



Technical Guide



People.
Plants.
Innovation.

Love flowers? Welcome to your happy place!

If you want the best flower seeds in the industry for your business, you've come to the right place!

With an almost 200 year old legacy as a family-owned business, you might think of Benary as an old or old-fashioned company... On the contrary.



Throughout our long history, world events have played a significant role in the necessity to continuously reinvent ourselves, giving us the spirit of a multi-generational startup.

Despite many challenges and transitions throughout the years, Benary has not only survived, but every obstacle we have faced has made us stronger, better.

Together we are striving to be the most professional, innovative and personal company in global floriculture.

Thank you for working with us!



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Moisture Codes, Signs & Symbols

Saturated (5)	Water is easily observed when finger is pressed on cell. Water moves freely from the top of the plug to the bottom.
Wet (4)	Media looks black and is not glistening. The media feels wet to the touch but there is very little water movement.
Moist (3)	Water is not easily visible. When finger is pressed on the cell there is very little movement from top to bottom.
Medium (2)	Media is not black, but now looks medium brown. There is no water movement when pressed with finger.
Dry (1)	Media has changed color to a very light brown and is dry to the touch.
ApeX	Benary's Seed Technology program for greater overall profitability
FastraX	Benary's program of first year flowering perennials (vernalization-free)

↑ Height

↔ Width

☀ Exposure

Seed Technology: Seed Forms

Raw

Purity in all Shapes

Seed, in its raw form, comes in all kinds of shapes. All raw seed lots are cleaned and processed using multiple mechanical procedures to obtain highly pure, homogenous seed products.



Detailed

Significant Improvement of Sowing

Detailed seeds are offered for seed forms having a tail, which makes the sowing more difficult. For some flower cultures such as Tagetes (Marigolds) the tail of the seed is mechanically removed, which significantly improves its sowability.



Coating

Seed Placement & Sowability

Thin coatings are used to monitor sowing efficiency. Colored seeds offer a high contrast and thus are easy to spot on dark soil. In contrast, thicker coatings (Encrustings) increase the flowability. Some plant species produce seeds that have a very flat or irregular shape. These seeds are of poor flowability and can severely impede automatic sowing processes. Encrusting the seeds to give a rounder shape and smoother surface can help solving this challenge.



Pelleting

Easy Sowing & Controlling of Seeds per Cell

Some types of plants produce extremely small sized seeds, which makes automated sowing nearly impossible. These seeds are pelleted to increase their size by approximately 5 to 20 fold. Pellets allow plug growers to easily sow and control the number of seeds per cell.



Multipellets

Contain several Seeds

Multipellets are just like standard pellets except each pellet contains several seeds. This makes producing some species such as Lobelia or Portulaca easier by guaranteeing a bushy plant with just one pellet.



Priming

Faster Germination & Higher Uniformity

During the priming process, germination is initiated and then interrupted at a specific stage of physiological development. When planted, primed seeds offer a faster and more uniform germination. The increased uniformity often remains well beyond the seedling stage. The faster seedling development allows growers to use greenhouse space more efficiently. At the same time, faster seedling development reduces the number of losses that can occur during the critical germination period.

Optimal storage: up to 6 months at 41 °F / 5 °C



Apex

Optimized Germination & Excellent Seed Quality

Many perennials from seed need to overcome a natural dormancy for proper germination. The Apex program combines a wide range of techniques to 'break' the dormancy. As a result, Apex-treated seeds show significantly increased germination efficiencies and ensure that the seed has the optimum germination for growers.

Optimal storage: up to 6 months at 41 °F / 5 °C



Annuals

Begonia boliviensis F.

Sun Cities Collection, Groovy, Funky™

Santa Barbara, Santa Cruz™, San Francisco

Family, Origin: Begoniaceae, South and Central America

Product Use: Pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Pelleted

FLOWERING

Flowering Type: Obligate long day plant requiring a daylength > 13.5 hrs. to initiate flowering. A night break can also be used, lighting for 5 hrs. during the night from 10 pm-3 am.

Flowering Mechanism: Tuberous begonias are light accumulators. Daylength extension and supplemental lighting will hasten flowering and improve plant quality.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development from the day of sowing until root emergence. Expect root emergence in 7-10 days.

Cover: Do not cover the seed, light is required for germination.

Sowing method: Sow 1 pellet per plug.

Media: pH 5.5-5.8; EC 0.5. Begonias are sensitive to high salt levels.

Temperature: Keep at 72-74 °F (22-23 °C) until radicle emergence. Higher temperatures, exceeding 80 °F (27 °C) will inhibit germination. Upon root emergence, on day 10-14 reduce

the temperature to 68-70 °F (20-21 °C) until cotyledon expansion. On day 21 the temperature can be reduced further to 68 °F (20 °C). For irrigation use warm water (above 64 °F / 18 °C) only.

Moisture: Begin with a media moisture level of saturated (5) from day 1-11. A saturated media and high humidity are critical to successful begonia germination. Beginning on day 12, alternate between moisture levels wet (4) and moist (3). Allow media to approach moist (3) before re-saturating to wet (4). On day 21 the seedlings need to begin a good dry-back cycle to aid rooting and avoid algae formation. Once germinated the seedlings are sensitive to watering with too much pressure and water volume, since they have just started rooting into the media. Since they have just begun to root into the media. It is easy to dislodge the seedlings resulting in a lower number of usable plants. Use a fine nozzle or water breaker with a gentle pressure and low water volume.

Humidity: Should be 95-100% until day 11; then dehumidify and reduce to 60 %. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is necessary for germination and will be beneficial for the germination process and improve quality. If utilizing a germination chamber, providing a light source of 10-100 ft. candles (100-1,000 lx) will improve germination and reduce stretch. Provide long days of 14-16 hrs. to improve germination and overall seedling quality.

Fertilizer: Begin fertilizing early once germination is complete, approximately day 14. Lower rates of feeding at 50 ppm N 2-3

times per week will help to size up the seedlings. Under higher light conditions use a 17-5-17 fertilizer and under lower light a 14-4-14.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedling root to the edge of the plug and reach the 4-6 true leaf stage where flower initiation occurs.

Media: pH 5.5-5.8; EC 1.25-1.5

Light: Long days of 14-16 hrs. are required to keep plants from producing tubers and to initiate flowering. Light levels of 8-10 mol/m²/day (25,000-30,000 lx) will improve quality and hasten flowering. Only moderate levels of light are required to keep plants vegetative. A minimum of 10-15 ft. candles (550 lx) is all that is required to avoid tuber formation, however-higher light will benefit overall quality. Supplemental lighting under low light conditions providing 350-600 ft. candles (3,500-6,000 lx) will improve quality. Shading is required when light levels reach 3,500-4,000 ft. candles to prevent leaf edge burn.

Temperature: To achieve the shortest crop time, on days 28-42 keep the temperature at 68-70. A slightly lower temperature of 67-68 °F (19-20 °C) will reduce stretch in the seedlings. Bolivienis begonias are very responsive to DIF, and a 2-3°F (1-2°C) DIF will also keep plants compact. Once roots have reached the bottom of the tray after day 42 the temperature can be lowered to 64-67 °F (18-19 °C).

Moisture: Use care to make sure that the media is not kept saturated and is allowed to dry back between waterings. Alternate between moisture levels wet (4) and moist (3). Allow media to approach level (3) before re-saturating to level (4). Avoid allowing the media to become too dry since begonia are sensitive to high salts and root damage can occur.

Fertilizer: Alternate between a calcium-based fertilizer (14-4-14 or 15-5-15) and an ammonium-based fertilizer (17-5-17) at 50-100 ppm N every 2-3 waterings. Fertilizer applications can be gradually increased in the later stages of bulking where a constant feed at 100 ppm is used. Under high light and long days an

ammonium-based fertilizer (20-10-20) at 50-100 ppm can also be used.

Growth Regulators: Very low rates of Cycocel (chlormequat chloride) as a spray at 250 ppm (0.04%) can be used. B-Nine (daminozide) sprays at 500-750 ppm can also be made. If larger plugs (72 trays) are being grown they may require one application of Cycocel or B-Nine before transplanting.

Fungicides: Apply preventative sprays for botrytis, pythium and rhizoctonia as needed.

GROWING ON

Media: Use a well-drained, growing substrate; pH 5.5-5.8; EC 1.0-1.5

Light: Continue with long days of 14-16 hrs. until the daylength is > 12 hrs. or mid March. Provide 10-12 mol/m²/day (30,000-35,000 lx) for optimal quality. If plants are placed under short day conditions growth will become uneven. Daylength extension is very important to continue vegetative growth. If light levels exceed 4,000 ft. candles provide shading to reduce the leaf temperature and prevent leaf edge burn.

Temperature: After transplanting provide 65-68 °F (18-20 °C) nights for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 60-64 °F (16-18 °C). An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop. Temperatures below 57 °F (14 °C) will result in tuber formation and a delay of the crop. A DIF of 2-3 °F (1-2 °C) will result in a more compact crop requiring little to no growth regulators.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow substrate to approach medium (2) before re-saturating to wet (4). Allowing plants to dry back too much can result in root damage.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Alternate between calcium-based fertilizer 14-4-14 and an ammonium fertilizer 17-5-17 at 100-150 ppm N. Keep the media EC at 1.5. Application of potassium nitrate

can help to keep the plants more compact. Under higher light and warmer temperatures a fertilizer with additional ammonium can be used. Tall, stretched plants with few flowers indicate too much ammonium. Stunted, chlorotic plants with marginal leaf burn indicate a lack of calcium and magnesium. Under high light and extended daylength an ammonium-based feed (20-10-20) at 100-150 ppm nitrogen can also be used.

Growth Regulators: If needed, Cycocel (chlormequat chloride) can be used as a spray two weeks after transplanting at 300-500 ppm (0,04%). Cycocel will not hasten flowering, but will increase the number of flowers. If using growth regulations two applications will likely be necessary. A negative DIF of 2-3 °F (1-2 °C) is also very effective in height control. If using DIF then no additional PGR's should be necessary.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, pythium, rhizoctonia, powdery mildew and tomato spotted wilt virus.

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping. Lowering the temperature to 60 °F (16 °C) 1-2 weeks prior to shipping will help to tone the plants.

Sun Cities Collection, Groovy:

Plug Crop Time		
288 tray	7-8 wks	
128 tray	8-9 wks	
72 tray	9-10 wks	
Finished Crop Time		
	288 tray	128 tray
4" / 10 cm pots	7-8 wks	5-6 wks
6" / 15 cm pots	8-9 wks	7-8 wks
10" / 25 cm baskets	10 wks	8-9 wks

↑	↔	☀
12-16" 30-40 cm	16-20" 40-50 cm	Sun – Partial shade

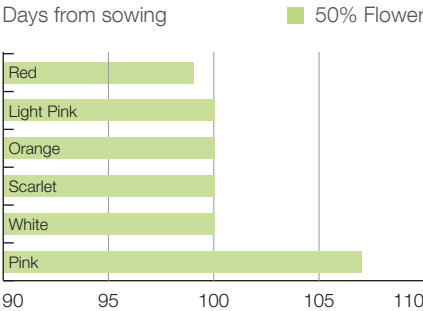
Funky™ (Hybrid):

Plug Crop Time		
288 tray	7-8 wks	
128 tray	9-10 wks	
72 tray	10-11 wks	
Finished Crop Time		
	288 tray	128 tray
4" / 10 cm pots (1*)	8-9 wks	6-7 wks
6" / 15 cm pots (1-2*)	9-10 wks	7-8 wks
10" / 25 cm baskets (3-5*)	11-12 wks	9-10 wks

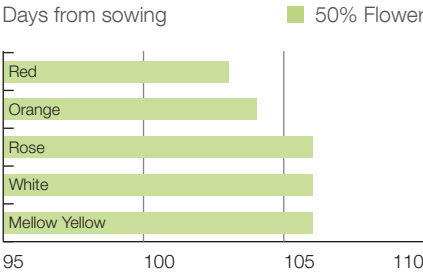
↑	↔	☀
8-12" 20-30 cm	8-10" 20-25 cm	Sun – Partial Shade

*plants per pot

Timing Funky™



Timing Groovy



Expert Tip

Spacing the plants will increase overall plant quality. Do not cultivate too wet since the roots are sensitive to over-watering. Keep humidity levels low to avoid problems with powdery mildew. Hang finished baskets in an appropriate location at maturity, since *Begonia boliviensis* produce an abundance of self-cleaning flowers.

Annuals

Begonia semperflorens F₁

Cocktail™, Super Olympia™, Sprint Plus, Nightlife, Super Cool, Nightsprint, CoolNight

Family, Origin: Begoniaceae, South and Central America

Product Use: Packs, pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Pelleted

FLOWERING

Flowering Type: Day neutral plant, will flower regardless of daylength.

Flowering Mechanism: Higher light intensity and warmer temperatures will hasten flowering. Supplemental lighting during germination will benefit but is not necessary.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 6-8 days.

Cover: No covering required. Light is required for germination and will benefit, giving a more uniform germination.

Sowing method: 1-2 seeds or pellets per plug

Media: pH 5.5-5.8; EC 0.5-0.75

Temperature: Maintain 72-76 °F (22-24 °C) days 1-11. For irrigation use warm water (above 64 °F / 18 °C) only.

Moisture: Begin with a saturated (5) media for the first 10 days and on day 11 begin to dry back slightly to wet (4). This will help the seedlings root into the media. On day 11 begin to alternate moisture between wet (4) and moist (3) until day 21. On day 21 it is critical to begin a good dry-back cycle. At this point you can alternate moisture between wet (4) and medium (2).

Humidity: 95-100% until day 11; then reduce to 40-60%

Dehumidify: On day 11 dehumidify, moving from 100% to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is required and will help giving a more uniform germination. If germinating in a chamber supply 10-100 ft. candles (100-1,000 lx); (50 Watt/m²) to prevent seedling stretch. Protect seedlings from direct light when moving to Stage II. Once established in Stage II the light levels can be increased. On days 12-14 light levels can be increased

to provide light levels of 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx).

Fertilizer: Maintain an EC < 1.0. Fertigation water should not exceed an EC of 0.5. Initial feeding should be with a balanced fertilizer low in ammonium. Begin feeding with a 4-4-14; 14-2-14 or 17-5-17 fertilizer at 50-60 ppm N.

Plug Bulking and Flower Initiation:

Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 4-6 true leaf stage flower initiation will occur.

Media: pH 5.5-5.8; EC 1.25-1.5

Light: Continue to protect from direct sunlight until they are well established. On day 21-22 the light levels can be raised to 10-12 mol/m²/day (3,000-3,500 ft. candles or 30,000-35,000 lx).

Temperature: Keep at 68-70 °F (20-21 °C) night and day. When the roots reach the bottom of the cell the temperature can be lowered to 67 °F (19.5 °C).

Moisture: Begin alternating moisture between wet (4) and moist (3) on day 12. To prevent algae it is important to begin a wet (4) to medium (2) cycle on day 21 where the media will dry back within a 24 hr. period. Good ventilation and horizontal airflow will create such an environment.

Fertilizer: Begin fertilizing early to improve seedling quality. Under high light conditions more ammonium-based fertilizers can be used (17-5-17) and under low light use a calcium-based fertilizer (14-4-14 or 14-2-14). Initial feeding should start at 50-100 ppm N and gradually work up to 100-150 ppm N.

Growth Regulators: No growth regulators should be necessary since growth can be controlled by temperature and moisture management. If seedlings are uneven a very light application of B-Nine (daminozide) or Cycocel (chlormequat chloride) can be applied.

Fungicides: Scout for botrytis and phytophthora during the plug stage and apply specific fungicides per the recommended rate.

GROWING ON

Media: pH 5.5-5.8; EC 1.2-1.5

Light: Provide 12-14 mols/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) nights, 64-67 °F (18-19 °C) days for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 62-65 °F (16-18 °C) day and night. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let media dry back to at least a moist (3) level before re-saturating to wet (4). Extremely dry plants will have a grayish cast to the leaves. Avoid watering plants under high temperature and light when the leaf temperature is excessive.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Moderate fertilization levels are required. Fertilize the crop weekly with 100-150 ppm nitrogen, using a complete balanced fertilizer. Avoid high ammonium and high nitrogen levels, because the foliage can grow very large. Avoid pH levels above 6.0, as high pH can cause iron deficiency. Watch for low Ca and Mg levels since this can result in stunted plants with marginal leaf edge burn. Under high light conditions use an ammonium-based fertilizer (17-5-17) and under low light use a calcium-based fertilizer (14-4-14).

Growth Regulators: With proper moisture and temperature management there should not be a need for growth regulators. If needed apply Cycocel (chlormequat chloride) at 300-500 ppm one to two weeks after transplant.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis.

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Cocktail™, Super Olympia™:

Plug Crop Time	
288 tray	7 wks
Finished Crop Time (from 288 tray)	
Packs	5-6 wks
4" / 10 cm pots	6-7 wks
10" / 25 cm baskets	7-8 wks

↑	↔	☀
8-10" 20-25 cm	8-10" 20-25 cm	Sun – Shade

Sprint Plus, Nightlife, Super Cool:

Plug Crop Time	
288 tray	6-7 wks
Finished Crop Time (from 288 tray)	
Packs	4-5 wks
4" / 10 cm pots	5-6 wks
10" / 25 cm baskets	6-7 wks

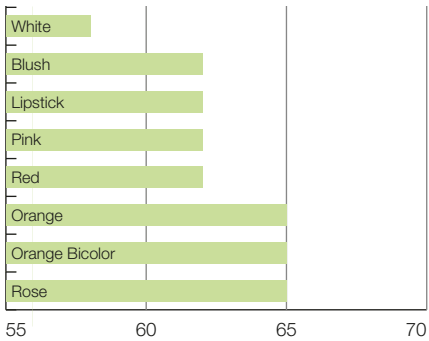
* Nightlife and Super Cool approx. 1 week later than Sprint Plus

↑	↔	☀
8-10" 20-25 cm	10-12" 25-30 cm	Sun – Partial shade

Timing Sprint Plus

Days from sowing

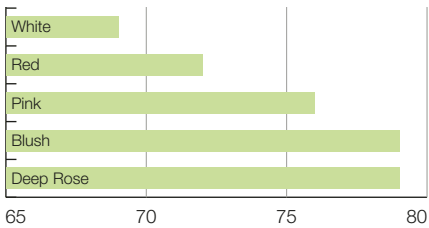
■ 50% Flower



Timing Nightlife

Days from sowing

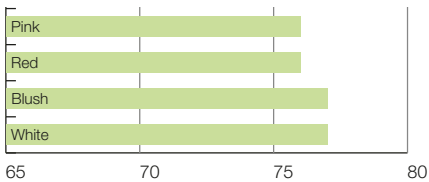
■ 50% Flower



EU Timing Super Cool

Days from sowing

■ 50% Flower



Annuals

Begonia tuberhybrida F₁

Nonstop™, Nonstop Joy®, Nonstop™ Mocca, Illumination®

Family, Origin: Begoniaceae, South and Central America

Product Use: Pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Pelleted

FLOWERING

Flowering Type: Obligate long day plant requiring a daylength > 13.5 hrs. to initiate flowering. A night break can also be used, lighting for 5 hrs. during the night from 10 pm-3 am.

Flowering Mechanism: Tuberous begonias are light accumulators. Daylength extension and supplemental lighting will hasten flowering and improve plant quality.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development should begin on the day of sowing until root emergence. Expect root emergence in 7-10 days.

Cover: No covering of the seed is required.

Sowing method: Sow 1-2 seeds or pellets per plug.

Media: pH 5.5-5.8; EC 0.5 Begonia are sensitive to high salt levels.

Temperature: Maintain 72-74 °F (22-23 °C) until roots emerge. Higher temperatures, exceeding 80 °F (27 °C) will inhibit germination.

Upon root emergence, on day 10-14 reduce the temperature to 68-70 °F (20-21 °C) until cotyledon expansion. On day 21 the temperature can be reduced further to 68 °F (20 °C). For irrigation use warm water (above 64 °F / 18 °C) only.

Moisture: Begin with a media moisture level of saturated (5) from day 1-11. A saturated media and high humidity are critical to successful begonia germination. Beginning on day 12, alternate between moisture levels wet (4) and moist (3). Allow media to approach moist (3) before re-saturating to wet (4). On day 21 the seedlings need to begin a good dry-back cycle. Once germinated the seedlings are sensitive to watering with too much pressure and water volume since they have just begun to root into the media. It is easy to dislodge the seedlings resulting in a lower number of usable plants. Use a fine nozzle or water breaker with a gentle pressure and low water volume.

Humidity: Maintain 95-100% humidity until day 11 then dehumidify and reduce to 60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is necessary for germination and benefits the germination process as well as improves quality. If utilizing a germination chamber, providing a light source of 10-100 ft. candles (100-1,000 lx) will improve germination and reduce stretch. Provide long days of 14-16 hrs. to improve germination and overall seedling quality.

Fertilizer: Begin fertilizing early, once germination is complete, approximately day 14. Lower rates of feeding at 50 ppm N 2-3 times per week will help to size up the seedlings.

Under higher light conditions use a 17-5-17 fertilizer and under lower light a 14-4-14.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedling root to the edge of the plug and reach the 4-6 true leaf stage flower initiation will occur.

Media: Use a well-drained, growing substrate; pH 5.5-5.8; EC 1.25-1.5

Light: Long days of 14-16 hrs. are required to keep plants from producing tubers and to initiate flowering. Light levels of 8-10 mol/m²/day (25,000-30,000 lx) will improve quality and hasten flowering. Only moderate levels of light are required to keep plants vegetative. A minimum of 10-15 ft. candles (550 lx) is all that is required to avoid tuber formation, however-higher light will benefit overall quality. Supplemental lighting under low light conditions providing 350-600 ft. candles (3,500-6,000 lx) will improve quality. Shading is required when light levels reach 3,500-4,000 ft. candles to prevent leaf edge burn.

Temperature: Maintaining the ideal temperature will achieve the shortest crop time. On days 28-42 keep the temperature at 68-70 °F (20-21 °C). A slightly lower temperature of 67-68 °F (19-20 °C) will reduce stretch in the seedlings. Tuberous begonias are very responsive to DIF where a 2-3 °F (1-2 °C) DIF will also keep plants compact. Once roots have reached the bottom of the tray after day 42 the temperature can be lowered to 64-67 °F (18-19 °C).

Moisture: Use care to make sure that the media is not kept saturated and is allowed to dry back between waterings. Alternate between moisture levels wet (4) and moist (3). Allow media to approach level (3) before re-saturating to level (4). Avoid allowing the media to become too dry since begonias are sensitive to high salts and root damage can occur.

Fertilizer: Begin fertilizing early, once germination is complete, approximately day 14. Lower rates of feeding at 100 ppm N 2-3 times per week will help to size up the seedlings. Under higher light conditions use a 20-10-20 at 50-100 ppm N and under lower light a 14-4-14.

Growth Regulators: Very low rates of Cycocel (chlormequat chloride) as a spray at 250 ppm (0.04 %) can be used. B-Nine (daminozide) sprays at 500-750 ppm can also be made. If larger plugs (72 trays) are being grown they may require one application of Cycocel or B-Nine before transplanting.

Fungicides: Apply preventative sprays for botrytis, pythium and rhizoctonia as needed.

GROWING ON

Media: Use a well-drained, growing substrate; pH 5.5-5.8; EC 1.0-1.5

Light: Continue with long days of 14-16 hrs. Until the daylength is > 12 hrs. or mid-March. Provide 10-12 mol/m²/day (30,000-35,000 lx) for optimum quality. If plants are placed under short day conditions growth will become uneven. Daylength extension is very important to continue vegetative growth. If light levels exceed 4,000 ft. candles provide shading to reduce the leaf temperature. Under high light conditions provide shading to prevent leaf edge burn.

Temperature: After transplanting maintain 65-68 °F (18-20 °C) nights for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 61-64 °F (16-18 °C). An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop. Temperatures below 57 °F (14 °C) will result in tuber formation and a delay of the crop. A DIF of 2-3 °F (1-2 °C) will result in a more compact crop requiring little to no growth regulators.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow plants to approach a medium (2) before re-saturating to a wet (4). Allowing plants to dry back too much can result in root damage.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Alternate between calcium-based fertilizer 14-4-14 and an ammonium fertilizer 17-5-17 at 100-150 ppm N. Keep the media EC at 1.5. Application of potassium nitrate can help to keep the plants more compact. Under higher light and warmer temperatures

a fertilizer with additional ammonium can be used. Tall, stretched plants with few flowers indicate too much ammonium. Stunted, chlorotic plants with marginal leaf burn indicate a lack of calcium and magnesium. Under high light and extended daylength an ammonium-based feed (20-10-20) at 100-150 ppm nitrogen can also be used.

Growth Regulators: If needed, Cycocel (chlormequat chloride) can be made as a spray two weeks after transplanting at 300-500 ppm (0.04 %). Cycocel will not hasten flowering, but will increase the number of flowers. A negative DIF of 2-3 °F (1-2 °C) is also very effective in height control. If using DIF then additional PGR's should not be necessary.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, pythium, rhizoctonia, powdery mildew and tomato spotted wilt virus.

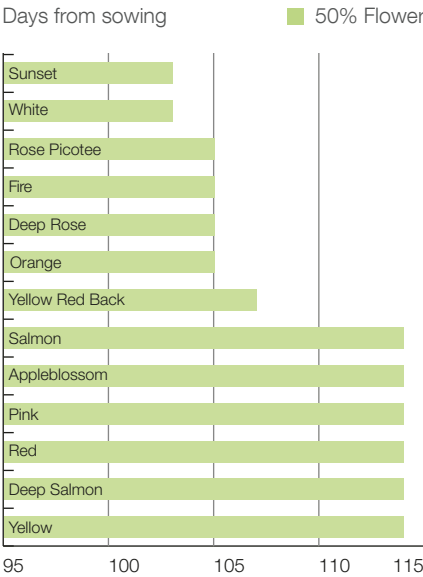
Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping. Lowering the temperature to 61 °F (16 °C) will help to tone the plants before shipping.

Plug Crop Time		
288 tray	7-8 wks	
128 tray	9-10 wks	
72 tray	10-11 wks	
Finished Crop Time (from 288 tray)		
	New Star, Nonstop™, Nonstop™ Mocca	Illumination®
4" / 10 cm pots	7-8 wks	8-9 wks
6" / 15 cm pots	8-9 wks	9-10 wks
10" / 25 cm baskets	11-12 wks	12-13 wks

↑	↔	☀
8-10" 20-25 cm	8-10" 20-25 cm	Partial shade – Shade

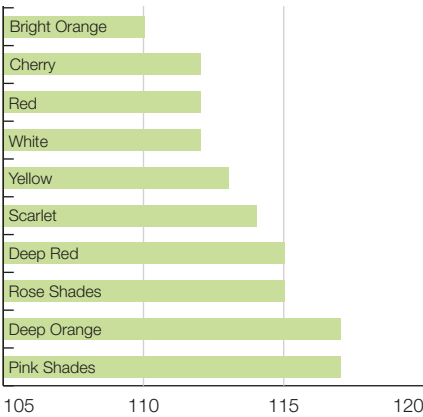
Timing Nonstop™



Timing Nonstop™ Mocca

Days from sowing

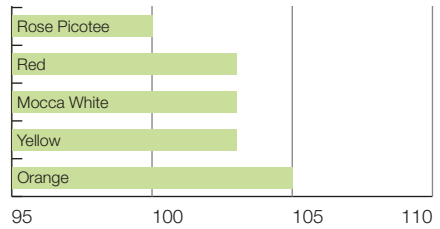
■ 50% Flower



Timing Nonstop Joy®

Days from sowing

■ 50% Flower



Expert Tip

Spacing the plants will increase overall plant quality. Do not cultivate too wet since the roots are sensitive to over-watering. Keep humidity levels low to avoid problems with powdery mildew. When transplanting with multiple plants in a pot or basket make sure that the points of the leaves face outward since this is the direction that the flowers will be produced heaviest.

– Jennifer, Marketing Specialist



I'M
KIND OF
A **BIG**[®]
DEAL.



Begonia BIG[®] in Beijing



BIG[®] Begonia, the most trusted begonia
in its class. Period.



Tiananmen Square, has been an iconic site in Chinese history since the Ming Dynasty. BIG® Red Bronze Leaf Begonias are planted around the square in intricate designs, wishing visitors happiness, success and good fortune. The uniformity, vigor, and outstanding color of BIG® Begonias make them ideal for these awe-inspiring plantings.

Annuals

Begonia x benariensis F₁

BIG[®], Whopper[®]

Family, Origin: Begoniaceae, South and Central America

Product Use: Packs, pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Pelleted

FLOWERING

Flower initiation: Days 25-38 when 4-6 true leaves are present.

Flowering Type: Day neutral plant, will flower regardless of daylength.

Flowering Mechanism: Higher light intensity and warmer temperatures will hasten flowering. Supplemental lighting during germination will benefit but is not necessary.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, beginning on the day of sowing until root emergence. Expect root emergence in 6-8 days.

Cover: No covering required. Light is required for germination and will benefit, giving a more uniform germination.

Sowing method: 1-2 seeds or pellets per plug.

Media: pH 5.5-5.8; EC 0.5-0.75

Temperature: Maintain 72-76 °F (22-24 °C) days 1-11. For irrigation use warm water (above 64 °F / 18 °C) only.

Moisture: Begin with a saturated (5) media for the first 10 days and on day 11 begin to dry back slightly to wet (4). This will help the seedlings root into the media. On day 11 begin to alternate moisture between wet (4) and moist (3) until day 21. On day 21 it is critical to begin a good dry-back cycle to prevent algae growth and help with the uptake of nutrients. At this point you can alternate moisture between wet (4) and medium (2).

Humidity: 95-100% until day 11; then reduce to 40-60%.

Dehumidify: On day 11 dehumidify, moving from 100% to 40-60% humidity. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is required and will help giving a more uniform germination. If germinating in a chamber supply 10-100 ft. candles (100-1,000 lx); (50 Watt/m²) to prevent seedling stretch. Protect seedlings from direct light when moving to Stage II. Once established in Stage II the light levels can be increased. On days 12-14 light levels can be increased to provide light levels of 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx).

Fertilizer: Maintain an EC < 1.0. Fertigation water should not exceed an EC of 0.5. Initial feeding should be with a balanced fertilizer low in ammonium. Begin feeding with a 14-4-14; 14-2-14 or 17-5-17 fertilizer at 50-60 ppm N.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 4-6 true leaf stage flower initiation will occur.

Media: pH 5.5-5.8; EC 1.25-1.5

Light: Continue to protect from direct sunlight until they are well established. On day 21-22 the light levels can be raised to 10-12 mol/m²/day (3,000-3,500 ft. candles or 30,000-35,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) night and day. When the roots reach the bottom of the cell the temperature can be lowered to 67 °F (19.5 °C).

Moisture: Begin alternating moisture between wet (4) and moist (3) on day 12. To prevent algae it is important to begin a good wet (4) to medium (2) cycle where the media will dry back within a 24 hr. period. Good ventilation and horizontal airflow will create such an environment.

Fertilizer: Begin fertilizing early to improve seedling quality. Under high light conditions more ammonium-based fertilizers can be used (17-5-17) and under low light use a calcium-based fertilizer (14-4-14 or 14-2-14). Initial feeding should start at 50-100 ppm N and gradually work up to 100-150 ppm N.

Growth Regulators: No growth regulators should be necessary since growth can be controlled by temperature and moisture management. If seedlings are uneven a very light application of B-Nine (daminozide) or Cycocel (chlormequat chloride) can be applied. In the finishing stages lowering temperatures to 55-58 °F (12-14.5 °C) will help to control leaf size and stem elongation. Approximately two weeks after transplanting a plug, when plants are established in the final container a very light application to Cycocel can be applied.

Fungicides: Scout for botrytis and phytophthora during the plug stage and apply specific fungicides as recommended on the label.

GROWING ON

Media: pH 5.5-5.8; EC 1.2-1.5

Light: Provide 12-14 mol/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) nights and day for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to

64-67 °F (18-19 °C) day and night. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop. Once well established in the final container, approximately two to three weeks after transplanting from a 288 plug, the temperature can be lowered further to 56-58 °F (13-15 °C). This will keep the plants toned and prevents large leaves.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let media dry back to at least a moist (3) level before re-saturating to wet (4). Extremely dry plants will have a grayish cast to the leaves. Avoid watering plants under high temperature and light when the leaf temperature is excessive.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Moderate fertilization levels are required. Fertilize the crop weekly with 100-150 ppm nitrogen, using a complete balanced fertilizer. Avoid high ammonium and high nitrogen levels, because the foliage can grow very large. Avoid pH levels above 6.0, as high pH can cause iron deficiency. Watch for low Ca and Mg levels since this can result in stunted plants with marginal leaf edge burn. Under high light conditions use an ammonium-based fertilizer (17-5-17) and under low light use a calcium-based fertilizer (14-4-14).

Growth Regulators: With proper moisture and temperature management there should not be a need for growth regulators. If needed apply Cycocel (chlormequat chloride) as a spray at 250-300 ppm 1-2 weeks after transplant.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis

Pests: Primarily aphids and thrips

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

BIG®:

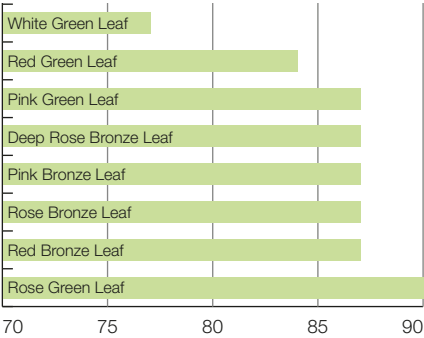
Plug Crop Time		
288 tray	7-8 wks	
128 tray	9-10 wks	
Finished Crop Time		
	288 tray	128 tray
Jumbo Packs / 306 Packs	5-6 wks	3-4 wks
4" / 10 cm pots (1")	5-6 wks	4-5 wks
5-6" / 13-15 cm pots (2-3")	7-8 wks	6-7 wks
8" / 20 cm pots (3")	8-9 wks	6-7 wks
10" / 25 cm baskets (3-4")	9-10 wks	7-9 wks

*plants per pot

↑	↔	☀
32" 80 cm	16" 40 cm	Sun – Shade

Timing BIG®

Days from sowing ■ 50% Flower



Whopper®:

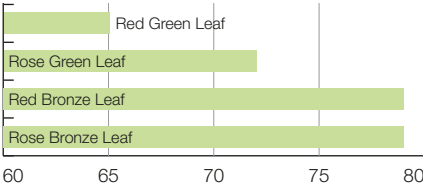
Plug Crop Time		
288 tray	7-8 wks	
128 tray	9-10 wks	
Finished Crop Time		
	288 tray	128 tray
4" / 10 cm pots (1*)	5-6 wks	4-5 wks
6" / 15 cm pots (2-3*)	7-8 wks	6-7 wks
10" / 25 cm pots (3*)	10-11 wks	8-9 wks
10" / 25 cm baskets (3-4*)	9-10 wks	7-8 wks

*plants per pot

↑	↔	☀
32-40" 80-100 cm	18" 46 cm	Sun – partial Shade

Timing Whopper®

Days from sowing ■ 50% Flower



Expert Tip

Do not hold in the plug stage too long. A root-bound plug will promote stretch and delay the crop. Reducing the temperature to 56-58 °F (13-15 °C) in the finishing stages 2-3 weeks after transplanting will keep plants toned with slightly smaller leaves.

– Susana, Flower Breeder



Annuals

Celosia plumosa

Fresh Look, Glorious, New Look™, Smart Look, Fashion Look

Celosia cristata

Brainiac

Product Use: Packs, pots, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Pelleted
Glorious: Raw

FLOWERING

Flowering Type: Obligate short day plant, requiring short days to initiate flowering.

Flowering Mechanism: Higher light intensity and warmer temperature will decrease the number of days to flower.

PLUG CULTURE

Germination: Optimum conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 2-4 days.

Cover: Cover seed with a light layer of vermiculite.

Sowing method: 1 seed per plug

Media: pH 5.5-6.0; EC 0.5 <

Temperature: Germination temperature of 72-77 °F (22-25 °C) for the first 7-14 days. On day 14 reduce the temperature to 64-68 °F (18-20 °C).

Moisture: Begin with a saturated (5) media moisture level to remove the seed coating and then reduce the moisture level to wet (4) on day 2-3. Alternate between wet (4) and moist (3) until all seeds have germinated.

Humidity: 95-100% until day 5; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Requires light for germination. Provide long days > 13 hrs. for the first 10-21 days to bulk the plant and prevent premature flower initiation. The Glorious series only requires 10-14 days to bulk the seedlings. Keep the light levels low at 6 mol/m²/day (2,000 ft. candles or 20,000 lx).

Fertilizer: On day 5 begin fertilizing at 50 ppm N using a well balanced feed. Use a 17-5-17 fertilizer or similar and include supplemental iron at 0.5 ppm. Maintain the EC at 0.75.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug and reach the 2-4 true leaf stage where flower initiation occurs.

Media: pH 5.5-6.0; EC<0.5. Use a well drained media low in soluble salts.

Light: Light levels can be increased to 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx).

Temperature: Maintain night temperatures of 63-64 °F (17-18 °C) and day temperatures of 70-75 °F (21-23 °C).

Moisture: Alternate between moisture levels of wet (4) and medium (2). Let the moisture level approach medium (2) before re-saturating to a wet (4). Never allow the media to dry out completely.

Fertilizer: Increase the fertilizer levels by feeding at 100-150 ppm N using a well balanced 17-5-17 fertilizer. Under high light conditions a 20-10-20 fertilizer can also be used at the same rate.

Growth Regulators: Applications of B-Nine (daminozide) sprays at 2,500 ppm work well. Bonzi (paclobutrazol) sprays and drenches can also be used. Sprays of paclobutrazol at 2-3 ppm and light drenches can be used.

Fungicides: Preventative applications of fungicides may be used for the control of rhizoctonia and pythium.

GROWING ON

Media: pH 5.5-6.0; EC 1.25-1.5

Light: Provide light levels of 12-16 mol/m²/day (3,500-4,500 ft. candles or 35,000-45,000 lx). Under long day conditions, in the late spring and summer, giving well established plants a short day treatment of less than 12 hrs. will shorten the finished height.

Temperature: 62-65 °F (17-18 °C) night, 65-70 °F (18-21 °C) day for the first 7-10 days or until the roots reach the bottom of the container. Thereafter the temperature may be lowered to 61-62 °F (16-17 °C) night and 65-70 °F (18-21 °C) day. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). In the final stages make sure to let the media dry back adequately between watering. Never allow the plants to dry out completely.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media.

Fertilizer: Celosia require a moderate feed program. Fertilize with a complete fertilizer, 17-5-17 at 150-200 ppm N. Under higher light conditions use a 20-10-20 fertilizer or alternate between the two.

Growth Regulators: Applications of B-Nine (daminozide) sprays at 2,500 ppm work well. Bonzi (paclobutrazol) sprays and drenches

can also be used. Sprays of paclobutrazol at 2-3 ppm and light drenches at ½-1 ppm can be used.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, pythium and rhizoctonia

Pests: Primarily aphids and thrips

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Fresh Look, New Look™, Smart Look, Fashion Look:

Plug Crop Time	
288 tray	4-5 wks
Finished Crop Time (from 288 tray)	
Packs	6-7 wks
4" / 10 cm pots	6-7 wks
6" / 15 cm pots	8 wks

Glorious, Brainiac:

Plug Crop Time	
288 tray	4-5 wks
Finished Crop Time (from 288 tray)	
Packs	4-5 wks
4" / 10 cm pots	4-5 wks
6" / 15 cm pots (2-3")	5 wks

*plants per pot

↑	↔	☀
8-10" 20-25 cm	6-8" 15-20 cm	Sun

Annuals

Gazania rigens

Zany™

Product Use: Packs, Pots, Mixed Containers and Landscape

Minimum Germination Rate: 85%

Seed Form: BeGreen Coating

FLOWERING

Flowering Type: Facultative long day plant, flowering more quickly under a longer daylength.

Flowering Mechanism: Longer daylength, higher light intensity and warmer temperatures will decrease the number of days to flower. Flower initiation occurs when the plants reach the 6-8 leaf stage. Supplemental lighting during germination will benefit but is not necessary.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 4-6 days

Cover: No cover is necessary; however, a thin layer of medium vermiculite will help improve moisture around the seed.

Sowing method: 1 seed per plug

Media: pH 5.5-5.8; E.C. 0.5-0.75

Temperature: 70-74°F (21-23 °C), until radicle emergence, then lower to 68-70 °F (20-21 °C)

Moisture: Begin with a wet (4) media and on day 4 reduce to moist (3). On day 6, after radicle emergence begin to alternate between wet (4) and medium (2). Allow the media to

approach medium (2) before re-saturating to wet (4). *Gazania* require slightly drier moisture levels during and after germination.

Humidity: 95-100% until day 4; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not necessary for germination but can improve overall seedling performance. If utilizing a germination chamber provide 10-100 ft. candles (100-1,000 lx) to prevent seedling stretch after germination.

Fertilizer: Maintain an EC < 1.0 Begin feeding on day 5 using 50-60 ppm nitrogen. Fertilize using a calcium based fertilizer 14-4-14 or 15-5-15. Lower phosphorous levels are recommended to keep seedlings more compact. Fertilized water should not exceed an EC of 0.5.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedling root to the edge of the plug and reach the 6-8 true leaf stage when flower initiation occurs.

Media: pH 5.5-5.8; EC 0.75-1.0

Light: Light levels can be increased to 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx)

Temperature: 68-70 °F (20-21 °C). To tone the plug before transplant reduce the temperature to 60 °F (16 °C) one week before transplanting.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow media to reach medium (2) before re-saturating to wet (4). Gazania prefer to be grown at a lower media moisture. This also helps to control soft growth.

Fertilizer: Fertilize with a complete calcium based fertilizer 1-2 times per week. Use a 14-4-14 or a 17-5-17 feed at 100 ppm nitrogen.

Growth Regulators: Gazania are not very responsive to growth regulators. Growing at lower temperatures will prevent seedling stretch. If needed, sprays with B-Nine (daminozide) at 2,500 ppm can be used. Under higher temperatures, the rate can be increased to 5,000 ppm. Cycocel (chlormequat chloride) sprays at 500 ppm can also be used at higher rates during warm temperatures.

Fungicides: Fungicide applications should not be necessary unless plants are grown under low light and cooler temperatures. Then an application at recommended rates would be beneficial.

GROWING ON

Media: pH 5.5-5.8; EC 1.0-1.5

Light: After transplant gazania prefer high irradiance conditions so they should be grown in full sun. Provide light levels of 10-18 mol/m²/day (3,000-5,000 ft. candles or 30,000-50,000 lx)

Temperature: 60-62 °F (16-17 °C) nights, 64-65 °F (17-18 °C) days for the first 7-10 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 55-60 °F (13-15 °C) night, with a moderate increase in day temperature.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media to reach a medium (2) moisture level before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Fertilize 1-2 times weekly using a complete fertilizer, 15-5-15, 17-5-17, at 150-200 ppm nitrogen. Under warmer temperatures and higher light conditions a 20-10-20 fertilizer can be used.

Growth Regulators: If growing cooler, no growth regulators are necessary. If needed, sprays with B-Nine (daminozide) at 2,500 ppm can be used. Under higher temperatures the rate can be increased to 5,000 ppm. Cycocel (chlormequat chloride) sprays at 500 ppm can also be used at higher rates during warm temperatures.

Fungicide: Apply fungicides during long periods of low light, cooler temperatures and high humidity.

Common Diseases: Botrytis is the primary concern under conditions of low light and high humidity.

Pests: Primarily Aphids and Thrips.

Post Harvest to Maintain Quality: Fertilize with Potassium Nitrate at 100 ppm 1-2 weeks prior to shipping.

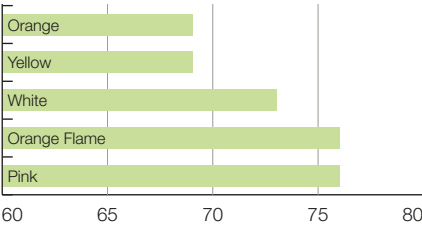
Plug Crop Time	
288 tray	5-6 wks

Finished Crop Time (from 288 tray)	
Packs	5-6 wks
4" / 10 cm pots	6-7 wks
6" / 15 cm pots	7-8 wks

↑	↔	☀
8-10" 20-25 cm	8-10" 20-25 cm	Sun

Timing Zany™

Days from sowing 50% Flower



Annuals

Helianthus annuus F₁

Bert, Pacino™

Product Use: Pots, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Raw

FLOWERING

Flowering Type: Facultative Short Day Plant— Under short daylength they will initiate and flower more quickly. Short day treatment will result in a more compact plant.

Flowering Mechanism: High light intensity and warmer temperatures shorten the total crop time.

PLUG CULTURE

Germination: Optimum conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 3-5 days.

Cover: Cover seed with vermiculite or substrate after sowing.

Sowing method: 1-2 seeds per plug. Can be sown directly into the finished container.

Media: pH 5.5-6.2; EC<0.75

Temperature: 70-75 °F (21-24 °C) until day 5 and then reduce to 68-70 °F (18-20 °C). Temperatures below 54 °F (12 °C) will result in slow and uneven germination.

Moisture: Saturate media (5) for the first 2-3 days and then reduce the moisture level to moist (3) on day 4. On day 10 reduce the media moisture further to medium (2).

Alternate between wet (4) and medium (2), allowing the media to approach medium (2) before re-saturating to wet (4).

Humidity: 95-100% until day 5; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Supplemental lighting and high light levels will improve seedling quality. Keep the daylength less than 13 hr. for optimum results.

Fertilizer: Maintain an EC < 1.0. Fertilized water should not exceed an EC of 0.5.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug.

Media: pH 5.5-6.2; EC 1.25-1.5

Light: Provide high light levels of 10-14 mol/m²/day (3,000-4,000 ft. candles or 30,000-40,000 lx).

Temperature: 64-68 °F (18-20 °C) nights, 68-70 °F (20-21 °C) days.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media to reach medium (2) before re-saturating to wet (4). Never allow the plants to dry out completely since yellowing of the older leaves will result.

Fertilizer: Begin fertilizing early on day 5 using a complete fertilizer at 50-75 ppm N. Use a calcium-based fertilizer (14-4-14 or 15-5-15).

Under high light conditions a (17-5-17) fertilizer can be used.

Growth Regulators: Growth regulator applications can delay flowering by one week. If needed, sprays with B-Nine (daminozide) can be made at 2,500 ppm.

Fungicides: Preventative applications of fungicides are recommended especially under cooler conditions and low light levels.

GROWING ON

Media: pH 5.5-6.2; EC 1.25-1.5

Light: High light levels will shorten the crop time and produce the best quality. Light levels of 10-16 mol/m²/day (3,000-4,500 ft. candles or 30,000-45,000 lx) are recommended.

Temperature: 59-64 °F (15-18 °C) nights, 64-70 °F (18-21 °C) days. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media to reach a medium (2) moisture level before re-saturating to wet (4). Never allow the media to dry out completely since yellowing of the lower leaves can occur.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media.

Fertilizer: Helianthus require high fertilization levels. Fertilize the crop weekly at 200-250 ppm nitrogen, using a potassium balanced fertilizer (N:K₂O – ratio 1:1.5). Blended fertilizers that are used for flowering can be used (11-7-23). If fertilizers with high potassium are not available then a complete calcium-based fertilizer can be used (14-4-14 or 15-5-15). Under high light levels a 17-5-17 fertilizer can be used. Application of magnesium sulfate (0.05%) can be made 1-2 times at 100 ppm to prevent magnesium deficiency. In case of iron deficiency apply iron-chelate 1-2 times.

Growth Regulators: If following good moisture management (allowing the media to dry back sufficiently between watering) no growth regulators should be needed. If plants require growth regulation B-Nine (daminozide)

sprays can be made at 2,500 ppm. Application of growth regulators can increase the total crop time by up to one week. Near finish a light drench of Bonzi or Piccolo (paclobutrazol) can be made. Helianthus respond well to a DIF or morning drop in temperature of 5 °F (2-3 °C).

Fungicide: Apply fungicides during long periods of low light, cool temperatures and high humidity.

Common Diseases: Pythium, Rhizoctonia and Botrytis.

Pests: Primarily Aphids and Thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time		
216 tray	2-3 wks	
128 tray	3-4 wks	
Finished Crop Time		
	216 tray	128 tray
5" / 12 cm pots	5-6 wks	4-5 wks
6" / 15 cm pots	6-7 wks	5-6 wks
Gallon / 15 cm pots	6-7 wks	5-6 wks
8" / 20 cm pots (3")	6-7 wks	5-6 wks

*plants per pot

↑	↔	☀
14-16" 35-40 cm	8-10" 20-25 cm	Sun

Expert Tip

Providing short day conditions in the early stages of production will result in a shorter finished plant. Application of growth regulators, B-Nine (daminozide) sprays can delay flowering by up to one week.

Annuals

Impatiens walleriana F₁

Lollipop

Product Use: Packs, hanging baskets and mixed containers

Minimum Germination Rate: 95%

Seed Form: Raw

FLOWERING

Flowering Type: Day neutral plant, will flower regardless of daylength.

Flowering Mechanism: Irradiance will not affect flowering. Supplemental lighting during germination will be beneficial but is not necessary. Temperature will have a greater affect on the total crop time.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect radicle (root) emergence in 3-5 days.

Cover: Seeds may be covered very lightly with a layer of vermiculite to maintain proper moisture levels. When trays are watered-in the media should be visible through the vermiculite.

Sowing method: 1 seed per plug

Media: pH 6.2-6.5. A low pH below 5.5 can promote shoot tip abortion and cause sodium toxicity. EC 0.5-0.75

Light: Light is necessary for germination. If utilizing a germination chamber provide 10-100 ft. candles (100-1,000 lx) to aid in germination and reduce stretch upon germination.

Moisture: Keep media saturated (5) for the first 1-2 days or until radicle (root) emergence. On day 3 the moisture level can be decreased to wet (4). Maintain a moisture level of wet (4) until approximately day 8, then reduce to moist (3). By day 11 start to alternate between wet (4) and medium (2), allowing the media to reach medium (2) before re-saturating to wet (4). Never allow any free moisture on top of the seedlings going into the night as this can cause tip abortion.

Humidity: Maintain 95-100% until radicle emergence; then reduce to 40-70% humidity. Provide proper ventilation and horizontal airflow to help dry back the media. This will allow more oxygen to the roots improving seedling quality.

Temperature: Maintain 72-75 °F (22-24 °C) until day 6 then reduce slightly to 70-72 °F (21-22 °C). A germination temperature below 70 °F (21 °C) will slow the speed and uniformity of germination. Excessive temperatures above 77 °F (25 °C) can cause a thermodormancy. Temperatures below 65 °F (18 °C) may cause tip abortion and malformed seedlings.

Fertilizer: Begin fertilizing early on day 3 with low rates of 25-5 ppm nitrogen using a calcium-based feed (14-0-14). Maintain an EC less than 0.75 for the first 7-10 days.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 2-4 true leaf stage flower initiation will occur.

Media: Keep pH 6.2-6.5, EC 0.75. Maintain an EC of less than 1.0. If the EC levels are greater than 1.25 shoot tip abortion may occur.

Light: Provide light levels of 8 mol/m²/day (2,500 ft. candles or 25,000 lx). Supplemental lighting can be used to produce sturdy seedlings, especially under low light conditions. Lighting for the first two weeks supplying 350-400 ft. candles (3,500-4,000 lx). Lighting for more than two weeks in the early stages of production can result in yellowing of the leaves (phyto-oxidation).

Temperature: Maintain 66-68 °F (19-20 °C) until the first set of true leaves. Thereafter grow at 62-65 °F (17-18 °C) to hold and tone the plugs. A temperature of 67 °F (19.5 °C) will give the shortest crop time.

Note: Using DIF can result in yellow leaves that can be eliminated by discontinuing DIF for approximately one week.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let the media approach medium (2) before re-saturating to wet (4). Proper moisture management is effective in controlling growth.

Humidity: 40-70%

Fertilizer: Fertilize with a calcium-based feed (14-0-14, 15-2-15) at 75-100 ppm nitrogen. Fertilize every second or third watering using a feed containing both potassium nitrate and calcium nitrate. Minimal use of fertilizer will keep seedlings compact and promote flowering. Avoid the use of phosphorous to prevent seedling stretch. Injection of phosphoric acid to control pH can result in seedling stretch.

Growth Regulators: Early applications of growth regulators are the best approach to control growth. In the later stages proper management of temperature, light and moisture will result in the highest quality plugs. Growth regulators that can be used effectively are B-Nine (daminozide), Bonzi (paclobutrazol) and Sumagic (uniconazole).

Fungicides: Applications of fungicides can be made, especially under low light and cooler conditions.

GROWING ON

Media: pH 6.2-6.5, EC 0.75-1.0

Light: Provide light levels of 8 mol/m²/day (2,500 ft. candles or 25,000 lx). Supplemental lighting can be used to produce sturdy seedlings.

Temperature: Maintain 66-68 °F (17-18 °C) nights, 70-75 °F (21-24 °C) days. An ADT (average daily temperature) of 67 °F (19.5 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels of wet (4) and medium (2). Allow moisture level to approach medium (2) before re-saturating to wet (4).

Humidity: 40-70% humidity is ideal. Providing good ventilation and horizontal airflow to help lower the humidity levels and dry back the media.

Fertilizer: Fertilize every second or third watering with a calcium based feed at 75-100 ppm nitrogen (13-2-13, 14-4-14). Minimal fertilization will result in more compact plants and promote flowering. Tall lush plants with flowers below the foliage or late flowering indicate too much fertilizer.

Growth Regulators: B-Nine (daminozide), Bonzi (paclobutrazol) and Sumagic (uniconazole) are most effective. In the later stages of production, after transplanting the best means of controlling growth is the proper management of temperature, light, moisture and fertilization.

Fungicides: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Pythium, rhizoctonia, alternaria leaf spot, botrytis, tomato spotted wilt virus, pseudomonas, downey mildew and impatiens necrotic virus.

Pests: Primarily aphids, fungus gnats, spider mites and thrips.

Post Harvest: Fertilize with potassium nitrate at 100-150 ppm 1-2 weeks prior to shipping.

Plug Crop Time	
288 tray	4-5 wks
Finished Crop Time (from 288 tray)	
Packs	4-5 wks
4" / 10 cm pots	5-6 wks
10" / 25 cm baskets	6-7 wks

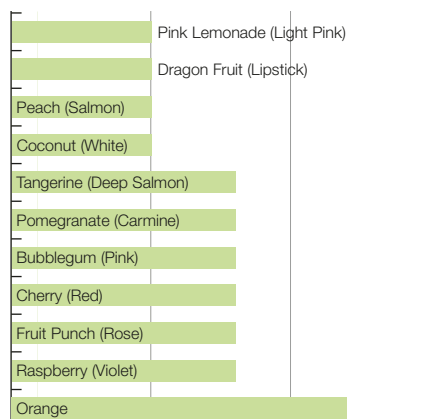
↑	↔	☀
8-10" 20-25 cm	8-10" 20-35 cm	Partial shade

Expert Tip

Lollipop Impatiens were bred to have a compact habit and only require growth regulators in the seedling stages. After transplanting maintain a good dry back between watering and use lower rates of fertilizer applications.

Timing Lollipop

Days from sowing ■ 50% Flower



Annuals

Pentas lanceolata (carnea)

Graffiti® 20/20, Graffiti® OG, Kaleidoscope, New Look™, Northern Lights*

*US Patent Number: 7,880,073

Product Use: Pots, Mixed Containers and Landscape/Mass plantings

Minimum Germination Rate: 90%

Seed Form: Pelleted

FLOWERING

Flowering Type: Day neutral plant, will flower regardless of daylength.

Very responsive to irradiance and additional lighting. Providing a 14-16 hrs. daylength, especially in the seedling stages, will shorten the crop significantly. In addition, growing at warmer temperatures will shorten the crop time.

Flowering Mechanism: Maturity of the plant, reaching the 3-5 leaf stage is the primary mechanism. Supplemental lighting during germination will benefit but is not necessary.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development beginning on the day of sowing until radical emergence. Expect radical emergence in 7-10 days.

Cover: No cover is necessary.

Sowing method: 1 pellet per plug

Media: pH 6.2-6.5 Starting with the proper pH of the media will improve the performance of the seedlings. Pentas can exhibit iron toxicity at lower pH levels, below 5.5. Pentas require close attention to the proper media pH. If the pH is too high, a micro nutrient deficiency may occur and if too low, an iron toxicity can occur. EC < 0.5.

Temperature: 73-78 °F (23-26 °C). Once germination is completed with fully expanded cotyledons, on day 14 the temperature can be lowered slightly to 72 °F (22 °C). Water trays using tempered water with a minimum temperature of 64 °F (18 °C). Media temperatures below 61 °F (16 °C) will inhibit the germination and growth.

Moisture: Begin with a saturated media (5) for the first 10 days. On day 11 begin to lower the moisture slightly to medium (4). Maintain a consistent moisture level without over saturating the media. Wide fluctuations in the media moisture levels can decrease seedling development and losses can occur.

Humidity: 95-100% until day 10; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not crucial for germination but providing supplemental lighting will increase the quality of the seedlings and uniformity of germination. If using a chamber provide a light source of 10-25 ft. candles (100-250 lx). When moved into stage two the light levels can be increased to 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx). On approximately day 21 the light levels can be increased to 10-12 mol/m²/day (3,000-3,500 ft. candles or 30,000-35,000 lx).

Fertilizer: Maintain an EC < 0.75. At this stage fertilized water should not exceed an EC of 0.5 Begin feeding on day 10 with 50 ppm N 14-2-14, 14-4-14 or 17-5-17.

Keep phosphorous levels < 8 ppm, iron levels at 2-3 ppm.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug and can reach the 3-5 true leaf stage where flower initiation occurs. If transplanted early flower initiation can occur after transplant.

Media: pH 6.2-6.5 When media has a higher pH, iron is not as available to seedlings so a slight increase in iron to the fertilizer can be beneficial. 2-3 ppm iron is optimal. If needed, iron levels can be adjusted to 0.5 ppm. At pH levels of 5.0-5.5 iron toxicity can occur. Flowable lime can be used to adjust the pH. EC 0.75-1.0.

Light: 12-16 mol/m²/day (3,500-4,500 ft. candles or 35,000-40,000 lx). High light levels and supplying supplemental lighting, especially in the winter can greatly shorten the crop time by as much as 2-3 weeks.

Temperature: 68-70 °F (20-21 °C) As plants become more mature the temperature can be lowered to 65-68 °F (18-20 °C) nights and 72- 74 °F (22-23 °C) days. Warmer temperatures will benefit and shorten the finish time.

Moisture: Alternate between wet (4) and medium (2). Allow the moisture level to approach medium (2) before re-saturating to wet (4).

Fertilizer: Maintain the EC levels below 1.2. Under lower light conditions fertilize with a calcium based fertilizer, 14-4-14 at 100 ppm N. Under higher light use a 17-5-17 feed at 100 ppm N.

Growth Regulators: B-Nine (daminozide) sprays at 2,500-5,000 ppm work well at controlling growth.

Fungicides: Under conditions of low light and high humidity fungicide applications may be necessary. Follow the recommended labeled rates.

GROWING ON

Transplant Ready: 6-7 weeks from sowing using a "288" plug tray. Add one week if less than optimal temperatures are experienced.

Media: pH 6.2-6.5. Continue to monitor the pH to make sure that it stays above 6.0. EC 1.0-1.2. Keep EC level < 1.5.

Light: Provide high light levels of 12-16 mol/m²/day (3,500-4,500 ft. candles or 35,000-45,000 lx). Long day treatment of 14-16 hrs. will shorten the total crop time significantly.

Temperature: 68-70 °F (20-21 °C) nights, 72-74 °F (22-23 °C) days for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 62-65 °F (16-18 °C) nights and 68-74 °F (20-23 °C) days. Higher temperatures are beneficial and will shorten the crop time. Pentas do not seem to have a maximum temperature that will inhibit growth and flowering.

Moisture: Alternate between moisture levels wet (4) and medium (2).

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Under low light conditions fertilize with a 14-4-14 fertilizer at 100-150 ppm N and under high light conditions use a 17-5-17 fertilizer at 100-150 ppm N. Watch for calcium and magnesium deficiencies which can cause stunted plants.

Growth Regulators: B-Nine (daminozide) sprays at 2,500-5,000 ppm are very effective in height control. Light applications of Bonzi (paclobutrazol) as a spray at 2-3 ppm can also be used. An A-Rest (ancymidol) spray at 2-4 ppm is also effective in growth regulation.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, Rhizoctonia and Pythium. Keep plants from becoming too wet for any period of time. Preventative fungicide drenches can be applied at the labeled rates.

Pests: Primarily Aphids, Thrips and Whitefly.

Post Harvest: Fertilize with Potassium nitrate at 150 ppm 1-2 weeks prior to shipping.

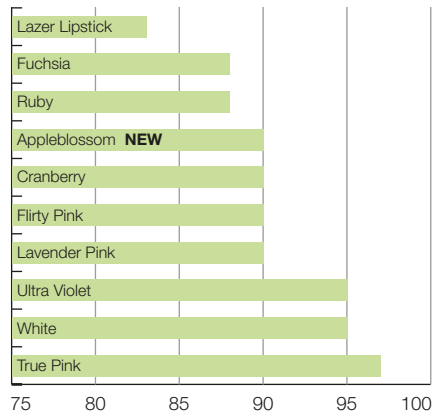
Scheduling: Some Graffiti® 20/20 colors have a shorter crop time of one week less compared to Graffiti® OG, but some colors like OG Violet and OG Red Velvet match Graffiti® 20/20 series fairly well in timing. Graffiti® 20/20 are very uniform in flowering response as a series. Consider timing differences when mixing varieties from both series.

Plug Crop Time		
288 tray	6-7 wks	
Finished Crop Time (from 288 tray)		
	All Pentas	Graffiti® 20/20
4" / 10 cm pots	9-10 wks	8-9 wks
6" / 15 cm pots	10-11 wks	9-10 wks
↑	↔	☀
8-16" 20-40 cm	10-12" 25-30 cm	Sun

Timing Graffiti® 20/20

Days from sowing

■ 50% Flower



Expert Tip

Pay close attention to maintaining a higher pH at or above pH 6.4. This will help with good seedling development and finished product.

Annuals

Petunia x hybrida Trailing F₁

Success!® TR

Petunia x hybrida grandiflora F₁

Success!® 360°, Success!® HD

Family: Solanaceae

Product Use: Pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: 90%

Seed Form: Pelleted

FLOWERING

Flowering Type: Facultative long day plants. Long days and high irradiance will promote flowering.

Flowering Mechanism: Flowering is affected by daylength, irradiance and temperature.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect root emergence in 3-5 days.

Cover: No covering is necessary.

Sowing method: 1 seed/pellet per plug

Media: pH 5.5-5.8; keeping the pH below 6.0 will help to keep boron and iron available. EC <1.0 or 0.75-1.0

Temperature: Maintain 72-76 °F (22-24 °C) until root emergence and then reduce to 68-70 °F (20-21 °C). The temperature can be lowered on approximately day 5. Once cotyledons have expanded lower temperature further to 65-68 °F (18-20 °C).

Moisture: Begin by watering to a saturated level (5); applying enough water to help

dissolve the pellets. After sowing do not allow the pellets to dry back before moving to the germination chamber or benches. Maintain a saturated media (5) for 3-4 days or until radicle emergence. On day 5 reduce media moisture to wet (4) for the next 5-6 days and on day 10-11 reduce further to medium (2). Alternate between a wet (4) and a medium (2) moisture level between waterings.

Humidity: Maintain 95-100% until day 5; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is necessary for germination. If using a germination chamber provide 10-100 ft. candles (100-1,000 lx).

Fertilizer: Maintain an EC < 1.0

Plug Bulking and Flower Initiation:

Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 3-6 true leaf stage, flower initiation will occur.

Media: pH 5.5-5.8; EC 1.25-1.5

Light: Petunias need long days to flower. Provide a minimum daylength of 11.5 hrs. To initiate buds under short days extend daylength to 13.5-14 hrs. Under long day, low light conditions, supplemental lighting of 350-500 ft. candles (3,500-5,000 lx) may be necessary.

Temperature: Maintain 65-68 °F (18-20 °C) until day 26-28, then reduce the temperature to 60-64 °F (15.5-18 °C). Keep temperatures > 60 °F (16 °C) until ready to transplant. For the

fastest finish maintain an ADT of 67 °F (19.5 °C). With these temperatures some additional growth regulators will need to be applied.

Moisture: On approximately day 12 for SUCCESS!® TR and day 10 for SUCCESS!® 360° / HD start to alternate between wet (4) and medium (2) levels between waterings. Allow moisture level to approach medium (2) before re-saturating to wet (4).

Fertilizer: Upon initial germination approximately days 5-7 begin feeding with 50 ppm nitrogen. Pay attention to the addition of boron since low boron can cause tip abortion. Ideal boron concentration is 0.5 ppm. Fertilize established seedlings at 100-150 ppm nitrogen. Under high light conditions, apply an ammonium-based feed (17-5-17). Under low light conditions, apply a calcium-based feed (14-4-14). Under high light and long or extended days, an ammonium-based feed (20-10-20) is preferred. For more shoot growth, add an additional ammonium treatment to the schedule. To prevent stretching under low light and cool temperatures, reduce ammonium and apply only calcium-based fertilizer.

Growth Regulators: Petunias are very responsive to B-Nine (daminozide) sprays in the early stages. Apply the first application early on day 14 as a spray at 2,500 ppm. B-Nine can be used as the main growth regulator up until bud-set. Later applications can be used as a spray at 2,500-5,000 ppm. If applied too many times or when buds are visible it can cause smaller and even distorted flowers. Bonzi or Piccolo (paclobutrazol) sprays can also be used effectively. In the early stages rates vary depending on temperature and light. These rates are between 3-5 ppm. A DIF of 5 °F (3 °C) can also be used effectively to control growth.

GROWING ON

Transplant Ready: Transplant as soon as the roots reach the edges of the cell and can be removed without being disturbed too much. SUCCESS!® petunias are less daylength sensitive and require fewer growth regulators than other trailing petunias.

Media: pH 5.5-5.8; EC 1.5-2.0

Light: Provide 12-18 mol/m²/day (3,500-5,000 ft. candles) of light in the finishing stages. Petunias need long days to flower.

To initiate bud under short days, extend daylength to 14 hrs. Under long day, low light conditions, supplemental lighting of 350-500 ft. candles (3,500-5,000 lx) may be necessary.

Temperature: After transplant maintain temperatures > 55 °F (13 °C) nights for the first 6 weeks to initiate flower bud development. The night temperatures can be lowered further to 50 °F (10 °C) to encourage basal branching and compactness. However, lower temperatures may also substantially decrease the number of flowers initiated. Growing at cooler temperatures will produce a higher quality plant. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow substrate to almost reach medium (2) before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Feed at 100-200 ppm nitrogen. Under high light conditions, apply an ammonium-based feed (17-5-17). To prevent stretching under low light conditions apply a calcium-based feed (14-4-14). Under high light and long days an ammonium-based feed (20-10-20) is preferred.

Growth Regulators: B-Nine (daminozide) as needed at 3,500-5,000 ppm. Apply B-Nine before the buds are visible. Late applications can delay flowering and reduce flower size. Also responsive to Bonzi and Piccolo sprays (paclobutrazol), Sumac (uniconazole) or B-Nine/Cycocel (chlormequat chloride) tank mix. Light drenches of Bonzi or Piccolo (paclobutrazol) can be used once established in the final container.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, rhizoctonia.

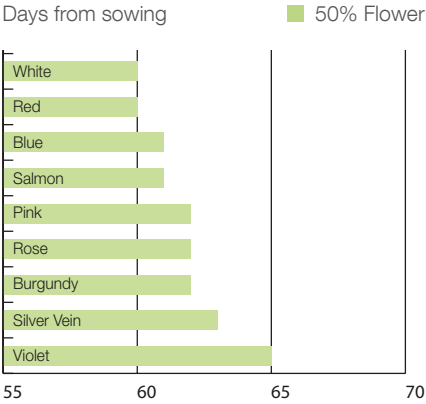
Pests: Primarily aphids.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

SUCCESS!® TR:

Plug Crop Time		
288 tray	4-5 wks	
Finished Crop Time (from 288 tray)		
Packs	3-4 wks	
4" / 10 cm pots	4-5 wks	
6" / 15 cm pots	5-6 wks	
10" / 25 cm pots	7-8 wks	
↑	↔	☀
10-12" 25-30 cm	24-28" 60-70 cm	Sun

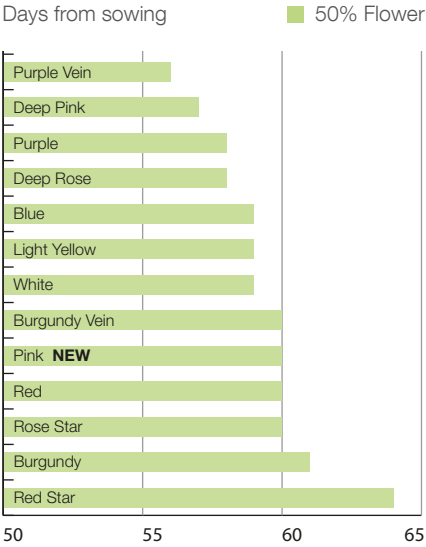
Timing SUCCESS!® TR



SUCCESS!® 360° / HD:

Plug Crop Time		
288	4-5 wks	
Finished Crop Time (from 288 tray)		
Packs	4-5 wks	
4" / 10 cm pots	5-6 wks	
10" / 25 cm baskets	7-8 wks	
↑	↔	☀
360°: 12-14" 30-35 cm	14-16" 35-40 cm	Sun
HD: 4-6" 10-15 cm		

Timing SUCCESS!® 360°



Expert Tip

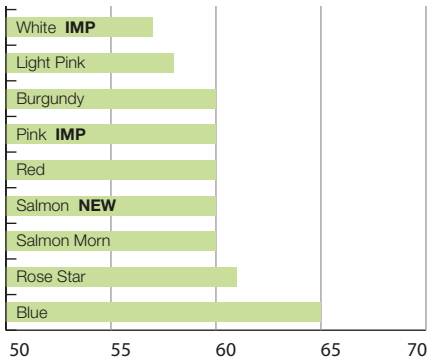
SUCCESS!® 360° require moderate applications of growth regulators. Provide a good dry-back cycle when watering to keep plants more compact.

Early flowering and unrivaled in growth, habit, and timing uniformity. Mix and match any colors together for an easy combo that will time perfectly.

Timing SUCCESS!® HD

Days from sowing

■ 50% Flower



Note: Since the SUCCESS!® HD series was bred with a more compact habit it does not require repeated applications of growth regulators. After the initial first application of B-Nine on day 7-10 for toning the seedlings they should not require additional growth regulators.

Annuals

Portulaca grandiflora F₁

Stopwatch, Sundial

Family: Solanaceae, Portulacaceae

Product Use: Packs, pots, mixed containers and landscape. Stopwatch is slightly less spreading with an excellent branching habit, making it very suitable for pack production and containers.

Minimum Germination Rate: 85%

Seed Form: Raw & Multipelleted

FLOWERING

Flowering Type: Obligate long day plant: Requires long days greater than 11 hrs. for flower initiation to occur. Providing a daylength greater than 12 hrs. will ensure early flowering.

Flowering Mechanism: Long days, higher light levels and increased temperatures will

shorten the total crop time. Supplemental lighting is beneficial during germination but is not necessary.

Note: The critical daylength is 10 ½ hrs. where short days may cause the plants to rosette and not recover and flower.

PLUG CULTURE

Germination: Optimum conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 2-3 days.

Cover: No covering is necessary unless drying down before emergence is a concern. Then cover lightly with vermiculite or media.

Sowing method: 1 multi pellet per cell.

Media: pH 5.5-6.2; EC 0.5 High salt levels can inhibit germination.

Temperature: 72-79 °F (22-26 °C).

Moisture: Begin with a saturated (5) media moisture to help break down the pellet. On day 2 start to reduce the moisture level to wet (4) since Portulaca are very sensitive to high moisture levels

Humidity: 95-100% until day 5; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not necessary for germination but will benefit in the uniformity of germination.

Fertilizer: Maintain an EC < 1.0. In the early stage fertilized water should not exceed an EC of 0.5.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug and reach the 4-6 true leaf stage where flower initiation occurs.

Media: pH 5.5-6.2; EC 1.0-1.2

Light: 6-8 mol/m²/day (2000-2500 ft. candles or 20,000-25,000 lx) Provide a daylength >12 hrs. to aid flower initiation. Minimum daylength required is > 10 ½ hrs. to prevent rosetting. In daylength extension, lower light levels of 10-15 ft. candles (100-150 lx) are all that is required.

Temperature: 70-72 °F (20-22 °C).

Moisture: Once fully expanded cotyledons develop, the media moisture level should alternate between wet (4) and moist (3). On day 14 begin to dry back to medium (2). Allow the media to dry back to medium (2) before re-saturating to wet (4).

Fertilizer: Keep ammonium and phosphorous levels low by using a complete calcium based fertilizer. Begin feeding at low levels of 50-60 ppm N and gradually work up to feeding at 100 ppm N using 14-0-14, 14-2-14 or 15-0-15 fertilizers. When the plants become more mature, at the end of the bulking stage,

higher rates of fertilizer can be applied at 100-150 ppm N. Under higher light conditions an occasional supplemental feeding with an ammonium based fertilizer 20-10-20 at 150 ppm N can be made.

Growth Regulators: No growth regulators should be necessary.

Fungicides: Apply fungicides as needed, especially under low light conditions. Portulaca are susceptible to rhizoctonia.

GROWING ON

Media: pH 5.5-6.2; EC 1.2-1.5.

Light: After transplanting provide plants with light levels of 18 mol/m²/day (5000 ft. candles or 50,000 lx).

Temperature: 65-68 °F (19-20 °C) nights, 68-78 °F (20-24 °C) days for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered slightly to 64-65 °F (18-19 °C) nights and 68-78 °F (20-24 °C) days. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop. Temperatures below 64 °F (18 °C) will inhibit flowering and vegetative growth.

Moisture: Provide a good dry-back cycle. Alternate between moisture levels wet (4) and medium (2). Allow media to reach dry (1) before re-saturating to wet (4). Never allow plants to have any free moisture on them going into the night. This promotes disease issues, especially with rhizoctonia.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Portulaca require moderate fertilization levels. Fertilize every other irrigation alternating between a calcium based feed and an ammonium based fertilizer at 150-200 ppm N. Alternate between a 15-0-15 or a 14-2-14 fertilizer and a 20-10-20 or a 17-5-17.

Growth Regulators: No growth regulators are necessary if allowing the media to dry back sufficiently between watering. If needed some that may be used are B-Ni-

ne (daminozide), Bonzi (paclobutrazol), and Sumagic (uniconazole).

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Phytophthora, pythium and rhizoctonia.

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with Potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

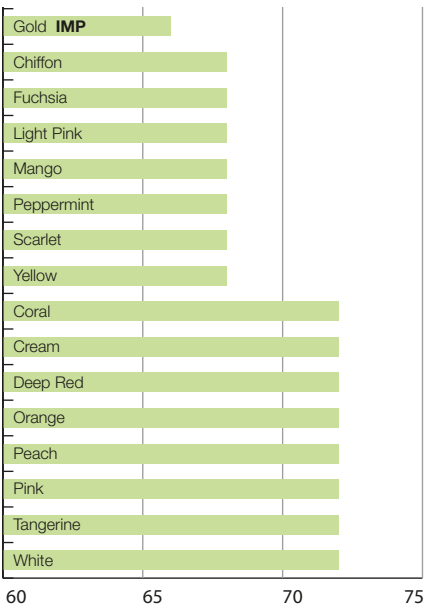
Plug Crop Time	
288 tray	4-5 wks
Finished Crop Time (from 288 tray)	
Packs	5 wks
4" / 10 cm pots	5-6 wks
10" / 25 cm pots	6-7 wks

↑	↔	☀
8-10" 20-25 cm	10-12" 25-30 cm	Sun

Timing Sundial

Days from sowing

■ 50% Flower



Expert Tip

Portulaca have a sensitive root system so over-watering or periods of high moisture levels result in a poor root system and promote disease issues. Lighting of young plants and providing long days >12 hrs. will result in earlier flowering.

– Doug, Area Sales Manager



Annuals

Ptilotus exaltatus

Joey®

European Community Plant Variety Protection Applied For

Family, Origin: Amaranthaceae, Australia

Product Use: Pots, mixed containers, landscape

Minimum Germination Rate: 85%

Seed Form: ApeX

FLOWERING

Flowering Type: Day neutral plant, will flower regardless of daylength.

Flowering Mechanism: Higher irradiance and warmer temperatures will promote earlier flowering. Supplemental lighting during germination is beneficial but not necessary.

PLUG CULTURE

Germination: Expect radicle emergence in 5 days with complete germination in 7 days.

Cover: Requires light for germination. Cover the seed very lightly with vermiculite. The seeds should be visible when watered in.

Sowing method: 1 seed per plug.

Media: Use a well drained media, pH 5.5-5.8; EC 0.5

Temperature: Maintain 75-78 °F (24-25.6 °C) for the first 7 days, then lower the temperature to 70-75 °F (21-24 °C).

Moisture: Begin with a saturated media (5) for the first 3-4 days and then begin to dry them back to wet (4) on day 5-6. On day 7 begin to alternate between wet (4) and medium (2). Allow the moisture level to approach a medium (2) before re-saturating to a wet (4).

Humidity: 95-100% until day 5, then lower it to 40-60%.

Light: Requires light for germination. If germinating in a chamber supply 10-100 ft. candles (100-1,000 lx); (50 Watt/m²) to prevent seedling stretch. Protect seedlings from direct light when moving to Stage II. Once established in Stage II the light levels can be increased. On days 7-10 the light levels can be increased to 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx). Providing a daylength > 12 hours will promote earlier flowering.

Fertilizer: Maintain an EC < 1.0. Fertilized water should not exceed an EC of 0.5. Initial feeding should be with a balanced fertilizer low in ammonium and phosphorous. Begin feeding on day 7 with a 14-4-14; 14-2-14 or 17-5-17 fertilizer at 50 ppm N.

Plug Bulking and Flower Initiation:

Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 4-6 true leaf stage flower initiation will occur.

Media: pH 5.5-5.8, EC 1.25-1.5

Light: Continue to protect from direct sunlight until seedlings are well established. On day 21-22 the light levels can be raised to 10-12 mol/m²/day (3,000-3,500 ft. candles or 30,000-35,000 lx). Higher light levels will facilitate early flowering and sturdy plants with large flowers.

Temperature: Maintain 68-70 °F (20-21 °C) night and day. When the roots reach the bottom of the cell the temperature can be lowered to 67 °F (19.5 °C).

Moisture: Begin alternating between wet (4) and medium (2) on day 7. To prevent algae it is important to begin a good dry-back cycle by day 12 where the media will dry back to medium (2) within a 24 hr. period. Good ventilation and horizontal airflow will create such an environment. Avoid watering late in the day and never allow plants to stay in a saturated state for a 24 hr. period. Over watered plants will develop yellow lower leaves.

Fertilizer: Begin fertilizing early to improve seedling quality. Under high light conditions slightly higher levels of ammonium can be used. Under high light conditions fertilize with a 17-5-17 feed and under low light use a calcium-based fertilizer 14-2-14 or 14-4-14. Initial feeding should start at 50 ppm N and gradually work up to 100-150 ppm N.

Growth Regulators: There are several growth regulators that can be used. B-Nine (daminozide) can be applied as a spray at 2,500-5,000 ppm. The higher rates are used under higher temperature and humidity levels. Cycocel (chlormequat chloride) can be applied as a spray at 750-1,000 ppm. Sprays using combinations of B-Nine (daminozide) + A-Rest (ancymidol) are also effective. Combine B-Nine at 2,500 ppm + A-Rest at 4 ppm and apply as a spray. Combinations of B-Nine and Cycocel can be used as a spray with 2,500 ppm B-Nine + 500 ppm Cycocel. Bonzi (paclobutrazol) does not seem to be very effective as a growth regulator. Sumagic (uniconazole) sprays at 5 ppm can also be used.

Fungicides: Scout for botrytis and phytophthora during the plug stage and apply specific fungicides per the recommended rate.

GROWING ON

Media: pH 5.5-5.8, EC 1.2-1.5

Light: Provide 12-14 mol/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx). Well established plants can be grown at 16-20 mol/m²/day (4,500-5,500 ft. candles or 45,000-55,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 65 °F (19 °C). An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let substrate dry back to medium (2) before re-saturating to wet (4). The drying back of the plants will help force the roots to the bottom of the pot.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Moderate to high fertilization levels are required. Avoid high levels of ammonium and high levels of nitrogen. Also keep phosphorous levels lower. Feed with a complete balance fertilizer 14-4-14 or 17-5-17 at 100-150 ppm N.

Growth Regulators: Additional growth regulators may be required approximately two weeks after transplanting. Apply the same growth regulator rates as those used in the plug stages as needed.

Fungicide: Apply fungicides during long periods of low light and high humidity. Fungicides against soil borne diseases and foliar diseases are recommended.

Common Diseases: Botrytis and phytophthora.

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time	
288 tray	5-6 wks
128 tray	6-7 wks
Finished Crop Time (from 288 tray)	
4" / 10 cm pots	7-8 wks
6" / 15 cm pots	8-9 wks
8" / 20 cm pots	9 wks

↑	↔	☀
12-14" 30-35 cm	8-10" 20-25 cm	Sun

Expert Tip

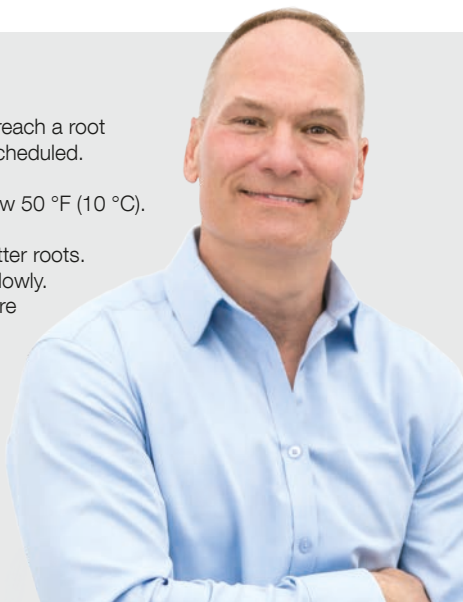
Do not hold plugs since plants should not reach a root bound state. Transplant plugs early or as scheduled.

Do not let the temperature levels drop below 50 °F (10 °C).

Keep plants on the dry side to promote better roots. Ptilotus develop a good root system very slowly. In periods of low light and lower temperature do not over water.

Pinching the plant once well established in the final container has resulted in better branching. This is usually done when the plants reach 7-8 nodes and they are pinched back to 5-6 nodes.

– Dwight, Area Sales Manager



Annuals

Rudbeckia hirta

Denver Daisy, Prairie Sun, Amarillo Gold

Family, Origin: Asteraceae, North America

Product Use: Borders, pots, containers and cut flowers

Minimum Germination Rate: 90%

Seed Form: BeGreen Pelletting

FLOWERING

Flowering Type: Obligate long day plant; a daylength > 13 hrs., with 6-8 true leaves will result in flower initiation.

Flowering Mechanism: Primary mechanism is long days and maturity.

PLUG CULTURE

Germination: Optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect root emergence in 10-14 days depending on temperature and moisture.

Cover: No cover is necessary however a light covering of vermiculite will aid in maintaining proper moisture and humidity levels during germination.

Sowing method: 1-2 seeds per plug. Can also be sown directly into the final container.

Media: Use media with pH 6.0-6.2, EC <1.0, and low soluble salts. Avoid media

compaction to aid in root penetration.

Temperature: Maintain 68-74 °F (20-23 °C).

Moisture: Begin with a moisture level slightly higher than wet (4) for the first 14 days or until root emergence has occurred. On day 15 begin to dry back the media slightly. Alternate moisture levels between wet (4) and moist (3). Allow media to reach a moist (3) level before re-saturating to wet (4).

Humidity: 95-100% until day 11; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is necessary for germination so if using a germination chamber provide 10-100 ft. candles (100-1,000 lx). Supplemental lighting is beneficial. Keep daylength less than 13 hrs. for the first 4-5 weeks to keep the seedlings from premature flower initiation. This is more critical after germination has occurred and seedlings are further developed.

Fertilizer: Maintain an EC < 1.0. Begin feeding once germination is complete or on approximately day 14. Fertilize with a calcium-based feed; 14-4-14, 17-5-17 or similar at 50 ppm N.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 6-8 true leaf stage flower initiation will occur.

Media: pH 6.0-6.2, EC 1.0-1.5

Light: Provide light levels between 2,500-4,500 ft. candles: 8-16 mol/m²/day (25,000-45,000 lx). Continue to keep the daylength less than 13 hrs. for the first 4-5 weeks or until the plants reach the 6-8 true leaf stage.

Temperature: Maintain 64-68 °F (18-20 °C).

Moisture: Alternate moisture between wet (4) and moist (3). Allow the media to reach moist (3) before re-saturating to wet (4).

Fertilizer: Rudbeckia require a moderate feed program using a well balanced fertilizer. Fertilize with a calcium-based feed, 14-4-14 or 17-5-17 at 50-100 ppm N. Under higher

light conditions an occasional feeding with a fertilizer having a higher nitrogen level can be used; 20-10-20 at 100 ppm N. As seedlings develop the fertilizer rate can be increased to 100-150 ppm N.

Growth Regulators: In the early stages B-Nine (daminozide) sprays at 1,250-2,500 ppm are very effective in controlling growth. DIF, or a morning drop in temperature of 5-10 °F (3-5 °C), is also very effective. Light sprays of either Bonzi (paclobutrazol) or Sumagic (uniconazol) can also be used.

Fungicides: Preventative sprays with fungicides should be done early to prevent foliar diseases. Apply sprays between days 21-35 to prevent diseases such as botrytis.

GROWING ON

Transplant Ready: Using a larger plug can help in manipulating daylength to control growth.

Media: pH 6.0-6.2, EC 1.5-1.75

Light: Provide 3,500-5,500 ft. candles; 12-20 mol/m²/day (35,000-55,000 lx). To initiate flowering provide a daylength of 14-16 hrs. The amount of time for flower initiation varies somewhat between varieties. Flowering initiation is well timed at 4 weeks after transplanting.

Temperature: Maintain 62-65 °F (16-18 °C) day and night. An ADT (average daily temperature) of 67 °F (19.5 °C) will give the fastest finished crop. Temperatures below 61 °F (6 °C) can increase crop time by up to three weeks.

Moisture: Alternate between wet (4) and medium (2) moisture levels. Allow the media to approach medium (2) before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity, resulting in fewer disease issues. Dry back the media to provide oxygen to the roots.

Fertilizer: Fertilize with a well balanced calcium-based feed, 14-4-14; 15-5-15 or 17-5-17 at 100-150 ppm N. Under higher light conditions occasional feeding with a higher nitrogen fertilizer can be used, 20-10-20 at 100-150 ppm N.

Growth Regulators: Several options can be used to control growth. Sprays with B-Nine at 2,500-5,000 ppm are effective, especially in the seedling stages. Sprays with Bonzi (paclobutrazol) and Sumagic (uniconizol) can be used. Light drenches with Bonzi 1-2 weeks after transplanting are also very effective. Alternative methods to control height involve daylength manipulation. Approximately two weeks after plants are established in their final container and flower initiation has occurred place under short day conditions, 10 hrs. daylength to shorten height. Maintain short days for 1-2 weeks to reduce plant height up to 50%. Response on height control varies by variety. More compact varieties, like Toto, require a longer period of short day treatment. Average response is 30% height control. After short day treatment return to long days of 14-16 hrs. until flowering.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis and pythium.

Pests: Fungus gnats, shore fly and whitefly.

Post Harvest: Fertilize with potassium nitrate at 100 ppm N 1-2 weeks prior to shipping. Light sprays of B-Nine (daminozide) at 2,500 ppm can also be used.

Plug Crop Time	
288 tray	5-6 wks
128 tray	6-7 wks
Finished Crop Time (from 288 tray)	
6" / 15 cm pots	7-10 wks

↑	↔	☀
20-30" 50-75 cm	20-30" 50-75 cm	Sun

Expert Tip

Keep humidity low and provide good ventilation. Avoid over-watering and drought stress. Drought stress can be a cause for necrosis of leaf edges. Avoid overhead irrigation and watering late in the day to reduce the risk of botrytis, especially in cooler growing conditions.

– Scott, Area Sales Manager



Annuals

Tagetes patula (Marigold)

Super Hero™, Little Hero, Safari

Tagetes erecta F₁

Discovery

Product Use: Packs, pots, mixed containers and landscape

Minimum Germination Rate: 85%

Seed Form: Raw, Detailed & Coated
Super Hero™: Detailed & Coated

FLOWERING

Flowering Type: Day neutral plant, will flower regardless of the daylength.

Flowering Mechanism: High light intensity and warmer temperatures will shorten the total crop time.

PLUG CULTURE

Germination: Optimum conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 2-3 days.

Cover: Seeds may be covered by a thin layer of medium vermiculite to maintain moisture and humidity levels. Light is not necessary for germination.

Sowing method: 1 seed per plug

Media: pH 6.2-6.5 Keep the pH level above 6.0 to prevent iron and manganese toxicity. EC 0.5-0.75; begin with an EC <0.75

Temperature: 72-75 °F (22-24 °C). On day 7, once cotyledons have expanded the temperature can be lowered to 68-70 °F (20-21 °C).

Moisture: Begin with a saturated (5) media for the first 1-2 days, then reduce to wet (4) for the next 3-4 days. Thereafter, on day 6, once germination is complete with cotyledon expansion, reduce the media moisture to medium (2). Alternate between moisture levels wet (4) and medium (2). Allow the media to reach a moisture level medium (2) before re-saturating to wet (4).

Humidity: 95-100% until day 3; then reduce to 40-60%. By dehumidifying it will help prevent seedling stretch. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not necessary for germination. Providing a light source will improve speed and uniformity of germination. If utilizing a germination chamber provide 10-100 ft. candles (100-1,000 lx). Supplying light in the germination chamber will greatly improve seedling performance. Keep light levels low, less than 250 ft. candles (25,000 lx) to prevent early flower initiation.

Fertilizer: Maintain an EC of less than 0.75. Begin fertilizing early on day 7 feeding at 50-60 ppm N, using a calcium-based fertilizer (14-2-14 or 13-2-13).

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug.

Media: pH 6.2-6.5 Continue to monitor the pH level. Keep the pH level above 6.0 to

prevent iron and manganese toxicity. Toxicity will be exhibited by the lower leaves having necrotic spots with a mottled discoloration. EC 0.75-1.0

Light: Provide 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx). Light levels that are too high can cause premature flower initiation.

Temperature: 64-68 °F (18-20 °C) until plants form two sets of true leaves. If stretching occurs, lower the temperature further to 63-64 °F (17-18 °C).

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media moisture level to reach medium (2) before re-saturating to wet (4). Do not allow seedlings to dry back too much since this can cause premature flowering.

Fertilizer: Fertilizer levels can be increased to 100-150 ppm N. Continue using a calcium-based fertilizer (14-2-14; 15-5-15; or even 17-5-17) under higher light conditions.

Growth Regulators: No growth regulators should be necessary. If needed B-Nine (daminozide) sprays at 2,500 ppm can be made.

Fungicides: Preventative drenches are recommended for Rhizoctonia and Pythium.

GROWING ON

Transplant Ready: Do not allow plugs to become root bound before transplanting.

Media: pH 6.2-6.5 Continue to make sure that the pH does not drop below 6.0 since iron and manganese toxicity can occur. Toxicity will be exhibited on the lower leaves having necrotic spots with a mottled discoloration. EC 1.0-1.25

Light: Provide 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx). For a better branched plant give a short day treatment after transplanting (9-10 hrs.) for two to three weeks.

Temperature: 63-64 °F (17-18 °C) until plants are well established in the final container. Thereafter, temperatures may be lowered further to 59-63 °F (15-17 °C) nights and 64-68 °F (18-20 °C) days. Avoid lower temperatures since temperatures between 64-68 °F (18-20 °C) promote flower initiation. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Continue to alternate between moisture levels wet (4) and medium (2). Allow the media moisture to approach medium (2) before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Marigolds require a moderate feed program. Fertilize weekly with a complete calcium based fertilizer at 150-200 ppm N. Recommended fertilizers are (14-4-14; 15-5-15; and 17-5-17) under high light conditions. Keep ammonium levels low since too much ammonium will result in large leaves and can also damage the roots.

Growth Regulators: No growth regulators should be necessary. Responsive to B-Nine (daminozide) sprays at 2,500 ppm. Bonzi or Piccolo (paclobutrazol) sprays can also be used.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis, pythium and rhizoctonia.

Pests: Primarily Aphids and Thrips.

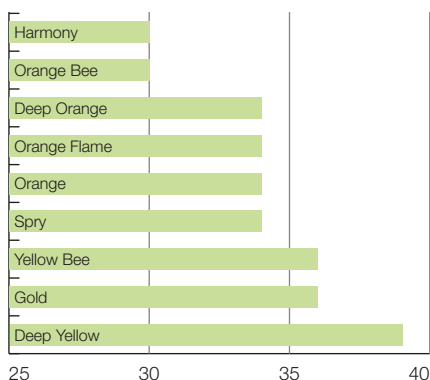
Post Harvest: Fertilize with Potassium Nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time	
288	3-4 wks
Finished Crop Time (from 288 tray)	
Packs	3-4 wks
4" / 10 cm pots	4-5 wks

↑	↔	☀
8-10" 20-25 cm	6-8" 15-20 cm	Sun

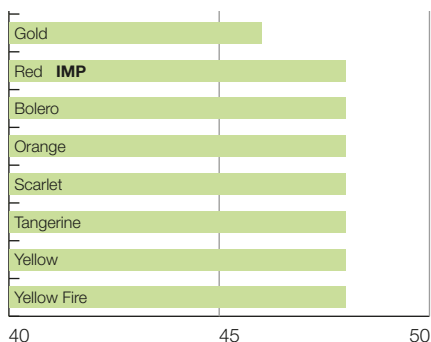
Timing Super Hero™

Days from sowing ■ 50% Flower



Timing Safari

Days from sowing ■ 50% Flower



Expert Tip

The Tagetes Super Hero™ were bred without the use of growth regulators so they can be grown without them. If using B-Nine (daminozide) it only needs to be used to tone the plants.

— David, Flower Breeder

Annuals

Verbena bonariensis

Vanity

Family, Origin: Verbenaceae, South America

Product Use: Border plant, cutflower, containers, landscape – ideal for mixtures

Minimum Germination Rate: 85 %

Seed Form: ApeX

FLOWERING

Flowering Type: Facultative long day plant, flowering more quickly under a long day length.

Flowering Mechanism: Typical cultivation as a flowering annual that flowers from June to late October. Higher light intensity will decrease the number of days to flower. Alternatively cultivation as herbaceous perennial plant is common.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect the emergence of the first seedlings after 14 days. If the germination rate at that moment is low, a cool period is advisable: Bring down the temperature to 50-60 °F (10-15 °C) during the next 7 days. Afterwards, bring temperature back to 68-72 °F (20-22 °C) during the day and 60-64 °F (15-18 °C) during the night for another 14 days.

Cover: Cover the seeds thinly with vermiculite.

Sowing method: 3-5 seeds per plug for 4.5" (12-18 cm) pots, 1-2 seeds per plug for 3.5-4.5" (9-12 cm) pots, direct sowing is also possible.

Media: Use a well-drained, pre-fertilized growing substrate with 20-30 % clay.

Temperature: During the day 68-72 °F (20-22 °C) is optimum, during the night you should lower the temperature to 60-64 °F (15-18 °C)

Moisture: After sowing keep the soil slightly moist but not wet.

Humidity: Avoid a high humidity.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug and reach the 4-6 true leaf stage where flower initiation occurs. Vernalization is not required for flower initiation.

Light: Grow at full sunlight to develop the intense flower colour.

Temperature: The seedlings should be grown at an average temperature of 65 °F (18 °C).

GROWING ON

Transplant Ready: Transplant the plugs from a spring sowing after 6 – 8 weeks in their final container – either in an optimally 4.5" (12-18 cm) pot or in smaller 3.5-4.5" (9-12 cm) pots to sell the green plants for landscaping. For this purpose 1-2 seeds per plug is sufficient.

Media: Well-drained soil, pH 5.8-6.2; E.C. 1.2-1.5. In field *Verbena* likes a humus, sandy-loamy soil with good drainage.

Light: Grow at full sunlight to develop the intense flower color.

Temperature: During the day around 64 °F (18 °C) is optimum, during the night you should lower the temperature to 56-60 °F (14-16 °C). Verbena does not tolerate frost.

Moisture: Well-drained soil, regular moisture.

Humidity: Avoid a high humidity during the finishing.

Fertilizer: Verbena requires a high fertilization level with a weekly dose of nitrogen. Also a good potassium level is important. But avoid high ammonium or nitrogen levels during the growing.

Growth Regulator: Pinching or the use of PGR is possible but not necessary. The genetics of the crop are responsible for the compact plant habit, even if no regulators are used.

Common Diseases: Stagnant moisture leads to root rot, powdery mildew.

Pests: Primarily Aphids, Thrips and Snails.

Post Harvest: Fertilize with potassium nitrate 1-2 weeks prior to shipping.

Plug Crop Time
4-6 wks
Finished Crop Time
6-8 wks

↑	↔	☀
32" / 80 cm	20" / 50 cm	Full sun- Partial shade

Expert Tip

Pay attention to the irrigation, stagnant moisture with root rot as a result is the worst case for Verbena. So the well-drained soil is an important factor during cultivation.

– Amelie, Product Manager



Biennials

Pansy – *Viola wittrockiana* F₁

Cats™, Cats™ Plus , Inspire DeluXXe®, Inspire® Plus

Family: Violaceae

Product Use: Packs, pots, mixed containers and landscape/mass plantings

Minimum Germination Rate: 90%

Seed Form: Raw & BeGreen Primed.
Cats™ only raw.

FLOWERING

Flowering Type: Daylength neutral plant will flower regardless of daylength.

Flowering Mechanism: Irradiance is the primary mechanism that initiates flowering. High light intensity 12-18 mol/m²/day (3,500-5,000 ft. candles or 35,500-50,000 lx) will initiate flowering once plants reach 3-5 true leaves (approximately day 15). Temperature is also critical to the number of days that flowering will occur. Long days will also enhance flowering.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect root emergence in 2-4 days.

Cover: Cover lightly with a thin layer of coarse vermiculite.

Sowing method: 1 seed per plug.

Media: pH 5.5-5.8; EC 0.5

Temperature: Maintain 65-68 °F (18-20 °F) until root emergence, then lower the temperature gradually to 62-65 °F (17-18 °C).

Moisture: Begin with a saturated media (5) for days 1-5, then reduce to moist (3) on day 6. As the seedlings become fully developed with expanded cotyledons, the moisture level can be decreased further to medium (2) on day 9. At this point, alternate moisture between wet (4) and medium (2) between waterings.

Humidity: 95-100% until day 5; then reduce to 40-60% to prevent hypocotyl stretch. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not necessary for germination to occur. If using a germination chamber providing a light source of 10-100 ft. candles (100-1,000 lx) will improve germination and overall quality. Going into the second stage of germination, on approximately day 6-7 the light levels can be increased to 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx). This is after germination is finished.

Fertilizer: Begin feeding early using a calcium-based fertilizer at lower rates to keep an adequate amount of calcium and nitrogen supplied to the seedlings. On days 5-7 begin feeding with a calcium-based fertilizer (14-2-14; 13-2-13: 15-5-15 or 17-5-17) at 50-60 ppm N. Maintain the EC between 0.5 and 0.75. Keep phosphorous levels between 6-8 ppm and boron supplied at 0.5 ppm.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 4-6 true leaf stage flower initiation will occur.

Media: pH 5.5-5.8 Maintain pH levels in the lower range to avoid outbreaks of thielaviopsis and boron deficiencies which may cause tip abortion. EC 0.75-1.0. Keeping the EC less than 1.5 can help control outbreaks of thielaviopsis and other root problems.

Light: The light levels need to be at 12-18 mol/m²/day (3,500-5,000 ft. candles or 35,000-50,000 lx). If high light temperatures are experienced during flowering, lowering the light level slightly to 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx) can help to further bulk the plug before flower initiation occurs.

Temperature: Maintain 65 °F (18 °C) nights, 65-70 °F (18-21 °C) days. When seedlings are well established the night temperature can be lowered to 59 °F (15 °C) to tone the plants as flower initiation occurs. An ADT (average daily temperature) of 67 °F (19.5 °C) will give the fastest finish.

Moisture: Alternate between wet (4) and medium (2) moisture levels between waterings. Let substrate reach medium (2) before re-saturating to wet (4). Avoid reaching dry (1), since this can promote root problems.

Fertilizer: Continue feeding with calcium-based fertilizers (14-4-14, 15-5-15 and 17-5-17) at 100-150 ppm N. Keep phosphorous levels between 8-10 ppm and boron levels at 0.5 ppm in the irrigation water.

Growth Regulators: Several growth regulators can be used successfully to prevent hypocotyl stretch and control plants from getting too soft. Some commonly used growth regulators are: B-Nine (daminozide) used as a spray at 2,500-5,000 ppm; A-Rest (ancymidol) used as a spray at 3-4 ppm. At times tank mixes are used combining B-Nine and A-Rest and B-Nine with Cycocel (chlormequat chloride). These combinations tend to give longer lasting effects. For specifics please contact a Benary representative.

Fungicides: Preventative drenches can be made with fungicides for the control of Thielaviopsis and other soil-borne diseases.

GROWING ON

Media: pH 5.5-5.8; keep the pH in the lower range; EC 1.25-1.5

Light: Provide 14-22 mol/m²/day (4,000-6,000 ft. candles or 35,000-50,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) nights, 64-67 °F (18-19 °C) days for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 62-65 °F (16-18 °C) day and night. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let substrate reach medium (2) before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal.

Fertilizer: Fertilize with a calcium-based feed-14-4-14, 15-5-15 or 17-5-15 at 100-150 ppm N as needed. Phosphorus levels should be between 8-12 ppm and boron between 0.5-0.75. Keeping the EC below 1.5 will help prevent root problems.

Growth Regulators: B-Nine (daminozide) used as a spray at 2,500-5,000 ppm, A-Rest (ancymidol) used as a spray at 3-4 ppm. At times tank mixes are used combining B-Nine and A-Rest and B-Nine with Cycocel (chlormequat chloride). These combinations tend to give longer lasting effects. For specifics on these and other growth regulators please contact a Benary representative.

Fungicide: Apply fungicides as needed to control root and leaf diseases. Follow the labels recommended rates.

Common Diseases: Botrytis, alternaria leaf spot, downy mildew, thielaviopsis root rot and cercospora leaf spot.

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 150 ppm 1-2 weeks.

Plug Crop Time

288 tray 4-5 wks

Finished Crop Time (from 288 tray)

	Cats™, Inspire DeluXXe®	Cats™ Plus, Inspire® Plus
Fall: Packs	5-6 wks	4-5 wks
Fall: 4" / 10 cm pots	6-7 wks	5-6 wks
Spring: Packs	7-8 wks	6-7 wks
Spring: 4" / 10 cm pots	8-9 wks	7-8 wks



6-8"
10-20 cm



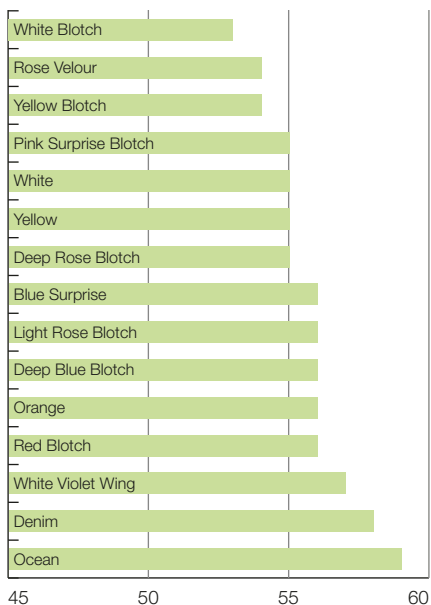
6-8"
15-20 cm



Sun – Partial
Shade

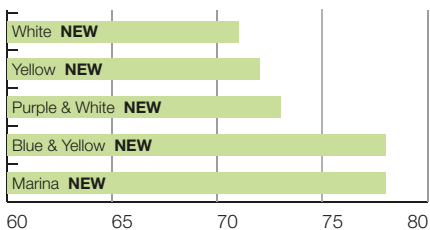
EU Timing Inspire DeluXXe® – Fall

Days from sowing 50% Flower



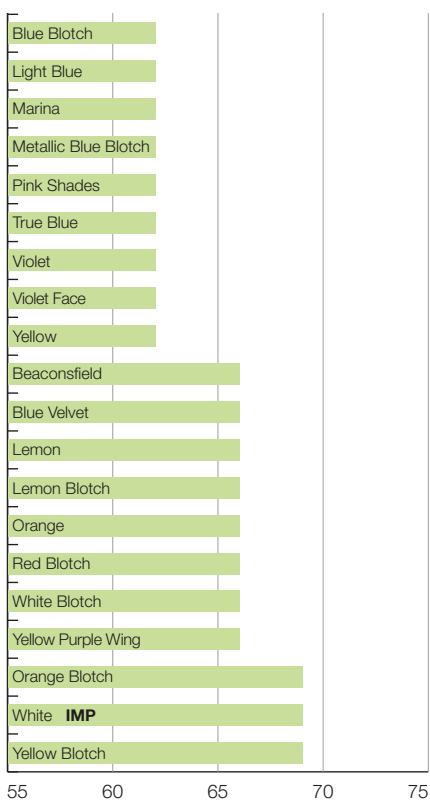
EU Timing Cats™ Plus – Fall

Days from sowing 50% Flower



Timing Inspire® Plus – Fall

Days from sowing 50% Flower



Biennials

Primula elatior F₁

Crescendo™, Piano

Family, Origin: Primulaceae, Europe

Product Use: Pots, mixed containers and landscape/bedding

Minimum Germination Rate: 85%

Seed Form: Crescendo™: BeGreen Primed
Piano: Raw

FLOWERING

Flowering Type: Facultative long day plant. Long day treatment will enhance flowering.

Flowering Mechanism: Maturity of the plant having 6-8 true leaves and irradiance, with light levels of 12-14 mols and long days will trigger flowering.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect root emergence in 6-8 days from sowing.

Cover: Cover the seed lightly with a thin layer of medium vermiculite to maintain optimum humidity levels around the seed.

Sowing method: 1 seed per plug.

Media: pH 5.5-5.8 Use a porous well drained media low in soluble salts. EC < 0.5. *Primula* are very sensitive to high soluble salts in the media.

Temperature: Maintain 64-65 °F (18-19 °C) Temperatures above 70 °F (21 °C) will reduce germination rates. Once the cotyledons are fully expanded the temperature can be reduced

to 60-62 °F (16-17 °C) to prevent stretch.

Moisture: Begin with a saturated media (5) for the first 7-8 days, then gradually reduce moisture to wet (4) once all of the seeds have finished germination. When watering re-saturate to fully saturated (5) for the first 11 days. Thereafter alternate moisture between wet (4) and moist (3) until day 25. After day 25 the moisture level can be decreased to medium (2) between waterings.

Humidity: 95-100% until day 11, then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media. If using a germination chamber it is critical to maintain a high humidity near 100% until all seeds have germinated. When the seedling trays are removed from the chamber make sure to maintain a high humidity level.

Light: Light is not necessary for germination but can be beneficial if using a germination chamber. Providing a light source of 10-100 ft. candles (100-1,000 lx) will reduce stretch and improve quality. When moving seedlings into the greenhouse keep the light levels at 4-6 mol/m²/day (15,000-20,000 lx).

Fertilizer: Maintain an EC < 1.0. The EC of the fertilized water should not exceed 0.5.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 6-8 true leaf stage, flower initiation will occur.

Media: pH 5.5-5.8 The pH needs to be kept below 6.0. At a higher pH of > 6.2 iron and manganese may become deficient. EC 1.0-1.2.

Light: 8-10 mol/m²/day (25,000-30,000 lx). As plants mature to the 6-8 true leaf stage the light levels can be increased further to 12-14 mol/m²/day (35,000-40,000 lx). Avoid direct sunlight since damage can occur as a result.

Temperature: Maintain 60-65 °F (16-18 °C) until seedlings are rooted to the bottom of the plug. Then the temperature can be lowered to 55-58 °F (12-15 °C) to tone the plants.

Moisture: Alternate between moist (3) and medium (2). Allow the soil to reach medium (2) before re-saturating to moist (3).

Fertilizer: Begin feeding early, on day14, using a complete fertilizer such as a 17-5-17, 14-4-14 or 15-5-15 at 50-60 ppm N. The fertilizer levels can be gradually increased to feeding every second or third watering at 100 ppm N when the plants reach 21 days.

Growth Regulators: No growth regulators should be necessary.

Fungicides: Use of a preventative fungicide is recommended to control soil borne diseases. Use the rates recommended on the label.

GROWING ON

Media: pH 5.5-5.8; use a porous, well drained media; EC 1.2-1.5.

Light: Provide 12-14 mol/m²/day (35,000-40,000 lx) for the fastest finish.

Temperature: For the first two to three weeks after transplanting or until the roots reach the bottom of the pot begin with 55-56 °F (12-13 °C). When plants are well established the temperature can be lowered to 45-48 °F (7-9 °C) for 4-6 weeks. The temperature can also be alternated between 50-54 °F (10-12 °C) days and 34-36 °F (1-2 °C) nights. In the final stages of finishing the crop for spring grow at 50-57 °F (12-14 °C). Temperatures above 60 °F (16 °C) will decrease plant quality and result in smaller, lighter colored flowers. Flowering pots can be stored in a cold storage room for 4 weeks at 33-36 °F (0.5-2 °C).

Moisture: Alternate between moisture levels wet (4) and medium (2). Water thoroughly periodically to even up the crop and then

begin to dry plants back with spot-watering.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: During the finishing stages additional potassium is beneficial for flower development. Finish plants with an N:K ratio of 1:3. In cool weather, maintain low ammonium levels to avoid excessive leaf expansion and vegetative growth. Alternate between nitrate based and calcium-based fertilizers (12-4-20 at 100-150 ppm N and 14-4-14 at 100-150 ppm N). An occasional clear watering every third or fourth watering will help to keep salt levels down.

Growth Regulators: With proper temperature and moisture management there should be no need for growth regulators. If needed apply B-nine (daminozide) as a spray at 2,500 ppm.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Ramularia and botrytis. Provide adequate ventilation and air circulation between plants.

Pests: Primarily aphids, cutworms, whitefly, fungus gnats, shore fly, leafminer and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time		
288 tray	6-7 wks	
Finished Crop Time (from 288 tray)		
	Crescendo™	Piano
4" / 10 cm pots	16-17 wks (incl. vernalization)	14-15 wks (no vernalization required)
↑	↔	☀
8-12" 20-30 cm	6-8" 15-20 cm	Sun – Shade

Biennials

Viola cornuta F₁

Admire®

Family: Violaceae

Product Use: Packs, pots, mixed containers, landscape/mass plantings

Minimum Germination Rate: 90%

Seed Form: Raw & BeGreen Primed

FLOWERING

Flowering Type: Facultative long day plant. Long days will also enhance flowering.

Flowering Mechanism: Daylength and irradiance are the primary mechanisms that initiates flowering. High light intensity, 12-18 mol/m²/day (3,500-5,000 ft.candles or 35,500-50,000 lx) will initiate flowering once plants reach 2-3 true leaves. Cool night temperatures below 59 °F (15 °C) will promote early flowering.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect root emergence in 3-4 days.

Cover: Cover lightly with a thin layer of coarse vermiculite.

Sowing method: 1 seed per plug.

Media: pH 5.5-5.8; EC < 0.5

Temperature: Maintain 65-68 °F (18-22 °C) until root emergence, then lower the temperature gradually to 62-65 °F (17-18 °C). Once cotyledons are fully expanded the temperature can be reduced further to 62-64 °F (16.5-17 °C).

Moisture: Begin with a saturated media (5) for days 1-5, then reduce to moist (3) on day 6. As the seedlings become fully developed with expanded cotyledons, the moisture level can be decreased further to medium (2) on day 9. At this point, alternate moisture between wet (4) and medium (2) between waterings.

Humidity: 95-100% until day 5; then reduce to 40-60% to prevent hypocotyl stretch. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is not necessary for germination to occur. If using a germination chamber providing a light source of 10-100 ft. candles (100-1,000 lx) will improve germination and overall quality. Going into the second stage of germination, on approximately day 6-7 the light levels can be increased to 6-8 mol/m²/day (2,000-2,500 ft. candles or 20,000-25,000 lx). This is after germination is finished.

Fertilizer: Begin feeding early using a calcium-based fertilizer at lower rates to keep an adequate amount of calcium and nitrogen supplied to the seedlings. On days 5-7 begin feeding with a calcium-based fertilizer (14-2-14; 13-2-13; 15-5-15 or 17-5-17) at 50-60 ppm N. Maintain the EC between 0.5 and 0.75. Keep phosphorous levels between 6-8 ppm and boron supplied at 0.5 ppm.

Plug Bulking and Flower Initiation: Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. When the seedlings root to the edge of the plug and reach the 4-6 true leaf stage, flower initiation will occur.

Media: pH 5.5-5.8. Maintain pH levels in the lower range to avoid outbreaks of thielaviopsis and boron deficiencies which may cause tip abortion. EC 0.75-1.0; keeping the EC less than 1.5 can help control outbreaks of thielaviopsis and other root problems.

Light: The light levels need to be at 12-18 mol/m²/day (3,500-5,000 ft. candles or 35,000-50,000 lx). If high temperatures are experienced lowering the light level slightly to 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx) can help to further bulk the plug.

Temperature: Maintain 65 °F (18 °C) nights, 65-70 °F (18-21 °C) days. When seedlings are well established the night temperature can be lowered to 59 °F (15 °C) to tone the plants. An average daily temperature of 67 °F (19.4 °C) will give the fastest finish.

Moisture: Alternate between wet (4) and medium (2) moisture levels between waterings. Let substrate reach medium (2) before re-saturating to wet (4). Avoid reaching dry (1), since this can promote root problems

Fertilizer: Continue feeding with calcium-based fertilizers (14-4-14, 15-5-15 and 17-5-17) at 100-150 ppm N. Keep phosphorous levels between 8-10 ppm and boron levels at 0.5 ppm in the irrigation water.

Growth Regulators: Several growth regulators can be used successfully to prevent hypocotyl stretch and control plants from getting soft growth. Some commonly used growth regulators are: B-Nine (daminozide) used as a spray at 2,500-5,000 ppm; A-Rest (ancymidol) used as a spray at 3-4 ppm. At times tank mixes are used combining B-Nine and A-Rest and B-Nine with Cycocel (chlormequat chloride). These combinations tend to give longer lasting effects. Pansies are also very responsive to a DIF of 5 °F (3 °C).

Fungicides: Preventative drenches can be made with fungicides for the control of thielaviopsis and other soil borne diseases.

GROWING ON

Transplant Ready: Under optimal conditions plugs are ready at 4 weeks.

Media: pH 5.5-5.8; keep the pH in the lower range. This will help control the outbreak of thielaviopsis. EC 1.25-1.5

Light: Provide 14-22 mol/m²/day (4,000-6,000 ft. candles or 35,000-50,000 lx).

Temperature: Maintain 68-70 °F (20-21 °C) nights, 64-67 °F (18-19 °C) days for the first 14 days or until the roots reach the bottom of the container. Thereafter temperatures may be lowered to 62-65 °F (16-18 °C) day and night. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop. Night temperatures below 59 °F (15 °C) will enhance flowering.

Moisture: Alternate between moisture levels wet (4) and medium (2). Let substrate reach medium (2) before re-saturating to wet (4).

Humidity: 40-60% humidity is ideal.

Fertilizer: Fertilize with a calcium-based feed 14-4-14; 15-5-15 or 17-5-15 at 100-150 ppm N as needed. Phosphorus levels should be between 8-12 ppm and boron between 0.5-0.75. Keeping the EC below 1.5 will help prevent root problems.

Growth Regulators: B-Nine (daminozide) can be used as a spray at 2,500-5,000 ppm, or A-Rest (ancymidol) can be used as a spray at 3-4 ppm. At times tank mixes are used combining B-Nine and A-Rest and B-Nine with Cycocel (chlormequat chloride). These combinations tend to give longer lasting effects.

Fungicide: Apply fungicides as needed to control root and foliar diseases. Follow the labeled recommended rates.

Common Diseases: Botrytis, alternaria leaf spot, downy mildew, thielaviopsis root rot and cercospora leaf spot.

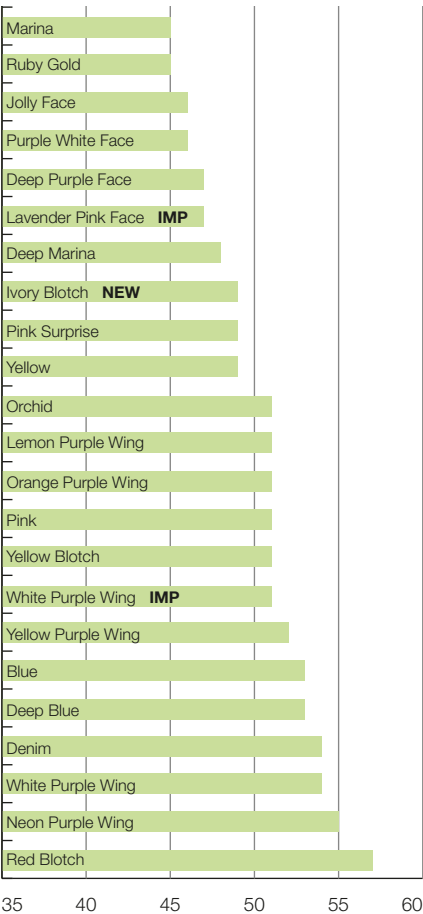
Pests: Primarily aphids and ahrrips.

Post Harvest: Fertilize with potassium nitrate at 150 ppm 1-2 weeks prior to shipping.




EU Fall Timing Admire®

Days from sowing

50% Flower



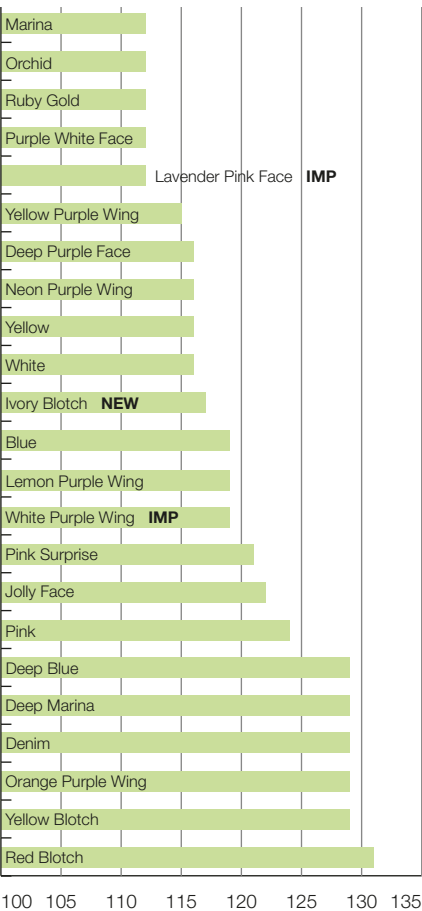
Plug Crop Time		
288 tray	4-5 wks	
Finished Crop Time (from 288 tray)		
	Spring	Summer / Fall
Packs	5-6 wks	4-5 wks
4 / 10 cm pots	6-7 wks	5-6 wks

		
6-7" 15-18 cm	6-7" 15-18 cm	Sun – Partial shade

EU Spring Timing Admire®

Days from sowing

50% Flower



Campanula carpatica F₁

Pearl

Product Use: Pots, hanging baskets, mixed containers and landscape

Minimum Germination Rate: Raw Seed 85%, Pelleted Seed 80%

Seed Form: Raw & Pelleted

USDA Hardiness Zone: 3a-8a

AHS Heat Zone: 9-1

FLOWERING

Flower Initiation: Beginning from the initial sowing. Flower initiation occurs approximately days 42-48 when 6-8 true leaves are present unless kept under short days.

Flowering Type: Obligate long day plant requiring a daylength > 13 hrs. to initiate flowering.

Flowering Mechanism: Daylength > 13 hrs. is required to initiate flowering. Supplemental lighting during germination will be beneficial but is not necessary.

PLUG CULTURE

Germination: Maintain optimal conditions for seedling development, should begin on the day of sowing until root emergence. Expect radicle emergence in 10-12 days.

Cover: No cover is necessary.

Sowing method: Raw seed – sow 6-8 seeds/plug; single pelleted seed-sow 2-3 pellets/plug.

Media: pH 5.5-6.2, EC 0.5 Sensitive to high salt levels during germination.

Temperature: Maintain 68-72 °F (20-22 °C) day temperature, 61 °F (18 °C) night temperature. The fluctuation between day and night temperatures will aid in the germination. By day 14 the temperature can be maintained at 64-68 °F (17-20 °C).

Moisture: Begin with a moisture level wet (4) for the first 8-9 days, after radicle emergence reduce to moist (3). On day 10, begin to alternate moisture levels between moist (3) and medium (2). Allow media to approach medium (2) before re-saturating to moist (3). Never allow the media to dry out completely.

Humidity: 95-100% until day 12, then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Requires light for germination. Supplemental lighting during germination will improve speed of germination and uniformity. During germination, and the first three weeks after germination provide a daylength of 10-12 hrs.

Fertilizer: Sensitive to high EC in the early stages so maintain an EC less than 0.5 for the first 10-14 days until germination is complete.

Plug Bulking and Flower Initiation:

Maintain optimal conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedling root to the edge of the plug and reach the 6-8 true leaf stage where flower initiation occurs.

Media: pH 5.5-6.2, EC 0.5-1.0 Use a well-drained media low in soluble salts.

Light: Supplemental lighting is beneficial but keep the daylength to 10-12 hr. to bulk the plants. Continue to keep the plants under short days for the duration of the plug production.

Temperature: Maintain 64-68 °F (17-20 °C) until roots are well established then lower the temperature to 62-65 °F (16-8 °C). In the last two weeks of plug production the temperature can be lowered further to 58-60 °F (14-16 °C) nights and 65-70 °F (18-21 °C) days.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media to approach medium (2) before re-saturating to wet (4). Try to maintain the moisture level of moist (3) as much as possible. Never allow the plugs to dry out completely.

Fertilizer: Moderate fertilizer requirements using a regime that supplies slightly higher levels of potassium. Use a balanced fertilizer low in ammonium to prevent high nitrogen levels. If possible use a potassium based fertilizer (N: K₂O-ratio: 1:1.5). Blended fertilizers that can be used are 11-7-23, 17-5-17 and 14-4-14. Begin feeding with low rates on approximately day 14-16 using 40-50 ppm nitrogen. As the plants develop further the rate can be increased to fertilizing weekly at 100 ppm nitrogen.

Growth Regulators: Sprays of B-Nine (daminozide) at 1,500-2,500 ppm are very effective in toning the plants and controlling growth. Cycocel (chlormequat chloride) sprays at 300-500 ppm can also be used effectively. Campanula are sensitive to Bonzi (paclobutrazol) and Sumagic (uniconazole).

Fungicides: Apply fungicides during long periods of low light and high humidity. Especially for soil born diseases.

GROWING ON

Media: pH 5.5-6.2, EC 1.0

Light: In spring production after the plants are established in the final container, approximately 3-4 weeks after transplanting they can be given long days to bring them into flower. Establish newly transplanted plants under short days until plants fill approximately 3/4 of the pot for 4" (10cm) pots, or approximately 3-4 weeks after transplanting

depending on the temperature. Supplemental lighting is beneficial but only use a 10-12 hrs. photoperiod. Campanula can also be grown in the summer and fall when the daylength is becoming short (less than 12 hrs.). They can be moved into a greenhouse and provided with long day treatment to bring them into flower. In this case provide a daylength of 14-16 hrs. Either use daylength extension or night interruption, lighting from 10 pm to 2 am. They only require 10 ft. candles (100 lx) to initiate flowering. In spring production once flower buds are visible, the long day treatment can be discontinued.

Temperature: Maintain 59-64 °F (13-18 °C). Once established in the final container the temperature can be lowered to 55-59 °F (13-15 °C) but the cooler growing temperatures will lengthen the overall crop time. Plants grown at the lower temperatures will have larger flowers. For the fasted finish grow at 65-67 °F (18-19 °C).

Moisture: The best approach is to water in plants thoroughly until wet (4), then let them dry back and alternate between wet (4) and medium (2) moisture levels. Allow the media to approach medium (2) before re-saturating to wet (4). Avoid drying the media out completely since root damage can occur.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Campanula require a light to moderate fertilization program. Use a balanced fertilizer low in ammonium to prevent high nitrogen levels. If possible use a potassium based fertilizer (N: K₂O-ratio: 1:1.5). Blended fertilizers that can be used are 11-7-23, 17-5-17, 14-4-14. Either use a constant feed program at 50-75 ppm nitrogen or fertilize weekly at 150-200 ppm N. During finishing in the fall do not fertilize after mid-September.

Growth Regulators: Sprays of B-Nine (daminozide) at 1,500-2,500 ppm are very effective in toning the plants and controlling growth. Cycocel (chlormequat chloride) sprays at 500-750 ppm can also be used effectively.

Fungicide: Apply fungicides during long periods of low light and high humidity. The most common problems are with soil born diseases and later with botrytis.

Common Diseases: Botrytis, pythium and rhizoctonia.

Pests: Primarily aphids, thrips and spider mites.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time	
288 tray	8-9 wks
128 or 144 tray	9-10 wks
Finished Crop Time (from 288 tray)	
4" / 10 cm pots	12-14 wks
6" / 15 cm pots / gallon	14-15 wks
10" / 25 cm baskets	14-16 wks

		
6-8" 15-20 cm	6-8" 15-20 cm	Sun

Expert Tips

Campanula Pearl can be grown in three different methods.

1. Grow plants in a greenhouse and move outdoors once well established in the fall for overwintering.
2. Force plants in the spring utilizing optimal conditions provided by a greenhouse.

3. Grow plants outdoors during summer with the possibility to force flowering during fall. During summer a higher quality can be achieved by providing short day treatment via blackcloth to bulk up young plants before flowering under long days.

Use care in transplanting to make sure that the plants are not transplanted too deep keeping the media from settling around the crown of the plant. Transplant at the soil level of the plug. Use a moderate fertilization program in production avoiding high levels of ammonium.

The total crop time is greatly influenced by temperature. Production at temperatures of 65-67 °F (18-19 °C) will give the shortest crop time. Bulk young plants under short days until plants are close to filling the finished container. When campanula are grown entirely under long days, the young plants can be bulked using a short day treatment of less than 12 hours.

Perennials

Lewisia cotyledon

Elise, Special Mix

Family, Origin: Montiaceae (Portulacaceae), NW Africa.

Product Use: Pots, Jumbo Packs, Mixed Containers, Beds, Borders, and Rock Gardens.

Minimum Germination Rate: 75%

Seed Form: ApeX Seed

USDA Hardiness Zone: 3a-8a

AHS Heat Zone: 7-1

FLOWERING

Flowering Type: Facultative long day plant. Long days and high light levels will facilitate earlier flowering.

Flowering Mechanism: Maturity of the plant having 6-8 true leaves and high irradiance, with long day's will initiate flowering. Will flower reliably in the first year without vernalization.

PLUG CULTURE

Germination: Optimum conditions for seedling development, beginning on the day of sowing until radicle emergence. Expect radicle emergence in 14-21 days.

Cover: Cover seed with a light layer of medium vermiculite.

Sowing method: 1 seed per plug

Media: pH 5.5-6.0; EC < 0.5. *Lewisia* are sensitive to high salts in the media.

Temperature: Maintain 64-68 °F (18-20 °C) until root emergence.

Moisture: Keep substrate saturated (5) for the first 10 days, then reduce to wet (4) until radicle emergence. After radicle emergence has occurred allow the media to dry back to moist (3).

Humidity: 95-100% until root emergence; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Lighting is not required for germination but can be beneficial if using a germination chamber. Providing a light source of 10-100 ft. candles (100-1,000 lx) will reduce stretch and improve quality. When moving plugs into the greenhouse, keep light levels at 4-6 mol/m²/day (1,500-2,000 ft. candles or 15,000-20,000 lx). Avoid direct sunlight to prevent damage.

Fertilizer: Maintain EC < 0.5. Fertilized water should not exceed an EC of 0.5. After germination has occurred fertilize with a complete fertilizer (14-4-14) or (15-5-15) at 50 ppm N.

Plug Bulking and Flower Initiation:

Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedlings root to the edge of the plug and reach the 6-8 true leaf stage where flower initiation occurs.

Media: pH 5.5-6.0; EC 1.0-1.2

Light: 8-10 mol/m²/day (2,500-3,000 ft. candles or 25,000-30,000 lx). As plants mature to the 6-8 true leaf stage, light levels can be increased further to 12-14 mol/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx).

Temperature: 63-68 °F (17-20 °C).

Moisture: Maintain a moist (3) substrate, and avoid excessive watering. Roots are slow growing, so allow the media to approach medium (2) before re-saturating to moist (3).

Fertilizer: Maintain EC 1.0-1.2. Excessive N can lead to stretching and soft growth. Begin feeding weekly using a complete fertilizer (15-5-15) at 100 ppm N. Rates can be increased up to 150 ppm N as seedlings develop.

Growth Regulators: No growth regulators should be necessary.

Fungicides: Use of a preventative fungicide is recommended to control soil-borne diseases. Use recommended rates on the label.

GROWING ON

Media: pH 5.5-5.8; EC 1.2-1.5

Light: Provide 12-14 mol/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx) for the fastest finish.

Temperature: Finish plants cooler at 50-65 °F (10-18 °C) for best quality. As plants begin to flower the temperature can be increased.

Moisture: Maintain an even moisture level as close as possible to moist (3) throughout production. Allow the media moisture level to reach medium (2) before re-saturating to moist (3). Roots are slow to develop so use care not to over water. Water periodically and thoroughly to even up the crop, then begin to dry plants back with spot watering.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Maintain EC 1.2-1.5. Excessive N can lead to stretching and soft growth. Fertilize weekly using a complete fertilizer (15-5-15) or a (17-5-17) under high light levels at 150 ppm N.

Growth Regulators: With proper temperature and moisture management, there should be no need for growth regulators. If needed, apply B-nine (daminozide) as a spray at 2,500 ppm.

Fungicide: Apply fungicides during long periods of low light and high humidity.

Common Diseases: Botrytis. Provide adequate ventilation and air circulation between plants.

Pests: Primarily aphids and thrips.

Post Harvest to Maintain Quality: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time	
288 tray	7-8 wks
128 tray	9-10 wks
Finished Crop Time (from 288 tray)	
4" / 10 cm pots (1*)	10-12 wks
6" / 15 cm pots (3*)	12-14 wks

*plants per pot

		
5-7" 12-16 cm	3-8" 15-20 cm	Partial Shade – Sun

Platycodon grandiflorus F₁

Pop Star™

Product Use: Pots, mixed containers and landscape

Minimum Germination Rate: 90%

Seed Form: Raw

USDA Hardiness Zone: 3b-9b

AHS Heat Zone: 9-1

FLOWERING

Flowering Type: Day-neutral plant platycodon flower regardless of the daylength, but providing long days and high irradiance greatly affects earlier flowering.

Flowering Mechanism: High light intensity and warmer temperatures will shorten the time to flower. Supplemental lighting during germination will benefit but is not necessary. Higher light levels build stronger plants. Young seedlings need to be protected from high light levels until they are well established.

PLUG CULTURE

Germination: Optimal conditions for seedling development, beginning on the day of sowing until radical emergence. Expect radicle emergence in 3-4 days.

Cover: No covering is necessary.

Sowing method: For 4" (10.5 cm) pot 1 seed per plug ; For 5-6" (12 cm) pot 4 seeds per plug.

Media: pH 5.5-6.0. EC<1.0; 0.5-0.75

Temperature: 68-70 °F (20-21 °C), after germination has occurred the temperature can be reduced slightly to 65-68 °F (18-20 °C).

Moisture: Begin with saturated media (5) for the first 4 days. On day 5 begin to reduce the moisture level to wet (4) for the next 4-5 days. Once the cotyledons have expanded reduce further to moist (3). This should occur on day 11-12. Begin to alternate between wet (4) and medium (2) moisture levels. Let the media approach medium (2) before re-saturating to wet (4).

Humidity: 95-100% until day 6; then reduce to 40-60%. Provide proper ventilation and horizontal airflow to improve oxygen levels in the media.

Light: Light is necessary for germination. If utilizing a germination chamber, provide light levels of 10-100 ft. candles, (100-1,000 lx). Providing light during germination will benefit and improve quality. Protect seedlings from direct sun light by shading.

Fertilizer: Maintain an EC < 1.0. Fertilized water should not exceed an EC of 0.5. Begin fertilizing early using a calcium-based feed, 14-4-14 or 15-5-15 at 50-60 ppm N.

Plug Bulking and Flower Initiation: Optimum conditions during the vegetative stage from cotyledon expansion to flower initiation. This stage is when the seedling roots to the edge of the plug.

Media: pH 5.5-6.0. EC 0.75-1.0

Light: As the seedlings become well established they can be given higher light levels of 6-10 mol/m²/day (2,000-3,000 ft. candles or 20,000-30,000 lx). Continue to protect seedlings from direct sunlight.

Temperature: 65-68 °F (18-20 °C)

Moisture: Alternate between moisture levels wet (4) and Medium (2). Allow the media to approach medium (2) before re-saturating to wet (4). Platycodon prefer slightly drier media conditions for good root development.

Fertilizer: Begin fertilizing at 100-150 ppm N using calcium-based fertilizers 14-4-14; 15-5-15; 17-5-17 and 20-10-20 under high light conditions.

Growth Regulators: If needed apply a B-Nine (daminozide) spray at 750-1,000 ppm to keep seedlings from stretching. Avoid higher rates of B-Nine since leaf edge burn may occur.

GROWING ON

Media: pH 5.5-6.0. EC 1.0-1.5

Light: Provide light levels of 12-14 mol/m²/day (3,500-4,000 ft. candles or 35,000-40,000 lx). Once plants are established providing long days of 16 hrs. and light levels of 16-18 mol/m²/day (4,500-5,000 ft. candles or 45,000-5,000 lx) for 3 weeks will shorten crop time and produce strong plants.

Temperature: 65-68 °F (18-20 °C) nights, 70-74 °F (21-23 °C) days for the first two weeks after transplanting. Thereafter temperatures may be lowered to 62-65 °F (16-18 °C) day and night. An ADT (average daily temperature) of 67 °F (19 °C) will give the fastest finished crop.

Moisture: Alternate between moisture levels wet (4) and medium (2). Allow the media to reach medium (2) before re-saturating to wet (4). Allowing the media moisture level to dry back will encourage good root development.

Humidity: 40-60% humidity is ideal. Providing good ventilation and horizontal airflow will help lower the humidity and dry back the media, providing oxygen to the roots.

Fertilizer: Higher rates of ammonium can now be used in the feed program. Fertilize at 150-200 ppm N using a 17-5-17 or 20-10-20 fertilizer. Under high light conditions 20-10-20 can be used.

Growth Regulators: B-Nine (daminozide) sprays at 1,000 ppm can be made as needed two weeks after transplanting. Higher rates may cause leaf edge burn.

Fungicide: Apply fungicides during long periods of low light and high humidity.

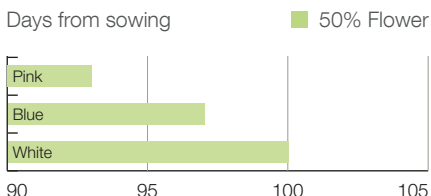
Common Diseases: Botrytis

Pests: Primarily aphids and thrips.

Post Harvest: Fertilize with potassium nitrate at 100 ppm 1-2 weeks prior to shipping.

Plug Crop Time		
288 tray	4-5 wks	
128 tray	5-6 wks	
Finished Crop Time (from 288 tray)		
4" / 10 cm pots	8-10 wks	
6" / 15 cm pots	13-14 wks	
↑	↔	☀
6-8" 15-20 cm	6-8" 15-20 cm	Sun

Timing Pop Star™



Production Schedule



Expert Tip

If using B-Nine (daminozide) sprays do not apply more than 1,000 ppm. Higher rates can cause leaf edge burn. Plants may also be too compact with a smaller flower.

Perennials

Sempervivum

Hippie Chicks

Product Use: Attractive plants for rock garden and dry stone walls, pot plants, plants for graves, ornamental leaf plant, plants attract bees, extensive roof planting

Sow Time: January-March for green pots; June-August for flowering in pots the following year

Seed Form: Apex Raw, BeGreen Apex Pelleted

USDA Hardiness Zone: 3a-9b

PLUG CULTURE

Germination: 14-25 days

Cover: Cover seed lightly after sowing

Sowing method: 3-5 seeds per plug

Media: pH 5.5-6.0. EC<1.0; 0.5-0.75

Temperature: 65-72 °F (18-22 °C)

GROWING ON

Media: Use a well-drained, growing substrate with 0-15 % clay, 0-15 % parts (e.g. bark, wood fibres, perlite, sand), 1-1,5 kg/m³ complete balanced fertilizer, 1-2 kg/m³ slow release fertilizer (3-9 months), iron-chelate, micronutrients, pH: 5.5-7.0.

Temperature: Grow at 50-64 °F (10-18 °C) or outdoors. In winter indoors frost free at 38-41 °F (3-5 °C) or outdoors. Outdoor fleece cover needed. For wintering the roots development should be very good. In spring the plants start to grow for 10-12 weeks at

59-64 °F (15-18 °C). Cold temperatures of 50-54 °F (10-12 °C) will increase the cultivation time. A chilling period (vernalization) is required for flower initiation.

Fertilizer: Low-moderate fertilization levels are required. Fertilize the crop weekly with 80-100 ppm nitrogen (at 2 kg/m³ slow release fertilizer in substrate), using complete balanced fertilizer. Avoid high ammonium and high nitrogen levels. Very high nitrogen levels in substrate cause shoot stretching and the shoots fall apart. Don't fertilize after mid September. In spring fertilize 80-100 ppm nitrogen of a complete balanced fertilizer. Prevent magnesium deficiency by applying magnesium sulphate (0,05 %) 1-2 times and in case of iron deficiency (above pH 6.0) apply iron-chelate for 1-2 times.

Stages: Stage I Starts with the radicle breaking through the testa. The roots are touching the medium. Ends with fully developed cotyledons. Stage II Starts from fully developed cotyledons. Ends with the fully developed true leaf or true leaf pair. Stage III Starts from the fully developed true leaf or true leaf pair and ends with 80% of the young plants being marketable. Stage IV All young plants are ready for sale and in the process of being hardened off. This stage lasts about 7 days.

The cultural recommendations are based on results from trials conducted under Central European conditions. Different conditions in other parts of the world may lead to deviations in results achieved.

Future-oriented. Eco-friendly Solutions for Sustainability.



BeGreen Seed Technology means:
Chemical and micro-plastics free seed
treatments by Benary

- For healthier plants
- For happier customers
- For being a true green thinking and acting company in our industry

"BeGreen" Seed – Priming and Pelleting
Your Advantages:

- Faster germination
- Higher uniformity
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- Enhanced control of seeds per cell
- Higher yields
- Improved cultivation efficiency
- Increased profitability

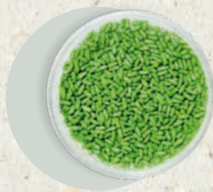


BeGreen Seed Technology by Benary at a Glance

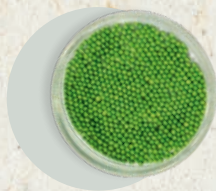
Treatments free of chemicals and micro-plastics



BeGreen Coating



BeGreen Pelleting



BeGreen Apex Pelleting



BeGreen Priming



BeGreen Apex

Breeding goes hand in hand with seed technology

Esthetics, performance and sustainability are our breeding ambitions. Our breeding teams strive to continuously develop excellent new varieties in professional seed quality.

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At Benary, we care about you, your customers and the environment.



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Please contact us for further assistance.

The North American Benary team is available to support you and assist with your individual needs. We are committed to your success and are happy to answer any questions.

Our seed storage and distribution departments in Hann. Münden, Germany and DeKalb, IL, USA provide fast order processing and prompt shipping to our customers.

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