

Propagating Strawberry Plants Through Runners

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Preface

By Anya Osatuke: The production of strawberry plants is challenging due to the rigorous sanitation needs that must be met, especially in field propagation settings, but also in greenhouse settings. Growers in New York may find it more difficult to obtain their preferred strawberry varieties in the coming years, as fewer nurseries are propagating strawberries. The production of strawberry runners in a controlled environment such as a greenhouse or high tunnel must be kept separate from the production of strawberry fruit, because the energy allocation of strawberry plants will tend to favor either runner production or fruit production, but not both.

From conversations I've had with growers, there could be a market for plug plants in the northeast market, particularly when it comes to rarer varieties that do well in the region, such as 'L'Amour' for perennial matted row systems and 'Everest' or 'Albion' for early-season annual plasticulture. Plug plants will fetch a higher price than dormant bare-root plants, due to the higher cost of production and lower availability in the Northeast, especially if plants are available in August. This article only discusses production and marketing potential of plug plants because successful field production of bare-root strawberries is very difficult to achieve without the use of highly restricted soil fumigants.

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Plug Production General Tips

- ✓ Bench-top propagation of strawberries is the best way to prevent root diseases in runners.
- ✓ Do not allow mother plants, runners, or plugs to touch natural soil. Natural soil can harbor diseases such as verticillium wilt, anthracnose, and red stele. Only use soil-free potting mix.
- ✓ Mother plants can produce runners for 2-4 years. The best production will be in the first year and it will decline every year after that.

How to Produce Runners

Sourcing Mother Plants

- Source dormant, bare-root strawberries (mother plants).
- Check mother plants for diseases:
 - Test 1 plant from each bundle. If a disease is found, test 2 more plants in the bundle.
 - Do not plant from bundles with much disease.
 - Cut crowns in half. Crowns should be pure white inside.
 - Scrape away root skins using a knife. Inside of roots should be pale white with a slightly darker tunnel down the middle. Roots should not have red tunnels or patches of dark color inside.

Planting

- Plant bare-root strawberries (mother plants) in spring or early summer.
- Plant in 1-gallon grow bags, 1-gallon pots, or plastic or PVC plant gutters with plant troughs. If planting containers have sharp edges, tape around the edges to make them smoother.
- Use soil-free potting mix. [I recommend Pro-Mix BK25, manufactured by Premier Tech, or a 2:1 peat:perlite mixture.]
- Combine potting mix with water to make it moist, then fill planting containers.
- To control arthropod pests, plastic mulch can be used to create a barrier between the vegetation and the potting mix.
- Install drip irrigation and fertigation. Sanitize drip tubing with rubbing alcohol or Lysol before installing. Drip tubing can prevent splashing of water from surfaces that touch ornamentals, which can prevent disease spread.
- Use scissors to trim roots of crowns to 2 inches. Wipe the scissors down with rubbing alcohol or Lysol before starting to cut, and wipe down again when you finish a row. This can stop the spread of rots.

Growing Conditions

- Fertigate with 20-10-20. Inject 100ppm N per irrigation.
- Keep temperatures between 75-80°F and provide 16 hours of light per day.
- Pinch off all flowers and discard far away from the nursery. Do not let plants make fruit.
- Runner tips will be ready to harvest in 8-10 weeks.

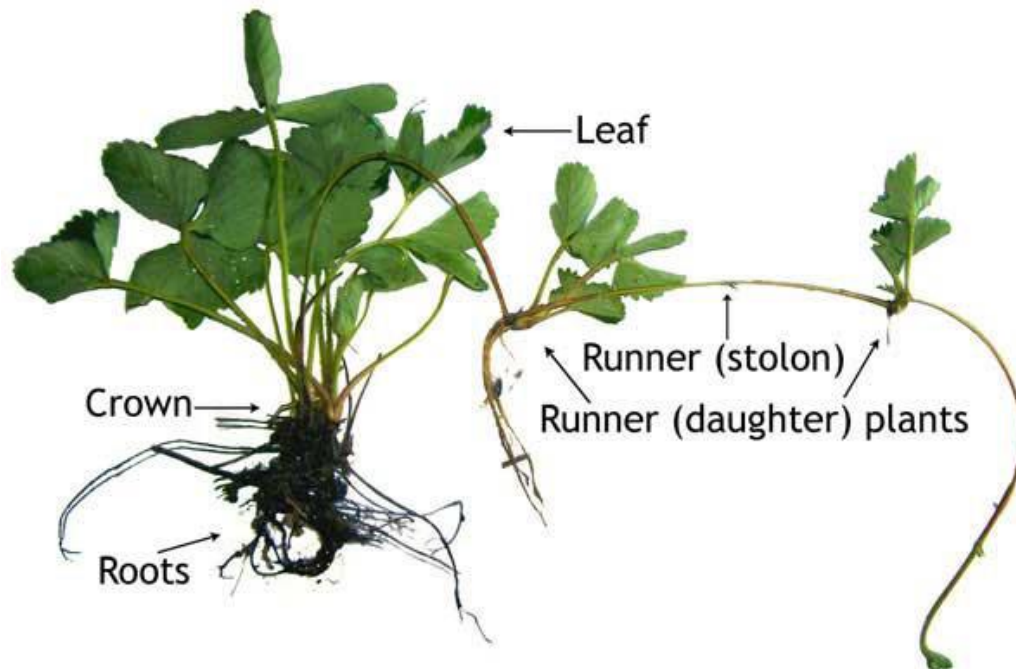


Figure 1: Parts of a strawberry plant. Photo from University of Minnesota Extension.

How to Harvest and Grow Out Runner Tips

Getting Started

- Use scissors to harvest runner tips (daughter plants).
 - Before and during harvesting, clean scissors using rubbing alcohol or Lysol.
- Cut away any dead leaves from mother plants. Move discards far away from strawberry plants.

Size

- Harvest tips that have visible root pegs and at least 2 trifoliate leaves.
- The tip should be 2.5 to 4 inches long from the base to the end of the leaf.
- Discard runners that are too large or too small. They will not be able to root well.
- Leave a 1/2-inch “tail” on the runner stem without any leaves.



Figure 2: A harvested runner tip. The runner tip should be between 2.5 to 4 inches long. Use the little leafless tail to anchor in the potting mix.

Runner Tip Handling Hints

- Some growers report better rooting if they harvest runner tips directly into a bucket of water, to provide moisture before planting.
- Transfer cut runner tips to a cooler within 15 to 20 minutes and keep out of the sun.

Planting Runner Tips

- Plant runner tips within 24 hours of harvest.
- Plant runners into 50-cell plastic trays.
- Use soil-free potting mix.
- Fill cells loosely with pre-wetted potting mix.
- The runner tip has a small “tail” of stem sticking out from the crown. The base of the runner tip has three small bumps (root pegs) growing from the base. Gently pat the runners in. Bury the root pegs and 1/2-inch tail of stem.
- Keep the crown above the potting mix.



Figure 3: Proper position of a runner tip in the potting media. Photo from Brad Bergefurd, Ohio State University.

Growing Environment & Care

- Immediately place newly planted tips under mist propagation system.
- Keep runners in a humid place. Frequent misting and humidity domes can be very helpful.
- Runners will root in 5-10 days.



Figure 4: Healthy runner tip with growing roots. Photo from Brad Bergefurd, Ohio State University.

- Let runners root for 1 week without fertilization.
 - After rooting, fertilize runners biweekly with a 10-10-10 fertilizer.
- Grow runners until they have 3-5 mature leaves and a 6-inch crown diameter. This will take about 1 month.



Figure 5: Established strawberry plugs can be lifted from the tray without dropping soil from the roots. Note the crown position, above the soil line. Photo from Brad Bergefurd, Ohio State University.

- Established plugs can be kept on tables outdoors to reduce mold, mites, and aphids.
 - Established plug plants can be lifted out of the trays without dropping the soil from their roots. The plug plants are ready for sale or winter hardening.

Selling Plugs

Dayneutral strawberries can be propagated in the spring and sold in the summer. They will fruit in the same year. Everest, Seascape, and Evie 2 are very cold-hardy and overwinter well in the field. Albion has been overwintered with success, as well, especially in more temperate regions of New York State. Most dayneutrals are likely to die off in the winter cold. If customers are buying for a strawberry farm, encourage them to pinch off flowers for the first 2-3 weeks after planting to help plants establish and maximize yields later in the season. If customers are buying for a small garden, pinching off flowers may not be as fun as harvesting those first “home-grown” berries.

Junebearing strawberries need to undergo cold temperatures and short days before they make flower buds. One strategy is to harvest Junebearing tips in the early spring and sell them in the summer, encouraging customers to pinch off all flowers in the year of planting. Do not sell Junebearers after September—the plants may not have time to establish after planting. Another option is to harvest Junebearing tips in early fall and sell plug plants in the spring so that they fruit soon after being bought. Well-rooted Junebearing plugs and mother plants can be overwintered in an area with controlled cold storage, where temperatures will remain between 29–32°F.

Winter Care for Mother Plants

Mother plants can be allowed to go dormant in the wintertime.

- Store in an area that does not drop below 29°F to avoid winter injury to the crowns.
- Do not provide supplemental light.
- Pinch off all flowers. Do not let plants make fruit.
- Check water status every 2 weeks to prevent the roots from drying out.
- Do not fertilize until the early springtime when temperatures will not drop below 55°F again.

Inducing Flower Buds in Plug Plants

Junebearing plug plants must be exposed to short fall days to induce flower bud formation.

- In mid-August, stop fertilizing.
- In November, reduce light to 9 hours or less if using supplemental lighting.
- Only provide supplemental heat if night temperatures will dip below 59°F.
- After 1-2 months of short days and cold night temperatures, the Junebearing plugs can be moved into dark, controlled cold storage as described in the previous section, “Winter Care for Mother Plants”.
- Very cold-hardy varieties of Junebearers, such as ‘Jewel’ and ‘Malwina’, may benefit from a longer short day/cold night treatment than low-chill varieties such as ‘Sweet Charlie’ or ‘Camarosa’. The latter will recruit flower buds from a 3-week induction period.

Dayneutral plugs do not need to undergo the short day/cold night treatment to make flower buds. Dayneutral plugs should not be fertilized after September.

Greening Up Overwintered Plug Plants

In mid-March or early April, start greening up the dormant plug plants. Plug plants will exit dormancy as soon as temperatures go above 55°F.

- Plugs will have similar heat and light needs as ornamentals or tomatoes—at least 6 hours of bright light but more is better. If using fluorescent lights, provide at least 7 hours of light.
- Fertigate weekly with 20-20-20.
- Check water status of soil daily.
- Pinch off flowers.
- Pot up in early May for sale in late May - June (Junebearers)
- Pot up in early May for sale throughout the summer (Everbearers)

Disease & Pest Management in Greenhouse or Hoop House

General Information

- Use a plastic mulch to create a barrier between soil and foliage to prevent fungus gnats, mites, and aphids.



Figure 6: Strawberry crowns growing through plastic mulch. The barrier between the leaves and the potting mix can reduce insect pest pressure. Photo from Justin James Muir, Cornell.

- Increasing ventilation in greenhouse or hoop house can reduce disease.
- Keep area around greenhouse or hoop house mowed.
- If mold becomes an issue, slow down watering and reduce fertilization.
- If leaves have tip burn, increase humidity at night. One way to do this is to place humidity domes over the plug trays.
- Quadris, Pristine, and Cabrio cannot be used for strawberry plug production.

Plug Plants and Ornamentals

Many ornamentals can spread *Phytophthora* rot to strawberries through water and soil.

- Do not let ornamental planters drip water onto strawberry pots or trays.
- Do not let soil from ornamentals touch the strawberry plants.

Control of Gray Mold (*Botrytis*) and Powdery Mildew

To control gray mold (*Botrytis*) and Powdery Mildew, alternate Captan, CaptElevate, and Switch as a foliar spray.

- Only apply after runner tips have rooted, at least 2 weeks after planting.
- Begin spraying if plants begin to wilt and collapse with a white or gray mold.
- Do not use Captan as a soil drench; plants will stunt.
- Rotate sprays on a weekly basis.



Figure 7: Powdery mildew spreading from fruit to a runner. The runner tip will not survive. Photo from Anya Osatuke, CCE Harvest NY.

Treatment of Whiteflies, Mites, and Aphids

To treat whiteflies, mites, and aphids, use a sulfur-based spray such as Thionex 3EC per label instructions. Only use 2–3 weeks after planting tips, on established plants.

Prevent Phytophthora Rot

To prevent *Phytophthora* rot, use a phosphite-based product such as Prophyt, Aliette, or Phostrol. Use foliar sprays after plants have established roots, 2-3 weeks after planting.

Prophyt: Use as a pre-plant dip (2 pints Prophyt diluted in 100 gallons water, dip plants for 15-30 minutes and plant within 24 hours). Or use as a foliar spray (2-4 oz per acre), wait 30-60 days between applications.

Aliette: Same pre-plant dip instructions as Prophyt. Or use as a foliar spray (2.5-5 oz per acre), wait 30-60 days between applications.

Phostrol: Use as a pre-plant dip (2.5 pints Phostrol diluted in 100 gallons water, dip plants for 15-30 minutes and plant within 24 hours). Same foliar spray instructions as Aliette.

Anthracnose Crown Rot

There is no fungicide that will control anthracnose crown rot in the greenhouse. Cull any diseased plants and surrounding trays.



Figure 8: Anthracnose in a plug production facility. Photo from article by Frank J. Louws, "Disease Management Considerations for Producing Strawberry Plug Plants."

Patent Status of Select Strawberry Varieties

Dayneutral, or Everbearing, varieties marked with an asterisk (*) are recommended for commercial fruit production in New York.

All listed short-day, or Junebearing, varieties are recommended for commercial fruit production in New York.

Type of Strawberry	Can the Variety be Propagated Commercially?	
	YES	NO
Dayneutral, Everbearing	<ul style="list-style-type: none"> ● Aromas - patent expired in 2016. Released by UC Davis (USA). ● *Everest - patent expired in 2018. Released by Edward Vinston (UK). ● Mara des bois - patent expired in 2011. Released by Jacques Marionnett (France). ● *Seascape - patent expired in 2010. Released by UC Davis. ● Tribute - no patent. Released by United States Department of Agriculture (USDA). High disease resistance to red stele, powdery mildew, verticillium wilt. ● Tristar - no patent. Released by United States Department of Agriculture (USDA). High disease resistance to red stele, powdery mildew, verticillium wilt. 	<ul style="list-style-type: none"> ● *Albion - patent expires in 2024. By UC Davis. ● Cabrillo - patent expires in 2035. By UC Davis. ● *Evie 2 - patent expires 2026. By Edward Vinston. ● *Monterey - patent expires in 2028. By UC Davis. ● Moxie - patent expires in 2040. By UC Davis. ● *Portola - patent expires in 2028. By UC Davis. ● San Andreas - patent expires in 2028. By UC Davis. ● Royal Royce - patent expires in 2039. By UC Davis. ● Valiant - patent expires in 2038. By UC Davis.
Junebearing	<ul style="list-style-type: none"> ● Camarosa - patent expired in 2013. By UC Davis. Early season. Highly susceptible to fusarium wilt crown rot. ● Darselect - patent expired in 2016. By Societe Civile Darbonne (France). Midseason. ● Darolyal - patent expired 2018. By Societe Civile Darbonne. Early season. ● Earliglow - patent expired 1995. By United States Department of Agriculture (USDA). Early season. Moderately resistant to red stele and verticillium wilt. ● Elsanta - patent expired 1995. By Plant Research International B.V. (Netherlands). Midseason. ● Flavorfest - no patent. By USDA. Midseason. Some resistance to anthracnose. ● Honeoye - patent expired in 1999. By CUAES. Early season. Sensitive to terbacil (Sinbar), susceptible to black root rot. ● Jewel - patent expired in 2005. By Cornell University Agricultural Experiment Station (CUAES). Midseason. Susceptible to many soilborne diseases. ● Ovation - no patent. By USDA. Late season. Adapted for annual plasticulture. Resistant to red stele and moderately resistant to anthracnose crown rot. ● Seneca. Patent expired in 2011. By CUAES. Midseason. ● Sparkle - patent expired in 1964. By Rutgers New Jersey Agricultural Experiment Station (NJAES). Late season. ● Sweet Charlie - patent expired in 2012. By Florida Foundation Seed Producers. Very early season. 	<ul style="list-style-type: none"> ● AC Valley Sunset - patent expires 2034. By Agriculture and Agri Food Canada. Late season. ● AC Wendy - patent expires 2025. Early season. By Agriculture and Agri Food Canada. ● Archer - patent expires 2037. By NYSAES. Midseason. Resistant to leaf spots, leaf scorch, and leaf blight. Moderately resistant to spider mites. Susceptible to powdery mildew, aphids, and thrips. ● Cabot - patent expires in May 2022. By Agriculture and Agri Food Canada. Midseason. ● Clancy - patent expires in 2024. By NYSAES. Late season. Resistant to red stele. ● Dickens - patent expires in 2039. By NYSAES. Midseason. Resistant to powdery mildew, spider mites, and red stele. ● Galletta - patent expires 2028. By North Carolina Agricultural Research Service. Early season. ● Herriot - patent expires 2033. By NYSAES. Midseason. Resistant to two spotted spider mite, leaf spot, leaf blight, and leaf scorch. Susceptible to aphids, thrips, and powdery mildew. ● L'Amour - patent expires 2024. By NYSAES. Midseason. Moderately resistant to spider mites and gray fruit mold. Susceptible to aphids, thrips. Susceptible to powdery mildew. ● Malwina - patent expires 2031. By Peter Stoppel (Germany). Late season. Resistant to verticillium wilt and red stele. <p>Any named variety will have its patent expire 20 years after it was issued in the United States.</p>

How to Propagate a Variety that is Patent-Protected

To obtain rights to propagate a patent-protected variety, contact the breeding program that released it.

UC Davis

- Patent-protected varieties as of 2022: Albion, Aromas, Cabrillo, Monterey, Portola, San Andreas, Rolls Royce, Valiant.
- Contact Isaac Rainwater at (530) 304-6266.
- Growers will pay a \$300 one-time fee for rights to propagate the variety and need to submit a report of sales twice a year. Growers will pay \$9 per every 1,000 plants sold.

Cornell / NYSAES (Cornell AgriTech)

- Patent-protected varieties as of 2022: L'Amour, Archer, Herriot, Clancy, Dickens
- Contact Jessica Stein at (607) 227-1916.
- Growers will pay \$0.02 per every plant sold. Reporting annually.

References and Further Information

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