



Pansy Production Primer

Sakata Ornamentals



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Viola Venus Series



Viola Rebelina Series



Pansy Supreme Series



Pansy Ultima Series



Pansy Dynamite Series



Pansy Majestic Giants II / Power Series



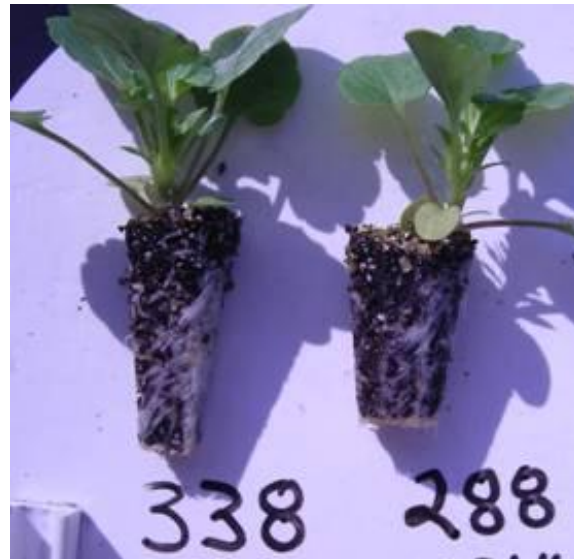
Seed Storage

- Store seed at 35°F/3°C and 35% relative humidity.
- Maintain seed moisture at 10%.



Plug Tray Size

- 512, 406, 392 cells Pack Production Quick Crop Time/Lower shipping costs
- 288 cell 4 inch/10 cm production Stronger for outdoor growing
- 128 cell 6 inch/15 cm production Often multi-sown/quick finish



A 4-5% taper to avoid root wrap.

Plug stage 1 (sowing to radicle emergence)

- Days 1-6
- Select a well-drained sterile media with a pH between 5.5-5.8 and an EC <0.6 mmhos (1:2 slurry).
- A long fiber peat, such as Pindstrup, works well.
- Apply a light cover of medium vermiculite or a combination of peat/perlite or peat/vermiculite works well.
- After sowing water in well and maintain a temperature between 64-68°F/18-20°C.
- The use of primed seed and a germination chamber with a fine mist system to maintain 100% relative humidity is ideal.



Seed cover options

Blending 50% plug media with 50% fine perlite is an alternative to straight vermiculite. The mix provides higher aeration, eliminates the “cap” effect creating one unit with the plug cell media. Also, the change in color from dark brown to tan when dry makes watering decisions easier.



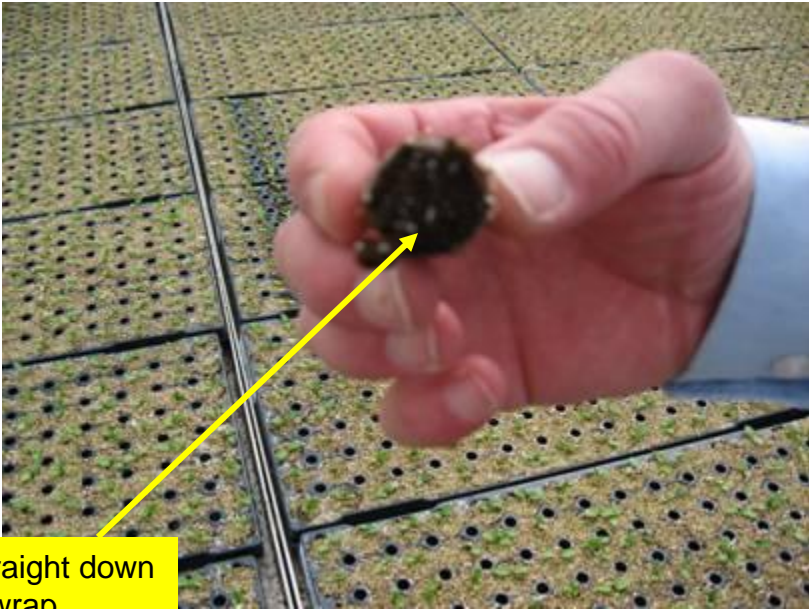
50/50 peat-perlite blend

Plug stage 2 (cotyledons to first true leaf)

- Days 7-14
- If using a germination chamber, remove flats when the seed coat is cracked.
- When green begins to appear in the flat, lightly fertilize with 75 ppm N from a well-balanced calcium nitrate fertilizer. Applying 0.25 ppm of boron, if needed, using Solubor or Borax, is recommended to avoid boron deficiency.
- After the initial feed, Increase fertilizer strength to 100-150 ppm N. Optimum EC is 0.6-0.8 mmhos.
- Maintain temperatures as cool as possible with good air-flow.
- Optimum light level is between 1,000-3,000 foot candles/11,000-32,000 lux.



Micro ellepots facilitate early transplanting



Roots go straight down and do not wrap.



288 ellepot

Excess moisture can retard growth

The same seed lot, location and cultivation management are applied to these plugs, except the amount of irrigation and irrigation frequency.



These plugs were watered excessively



These plugs received water when the plug media surface became dry (light brown in color) but before wilting.

Stage 3 (plug bulking)

- Days 15-25
- Fertilize as need to maintain media EC at 0.8-1.0 mmhos. When applying fresh water, (no fertilizer), maintain micro elements at full strength; especially boron which is easily leached.
- Use mineral acid, if needed, targeting a water alkalinity of 60-80 HCO₃ to maintain media pH between 5.5 and 5.8.
- Moving plants outdoors under a saran house will reduce temperatures and provide optimal air movement. Maintain light levels up to 6,000 foot candles/65,000 lux but avoid heat and water stress.
- If plant height control is needed, B-Nine (daminozide), Cycocel (chlormequat) and A-Rest (ancymidol) are effective. Begin spraying when the leaves are the size of a dime.



Stage 4 (transplanting)

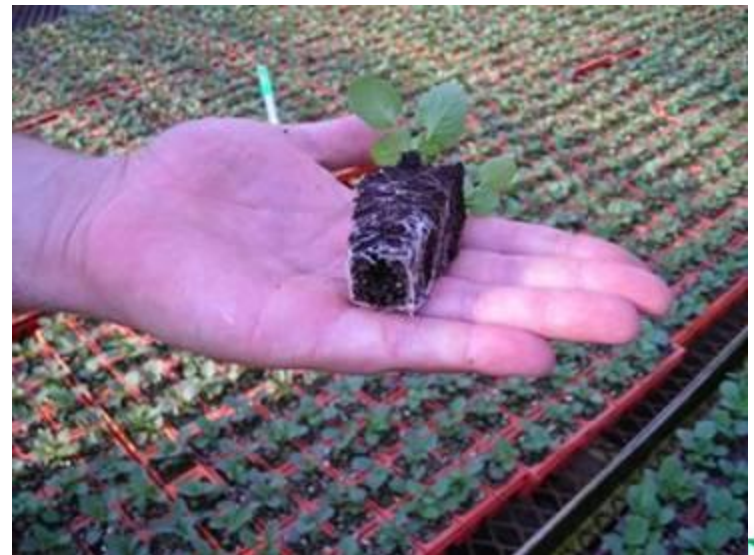
- Plug flats are approaching market size, feed every 2nd or 3rd watering, alternating with acid, (if needed), and trace elements to maintain soil pH and trace element supply; especially boron. During periods of hot and humid weather, or before shipping plugs in a box or truck, apply either Manzate or Zyban to control anthracnose.
- Do not delay transplanting which delays flowering and reduces quality.



Optimum transplant stage is prior to root wrap.

Optimum plug characteristics

- Active root system
- Healthy white roots that have just formed at the bottom of the cell.
- Clean foliage with a bright green color.
- Tight internodes
- Ideal plug age is 30 days old with active growth.
- Soft tissue with little or no growth regulator applied.
- Free of disease and insects.



Benefits of using a white colored plug tray

- White colored plug trays reflect heat to optimize germination conditions limit heat stress in the greenhouse.



Black plastic plug trays raise media temperature by 5-12°F/3-6°C compared to white plastic trays.



Benefit of white-colored plug trays in pansy production



White plug trays reduce soil temperature and promote roots that are better branched and full.

Although the weight of the roots may be similar, the shape is different. The roots from white trays are shorter and more fibrous, while the roots from black trays are longer but more tap-like (pointed).

Benefit of white-colored plug trays in pansy production



Plants grown in white trays are short but abundant and yield a compact plant with good basal branching. This reduces the amount of plant growth regulators.

Roots shape tends to correlate with plant habit.

Media

- Traditional peat-lite blends of peat/perlite or peat/perlite/vermiculite work well to produce high quality plants.
- For plants grown outdoors and subject to days of heavy rains select a coarser peat and larger particle sizes.
- Optimum pH range is 5.5 to 5.8. Black root rot (*thielaviopsis*) is less active at pH 5.5.
- Start with a low EC, (< 0.6 mmhos, 1:2 slurry) and do not incorporate slow release fertilizer into the media for better control.
- If bark is used be sure that it is stable and will not deplete nitrogen.
- Larger particle calcined clay, up to 5%, can be beneficial in stabilizing the pH, retaining nutrients and adding texture to the mix.
- Target a cation exchange capacity of 6-25 meq/100cc.



Transplanting



Ultima Radiance Deep Blue

- Place the plugs slightly high in the pot to avoid stem rot.
- Water in with 100 ppm nitrogen.
- Keep soil moderately moist and avoid keeping the media saturated.
- Keep plants indoors until rooted if no rain protection is available outdoors.

Management after transplanting



- Placing pots directly on the ground reduces drainage and increases the odds for an outbreak of disease, such as Black root rot (*Thielaviopsis*) and Leaf spot (*Cercospora*); especially during periods of high temperatures.

Pansy Plug Age Transplant Demonstration

- Transplanting a younger plug equates to higher quality finished product.
 - Quicker crop turn
 - Better root development
 - Better plant habit
- Sakata genetics form buds as early as the 5th node. Timely transplant capitalizes on the first bud, induces earlier branching and builds a good structured plant body prior to flowering.



Day 21 – Day 28 – Day 35 - Day 42*

*transplant day from sowing (392)



Sown week 31 (392 cell). Photos week 39 (61 days from sowing)



Transplant actively growing seedlings

- Holding plugs longer than necessary affects root development, and the ability to build a well branched plant prior to first flower.



Day 42 – Day 35 – Day 28 – Day 21*

*transplant day from sowing (392)



Importance of transplanting on time



25 day old seedlings

30 day old seedlings

40 day old seedlings

50 day old seedlings

Scheduling



- Sakata's pansy genetics are less affected by day length and temperature.
- This allows for reduced crop time and the advantage of sowing later when environmental conditions are more favorable.
- When sowing in mid to late summer (July, August) crop time can be reduced an additional 7-10 days due to rapid development due to the long photoperiod, higher temperatures and light intensity.

Crop Scheduling

Series	Recommended plug transplant age	Able to initiate flowers as early as this leaf stage*	606 Jumbo Pack from sowing**	4-inch Pot from sowing**
Viola Venus	30 days	5 th true leaf	7-8 weeks	8-9 weeks
Ultima	30 days	6 th true leaf	8-9 weeks	9-10 weeks
Supreme	30 days	5 th true leaf	7-8 weeks	8-9 weeks
Dynamite	28 days	6 th true leaf	8-9 weeks	9-10 weeks
Majestic Giants II	28 days	7 th true leaf	10-11 weeks	11-12 weeks

* if plugs are transplanted on time and not checked

** based on 288 cell size. In late summer under high heat conditions reduce by 1 week.



Pansies may produce flowers as early as the 5th or 6th leaf so accelerate growth early to build the plant canopy.



Indianapolis Motor Speedway

Fertilization



- Calcium nitrate based fertilizers at 150-200 ppm N builds strong and healthy plants.
- To maintain optimum pH it is best to use mineral acid rather than ammonium based fertilizers. As ammonium promotes soft and stretchy growth; especially in high temperatures.
- Cal/Mag formulations work well to supply both calcium and magnesium.
- Pansy Special formulations, such as 15-3-20 supply higher minor elements, such as boron, at a lower nitrogen ppm (125 ppm N yields 0.25 ppm B). This allows one to feed at lower nitrogen rates and still maintain optimum levels of minor elements in the fertilizer solution.
- Optimum media EC level is 1.2 to 1.5 (1:2 slurry).

Gas and Oil

- NPK is analogous to the gas pedal on a car. One can easily push a crop by increasing NPK.
- Micro elements (micro in amount not importance) are analogous to the engine oil. One never wants to run low. Longer recovery time when a deficiency occurs.
- Ideally, have separate stock tanks for minor and NPK so that minors are applied at every irrigation with or without NPK in the line.



Premixed trace elements

- Greencare Fertilizer offers two pre-mixed trace element formulations. Custom blends are available. (815) 936-0096.
- Sulfate: (includes iron chelate instead of iron sulfate)
- Chelated trace elements
- 1.0 Fe, 0.5 Mn, 0.5 Zn, 0.25 Cu, 0.25 B, 0.1 Mo

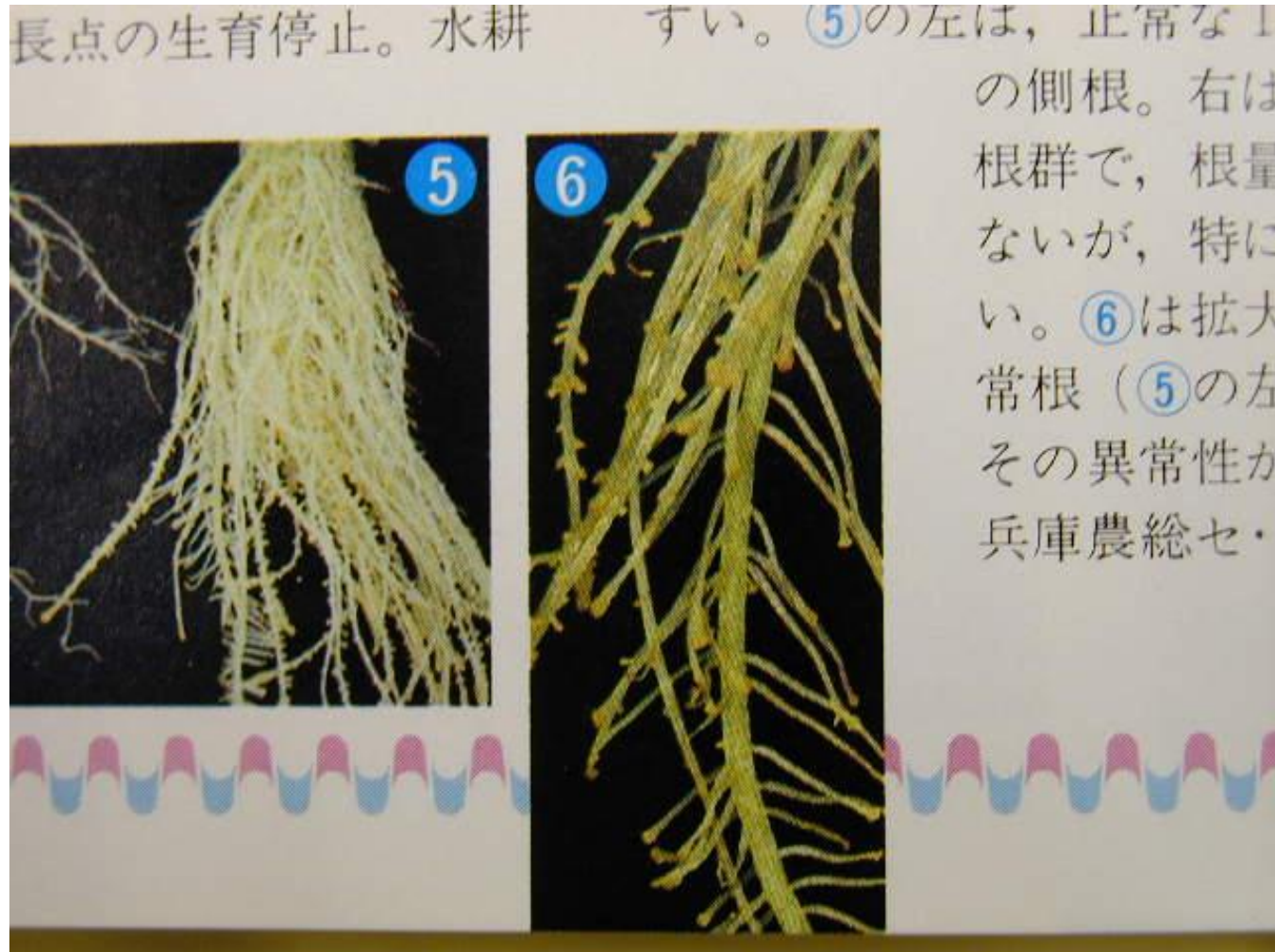
Boron Deficiency

- Boron maintains calcium in a soluble form and is responsible for the translocation of sugars from the leaf canopy to the root zone. Within 24 hours of a boron deficiency there is evidence of damage at the root tip.
- Readily available at a pH of 5.9 or lower.
- Easily leached.
- Deficiency results in a leaf cupping, leaf crinkling, tip abortion and edge burn.
- Target 50-75 ppm in tissue and 0.5-0.7 ppm in media.
- Flower size is impacted by boron. Optimizing boron will promote maximum flower size.



Leaf cupping

Boron deficiency also impacts roots with a loss of root hairs



Temperature and Light

- Up to 7,000 foot candles/76,000 lux is optimum for pansy growth.
- Shade only to control temperature.
- Pansies are more susceptible to pythium and thielaviopsis at higher temperatures (>80°F/27°C).
- Flower size is reduced under high temperatures
- Retractable roof houses are ideal, allowing higher light levels in early to mid morning and again from mid afternoon to evening.



Photoperiod

- As day length shortens 40% of buds on older genetics abort (concave tipped buds). On newer genetics 100% of buds develop normally.



Aborted flower
bud (October)

Pansy Crown White

Growth regulation

- Use less potent and shorter residual chemicals in the beginning to check but not stop growth. Recommendations include B-Nine (daminozide), A-Rest* (ancymidol) and Cycocel (chlormequat)
- Best to avoid using Bonzi and Sumagic early in the crop cycle. If needed, use them later in the crop, after the plants are filled in, to avoid over regulation.
- Identify extra vigorous cultivars and series and treat more aggressively.
- Best to be more reactive than proactive when growing free flowering-type pansies.

*A-Rest can tie up boron.



Environmental Factors affecting plant growth

Factor	Promotes Shoot	Promotes Roots
Temperature	Increasing (between 50-80°F/10-27°C)	Increasing (between 50-80°F/10-27°C)
Light Intensity	Low (<1500 f.c./16,000 lux)	High (> 1500 f.c./16,000 lux)
Moisture	High	Low
CO ₂	High (1,000 ppm)	High (1,000 ppm)
Humidity	High	Low

Chemical Growth Regulation

Summer/Fall Production rates*

Region	B-Nine (daminozide)	A-Rest Spray (chlormequat)	A-Rest Drench (chlormequat)
Northern Growers	2,500-5,000 ppm	5-7 ppm	2-3 ppm
Southern Growers	2,500-5,000 ppm	5-10 ppm	2-5 ppm

Region	B-Nine + A-Rest Tank Mix Spray	B-Nine + Cycocel Tank Mix Spray
Northern Growers	2,500 ppm + 3-5 ppm	1,000-2,500 ppm + 350-750 ppm
Southern Growers	2,500 ppm + 3-7 ppm	1,000-2,500 ppm + 500-1,000 ppm

*for early spring production, reduce rates by ½; especially if growing cool (50-55°F/10-13°C)

Florel

- Florel is actually the chemical Ethephon that breaks down into ethylene as pH and temperature increase.
- Florel does not translocate in the plant, only affecting the area that is sprayed.
- Research is showing that Florel can have positive effects on annuals, such as summer pansies, by delaying flowering and increasing branching.
- Research is showing that humidity plays a greater role in Florel's efficacy than temperature between 50–86° F/10-30°C as it relates to keeping the leaf wet for greater absorption.
- Florel is a signal compound that turns on the plant's defense mechanism and enhances the plant's immune system.
- Still in the experimental stage.

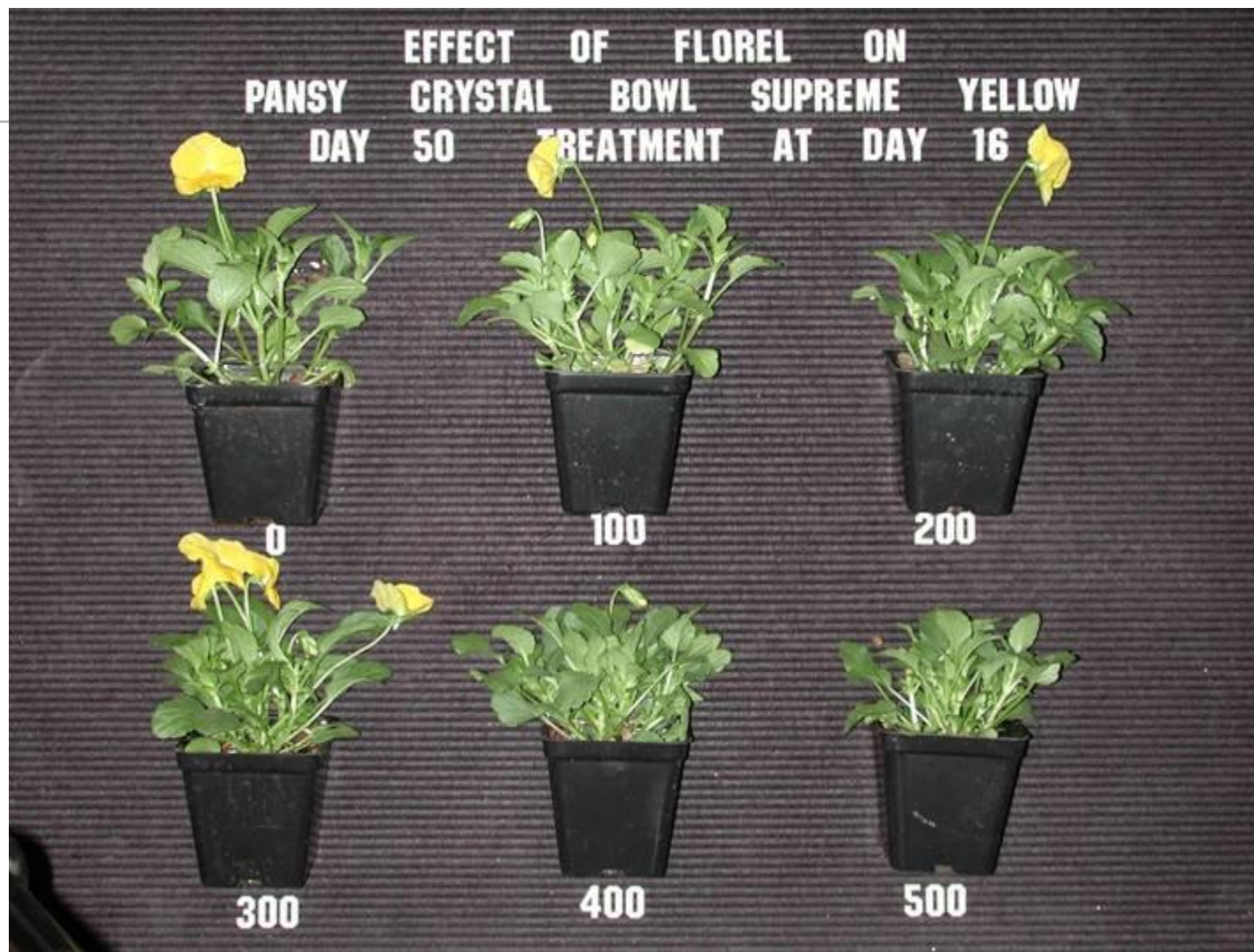


Florel

- Florel promotes branching yielding a full beefy plant with more branching and flowers
- Florel may abort flowers up to six weeks after application.



606, 6 weeks from transplant.



The impact of Florel concentration (0-500 ppm) on leaf number below the first flower of *Viola x wittrockiana* grown under summer conditions, (86°F/30°C day and 68°F/20°C night with 16 hour photoperiod).

Florel

0 ppm



500 ppm



The effect of a 500 ppm application of Florel as an inhibitor of early flowering of French marigold 'Janie' seedlings in plug trays.

Florel Research

- Experiments performed in greenhouse with 86°F/30°C days and 68°F/20°C nights and 16 hour photoperiod to simulate summer conditions.
- Apply 600 ppm of Florel at day 14 when cotyledons are open and laying flat.
- Allow to stay on leaves for 40 minutes and then wash off.
- Effect varies by cultivar with increased branching and delayed flowering from 2 – 11 days.
- Recommendations are for experimental purposes only!
- *Research sponsored by Minnesota Flower Growers, Sakata, Kieft, Goldsmith, Wagner Greenhouse and FIRST*



Dynamite Blueberry Thrill

Conclusions - *Florel*

- Florel can be an effective tool in controlling plant height on pansies. Florel does not work on all annuals, like *Salvia faranacea*, and has been shown to be phytotoxic on *Celosia*.
- If height control is your goal, apply Florel and let it stay on the leaf wet for 40 minutes and then wash it off.
- If delay in flowering is your goal, apply Florel and have it stay on the leaf wet for 60 minutes.
- However, allowing Florel to stay wet on the leaf for more than 40, minutes delays flowering longer and consequently results in a taller plant. (60 minutes increased plant height by an additional 1.6 inches/4 cm, 80 minutes increased height by an additional 3.2 inches/8.1 cm.

Florel study – Majestic Giants II Purple

August 11th (24 days from sowing)



August 15th (28 days from sowing)



August 18th (31 days from sowing)



Florel study

- Sow: July 18th
- Transplant: August 21st (34 days from sowing).
- 300 ppm Florel: August 9th (21 days from sowing), and on August 26th (5 days after transplanting / 38 days after sowing).



Photo taken on September 2nd (6 ½ weeks old).

Florel study – First Flower September 10th (54 days from sowing)

September 10th



September 15th



September 18th



Florel study

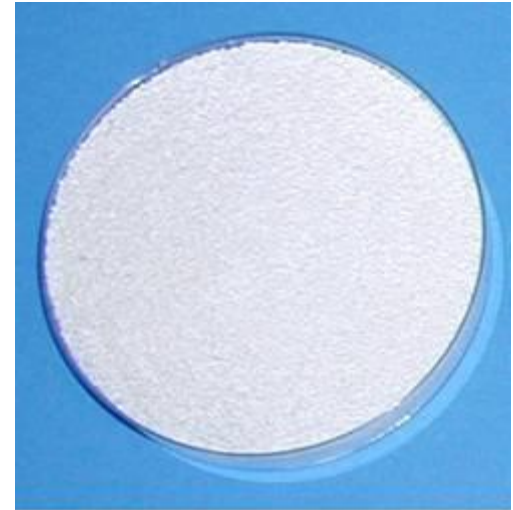
- 10 weeks sowing to shipping!



September 26th

Compalox Low P Buffer

- Compalox® is an activated aluminuoxide that has a very high affinity for P adsorption and desorption. Compalox® also adsorbs and desorbs other nutrient elements (cations and anions) as well as other polar compounds as e.g. organic acids.
- Compalox® can be used flexibly. Depending on the environment of the grower, different growth strageies apply.
- Exerts a strong growth retardant effect on pansies and violas.
- Incorporated into media at 5 grams/liter or 8 lbs/cubic yard which is equivalent to approximately 1.5 ppm (50 μ M P).
- A 20 fold reduction from typical phosphorus fertilization.



Compalox® pansy trial, Salinas, California



L-R: Compalox-P Buffer only – Compalox-P Buffer + Dynamic P* – Control

*equivalent to 4.5 ppm P

Control (P
regularly applied)

Compalox® +
Dynamic P

Compalox® only



Root rot on pansy – *Grower Talks June 2002*

Disease	Symptoms	Cultural Control	Chemical Control
Thielaviopsis (Black Root Rot)	Yellowing of lower foliage and clubby roots with black discoloration.	Avoid saturated soil until plants are rooted in. Optimum nutrition, pH 5.5, low ammonium and avoid the chemical metalaxyl (Subdue).	Thiophanate methyl or Triflumizole. Don't saturate soil.
Mycothecium Crown Rot	Plant yellowing followed by wilting. Easily breaks at soil line.	Avoid keeping recently transplanted plugs too wet. Planting plugs too deep.	Chlorothalonil, fludioxonil, triflumizole and trifloxystrobin.
Pythium (primarily seen in plug production)	Black shiny roots in which the outer root layer easily separates from the inner sheath.	Water mold favored by excessive soil moisture. Avoid old plug trays and use sterile media.	Etridiazole, mefenoxam, metalaxyl (metalaxyl is not recommended for pansies)
Rhizoctonia (primarily seen in plug production)	Stem canker at the soil line with healthy root growth. Starts at crown and moves up.	Water mold favored by excessive soil moisture. Avoid excess vermiculite covering in germination.	Terraclor is specific for rhizoctonia, sprinch of a fungicide containing fludioxonil or triflumizole
Fusarium (less common and often mistaken for myrothecium crown rot)	Rot starts on the root and then goes to the crown. Often pythium is involved.	Sanitation and keeping the hose off the ground. Use new plug trays and a sterile media.	Spray combo Iprodione /chlorothalonil or Thiophanate/methyl/ chlorothalonil combo

Disease - Leaf Spots

- Alternaria, Anthracnose, Colletotrichum, Cercospora sp. and Mycoцентросpora are common when plants are nutritionally deficient and exposed to prolonged leaf wetness.
- Best to have a lab diagnose the exact pathogen as many look similar.
- Best to spray every 7 days under conditions of high humidity and every 14 days under bright and sunny conditions.
- Combinations of iprodione/chlorothalonil or thiphanate methyl/chlorothalonil are very effective as well as Zyban and Manzate.



Cercospora leaf spot



Anthracnose on pansy

Leaf spot (*Cercospora violae*)



Cercospora appears on the stems and leaves under high humidity and moderate (65-68°F/18-20°C) temperatures. The typical symptom is a spot that starts out black and progresses to gray-brown in color (similar to a mold) with a brown-red margin.

- The most effective method for preventing this disease is good air flow/ventilation and removing infected leaves and plants from the greenhouse.

Disease – Black Root Rot (*Thielaviopsis basicola*)

- Characterized by stunting and wilting with chlorotic leaves.
- Roots develop dark spots or bands that are easily seen against the normally white pansy roots.
- The infection starts at the root tips and then progresses until the entire root system becomes black and water-soaked. The black color is due to darkly colored fungal spores within the root.
- Keep the pH at 5.5
- Avoid using the chemical metalaxyl (Subdue).
- Fertilize with a well-balanced calcium nitrate based fertilizer, avoiding ammonium salts.
- Reduce stress from high heat.
- Use a well-aerated media and allow it to dry slightly in between irrigations to break the fungal cycle.



Black root rot – cultural controls

Black root rot (*Thielaviopsis basicola*) is an opportunistic pathogen, which is more problematic in hot and humid conditions. The following managements are essential to avoid an outbreak of this disease.

1. Use a new plug trays, pots and containers; this fungus survives on the surface of these materials for many years. Always use new, sterile media for plug and pots. Do not use recycled media from the “dump pile”.
 2. Use risers to elevate pots off the ground as the fungus is carried in run off water and infects pansy roots through absorption.
 3. Reduce stress as much as possible by providing optimum environmental conditions. Elevated temperatures (>85°F/29°C), excess moisture or a lack of fertilizer weakens the plants making them more susceptible to infection.
- If you find infected plants in your fields, destroy (by burning) the whole plant to prevent spreading the disease.

Disease - TSWV (Tomato Spotted Wilt Virus)



- This plant was infected with TSWV in the seedling (plug) stage. The typical symptoms of the disease are necrotic spots on leaves and stems, aborted flower buds and twisted stalks.

Disease - TSWV

- Thrips are vectors of TSWV as well as plant touching (contact infection). When plants are infected at a young stage, it causes major damage as seen in the previous slide.
- Perennial plants and weeds in crop fields surrounding greenhouses are often a source for this virus. These weeds may harbor the virus for several years.

Therefore, **thrip control and elimination of weeds around crop fields is essential** to avoid a virus outbreak.

- If you find infected plants in your fields, destroy (by burning)) the whole plant to prevent spreading the disease.

CMV (*Cucumber mosaic virus*)



- CMV is a common virus disease that is carried and spread by aphids. The typical symptom of this disease are stripes (mosaic) on flower petals and leaves.
- A preventative spray program is needed to manage the disease.

Leaf spot (*Septoria violae*)



- *Septoria* appears on the leaves under high humidity and moderate (65-68°F/18-20°C) temperatures. The typical symptom is a bluish-white leaf spot with a brown margin.
- This disease can be controlled through soil sterilization prior to planting, providing good ventilation and spraying with fungicide.

Gray mold (*Botrytis cinerea*)



- Grey mold (*botrytis*) appears on flower petals and leaves when air humidity is high. The typical symptom is de-colored spots on flower petals and light brown-colored spots on leaf surfaces.
- The most effective method for preventing this disease is heating and venting and eliminating spent flowers (dead tissue) from the plant.

Insects

- Aphids - often show up prior to shipping. Control with acephate combined with pyrethroid.
- Fungus gnats/shore flies – problem in excessively wet media. Chlorpyrifos eradicates insect larvae and a pyrethroid to knock down adults.
- Caterpillars – larvae can chew large holes in foliage and often are seen by large droppings left behind. Easily controlled by spraying *Bacillus thuringiensis*.
- Slugs – feed on foliage causing damage. Use metaldehyde baits to control.



Insects - Common cutworm (*Spodoptera litura* Fabricius)



- Juvenile cutworms feed on the undersides of leaves causing plant damage.
- To control, spray with an insecticide at first sign of damage.

Ellepots for landscaping without the root wrap!



Shipping

- To avoid leaf spots, spray plants with Manzate or Zyban prior to shipping if they will be exposed to shady and damp retail conditions.
- Another option is to drench with Cleary's 3336 which provides systemic control.
- Raise EC prior to ship for holding ability at retail.



Summary

- Purchase healthy disease free plugs.
- Use a well drained media with a pH of 5.5-5.8.
- Transplant into dibbled flats and avoid burying the plug. Avoid keeping new transplants excessively wet. Do not move outdoors until rooted unless there is rain protection.
- Fertilize with 150-200 ppm N as needed to maintain an EC of 1.2 to 1.5 mmhos, (1:2 slurry) and allow sufficient drying between irrigations.
- Supply sufficient trace elements; especially boron at 0.25 ppm at each irrigation.
- Avoid using strong PGR's, like Bonzi, and be more reactive than proactive on newer genetics.
- Reduce stress by lowering temperature with shade during the heat of the day. Photosynthesis is maximized between 6,000-7,000 foot candles/65,000-76,000 lux.
- Employ a preventative spray program for leaf spots.
- Outdoor production or open roof houses greatly benefit pansies by providing high light, fresh air and cooler nights.
- Good cultural practices are your best defense against disease!

Advantages of Sakata's Pansy genetics

- Shorter crop time – allows growers to cut 7 to 10 days off crop time = \$\$\$ savings!
- Gives retailers more flowers – better sell through and extended shelf life
- Greater consumer satisfaction as plants flower during the shortest days of the year.



Thank you!



Majestic Giants II White w/b

- “Amateurs built the Ark, Experts the Titanic”.
- You know your business better than anyone so experiment on a small scale first before making any major changes.