html

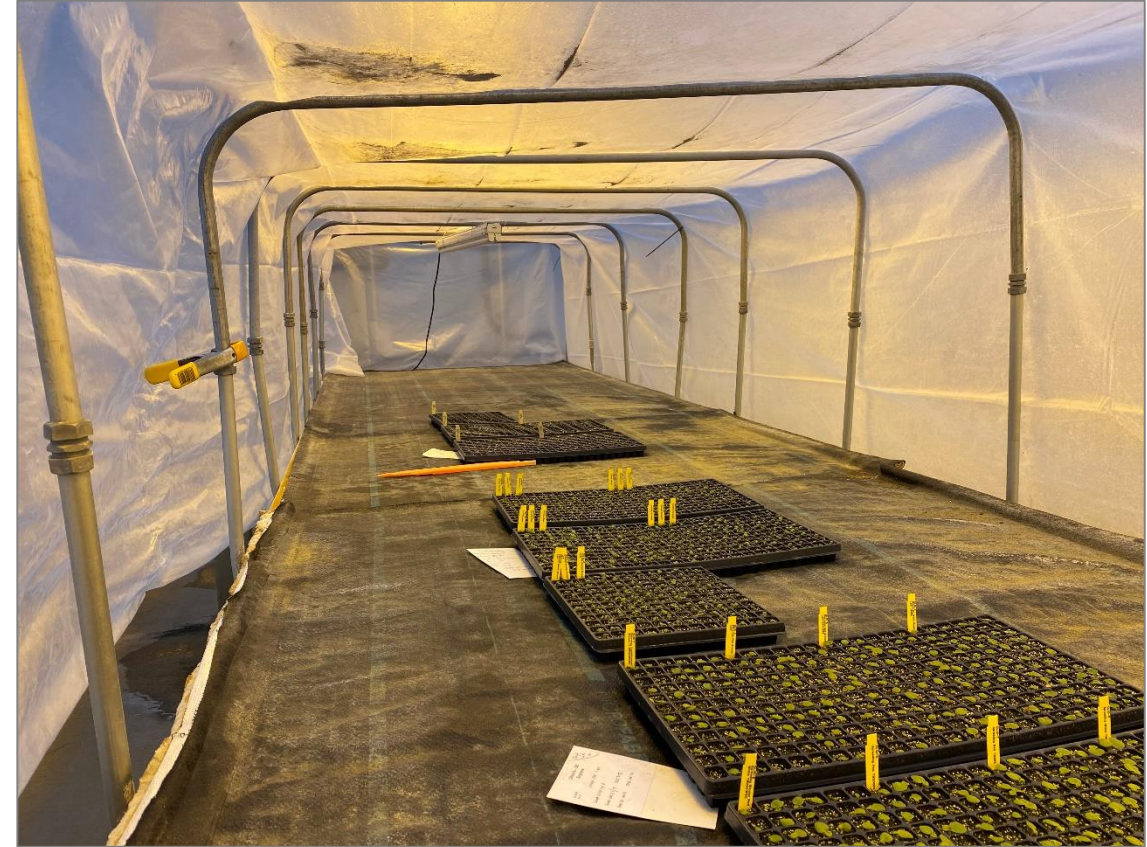
Germination Chambers



- Best option for controlling temperature, maintaining moisture and lights if you can
- You can make your own, focus on controlling key variables
- Great companies out there that will help build custom solutions



Germination – Controlling Humidity on the Bench



- Bottom heat to help for warmer temps in early-stage (Stage 1/2) germination

OMRI Fungicides

- Copper based fungicides
 - Preventative effective on early and late blight, leaf spots, downy and powdery mildew, anthracnose, and black rot.



- Regalia®
 - Effective in control of powdery and downy mildew, *Cercospora*, *Botrytis*, bacterial leaf spot, early and late blight, and others when used as a preventative treatment.



Use as directed

OMRI Fungicides

- Milstop® or Mildew Cure®
 - Effective on mildews
- Actinovate®
 - Effective against root rots; drench or spray.



Use as directed



BloomStudios
CUT FLOWER INNOVATIONS BY BALL

Common Problems



Tips & Tricks



Common Problems – Uneven germination



- Causes?
 - Most Likely: Uneven Moisture
 - Many potential causes:
 - Temperature incorrect
 - Covered/not Covered incorrectly
 - Light/no light incorrectly
 - Poor seed (low vigor or dormancy)
- What can you do?
 - Most crops:
 - Remove very small runts; keep growing rest and medium seedlings may catch up.
 - Re-sow & monitor moisture more closely.
 - This will allow you to get the numbers you need for your crop.

Common Problems – Extreme Stretch



- Causes?
 - Not enough light
 - Temperatures too warm
- What can you do?
 - Most crops:
 - Throw away and start over
 - Very few exceptions:
 - Transplant up in larger plug or pack size and bury deep
 - *See 1st point, probably throw away and start over.*

Common Problems – Damping off



- Causes?
 - Fungal pathogens
 - Too wet, poor air circulation, other stressful conditions (too cool, too hot, etc.)
- What can you do?
 - To prevent:
 - Sanitize trays and flats
 - Good sanitation practices
 - HAF fans for good airflow
 - Good moisture management
 - To treat:
 - Fungicides, Banrot, Subdue, Chipco, etc. (use as directed)

content.ces.ncsu.edu/damping-off-in-flower-and-vegetable-seedlings

Common Problems – Root Bound Plugs



- Causes?
 - Not transplanting on time
 - Always try to transplant on time
- What can you do?
 - Most crops:
 - Throw away and start over
 - Some crops:
 - Transplant and push with fertilizer

Common Problems – Flowering in the Tray?



- Causes?
 - Not transplanting on time
 - Incorrect daylength for the crop
 - Celosia, Panicum
- What can you do?
 - Most crops:
 - Throw away and start over
 - Some crops:
 - Break up the root ball, transplant, and push with fertilizer

Special Thanks for Supplying Photos & Content

- Dr. Todd Cavins
 - Technical Services Specialist, Ball Seed
- Dr. Bin Liu
 - Senior Culture Research Manager, PanAmerican Seed
- Johnny's Select Seeds
 - Soil blocking and Fungicide info
- Google Images
 - Sometimes...you just need Google 😊

BallSeed®

PanAmericanSeed®

Where to find more information?

- Technical Sheets with Growing Information
 - <https://www.bloomstudios.com/en-us/TechnicalResources>
- Cut Flower Variety Photos
 - <http://photolibrary.ballhort.com:8085/bloomstudios/#/>


BloomStudios
WITH PANAMERICAN SEED®

Dianthus Sweet™ F₁ Series

(Dianthus barbatus) Cut Flowers Culture (revised 12/04/20)

Versatile and programmable series can be produced without vernalization and is the best dianthus for cooler production seasons. A top-notch filler series that features large, long-lasting blooms on strong stems.

General Information

Cultivation Type	Usage	Stem Length	Timing Group
Greenhouse, Tunnel	Filler, Secondary	18-36 in. (46-91 cm)	N/A

Germination

Seed Form	Recommended Plug Size	Seeds/Cell	Plug Crop Weeks	Days to Germinate	Initial Media pH/EC (1:2)	Cover Seed
PEL	288	1	5-6	3-4	5.8-6.2 pH 0.75 mmhos/cm	Yes

Plug Production

	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3-4	Level 3-4	Level 3
Temperature	64-68°F (18-20°C)	65-70°F (18-21°C)	60-65°F (16-18°C)	55-60°F (13-16°C)
Light	Optional	5-8 mol·m ⁻² ·d ⁻¹	8-10 mol·m ⁻² ·d ⁻¹	10 mol·m ⁻² ·d ⁻¹
Fertilizer		Less than 100 ppm N (Less than 0.7 EC)	Less than 100 ppm N (Less than 0.7 EC)	175 to 225 ppm N (1.2 to 1.5 EC)



Using the Quickfind
A simple search will find anything that starts with that word (EXAMPLE: search **Potomac**, you get 42 results)
You can use **AND, OR, NOT** (must be all caps) to search for multiple words or exclude certain words
(EXAMPLE: search **Potomac AND Early**, you get 11 results; search **Potomac NOT Early**, you get 31 results)
If you are unable to find what you are looking for, please contact the Ball Photo Library at photolibrary@ballhort.com

Cataloged 0 selected

Found 629 Items



Where to find more information?

www.BallSeed.com

 **Dianthus Sweet Neon Purple**
Dianthus barbatus 
Form: Plug, Seed

Product Info
Hi-Res Photos

Hi-Res Photos

 [Download Photo](#)

 [Download Photo](#)

 [Download Photo](#)

 [Download Photo](#)

 **BloomStudios**
WITH PANAMERICAN SEED®

Dianthus Sweet™ F₁ Series
(*Dianthus barbatus*) Cut Flowers Culture (revised 12/04/20)

Versatile and programmable series can be produced without vernalization and is the best dianthus for cooler production seasons. A top-notch filler series that features large, long-lasting blooms on strong stems.

General Information

Cultivation Type	Usage	Stem Length	Timing Group
Greenhouse, Tunnel	Filler, Secondary	18-36 in. (46-91 cm)	N/A

Germination

Seed Form	Recommended Plug Size	Seeds/Cell	Plug Crop Weeks	Days to Germinate	Initial Media pH/EC (1:2)	Cover Seed
PEL	288	1	5-6	3-4	5.8-6.2 pH 0.75 mmhos/cm	Yes

Plug Production

	Stage 1	Stage 2	Stage 3	Stage 4
Moisture	Level 4	Level 3-4	Level 3-4	Level 3
Temperature	64-68°F (18-20°C)	65-70°F (18-21°C)	60-65°F (16-18°C)	55-60°F (13-16°C)
Light	Optional	5-8 mol·m ⁻² ·d ⁻¹	8-10 mol·m ⁻² ·d ⁻¹	10 mol·m ⁻² ·d ⁻¹
Fertilizer		Less than 100 ppm N (Less than 0.7 EC)	Less than 100 ppm N (Less than 0.7 EC)	175 to 225 ppm N (1.2 to 1.5 EC)

Contact your
Distribution Sales Rep,
they are an expert in
your region to help
advise



Thank you!



Contact us for more
information anytime:

scott@bloomstudios.com