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Boosting strawberry propagation: Techniques for conditioning mother plants

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Mother plant conditioning with artificial chilling and short-day (SD) treatment can increase stolon (runner) and daughter plant productivity in an indoor strawberry propagation system.

As controlled environment agriculture (CEA) strawberry production continues to expand, growers face persistent challenges such as securing high-quality, disease-free transplants when needed. Conventional open-field nursery plant supply chains are optimized for field growers, delivering plants seasonally (e.g., frigo bareroot plants from January to June; fresh-dug plants in autumn). However, indoor CEA operations aiming for high-value off-season markets require transplants in mid summer (July or August), when field-grown transplants are scarce. Furthermore, outdoor-grown transplants carry risks of soilborne pathogens that can be a huge risk in indoor production systems.

Figure 1. Strawberry propagation in elevated gutters in greenhouse at The Ohio State University

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Strawberry cultivars can be classified into two groups based on their photoperiodic flowering responses (obligate SD and facultative long day (LD) plants). As facultative LD-type cultivars continuously produce flower buds, flowering competes directly with stolon and daughter plant production, which is a key drawback in nursery propagation systems. Additionally, some cultivars (e.g. 'Fronteras') produce only a few runners and are difficult to propagate. This article summarizes conditioning methods specific to cultivar's photoperiodic type (SD and LD) developed at Ohio State University (Tripathi, 2026). These methods are applied to young mother plants before transplanting into a propagation system for runnering.

[General conditions for promoting runnering]

For runnering (propagation), we recommend an average daily temperature at 26 °C (28 °C day/22 °C night) and LD conditions (16 h photoperiod) to promote vegetative vigor and stolon production in strawberry plants. The warm temperatures of 26°C typically prevent flowering, increasing the propagation efficiency. During this stage, a nutrient solution that we use contains (in $mg \cdot L^{-1}$): 80 NO_3-N, 20 NH_4-N, 21.4 P, 119.3 K, 50 Ca, 12.2 Mg, 38.9 S, 4.1 Cl, 2 Fe, 0.34 B, 0.55 Mn, 0.05 Cu, 0.05 Mo, 0.33 Zn. The nitrogen forms (NO_3-N vs. NH_4-N) and their ratios are especially important to optimize for different cultivars (Yafuso and Boldt, 2025). More information is provided at the OSU Controlled Environment Berry Production Website. Routine management during the propagation stage involves removing flower buds from mother plants. The growing system for mother plants should be set up so that runners are hanging freely to ensure the production of clean plant material (Figure 1).

[Chilling treatment for LD-type cultivars]

Chilling treatment before planting in a propagation system is effective for LD-type cultivars to enhance runnering and daughter plant production. We typically treat young mother plants with >1 cm crown diameter and 3-4 leaves with cultivar-specific chilling hours in a dark humid cooler controlled at 0°C. Theoretically, temperatures in the range of -1.5 - 7°C should have the same efficacy, but we recommend 0°C in order to minimize the risk of fungal disease and chilling damage. If the cooler does not have humidity control capability, plastic film wrap over the nursery racks can be used to protect the plants from excessive water loss during the chilling. In our research trial, as example, LD-type cultivar, Albion, produced 86% and 40% more runners and daughter plants respectively when 1,050 hours of chilling were applied prior to transplanting (Figure 2). Degree of plant responses may be cultivar specific. ‘Finn’ and ‘Miss Jo’ responded positively to chilling treatment while 'Monterey' and ‘Portola ‘ increased vegetative growth (number of leaves and branch crowns) rather than immediate stolons in our trial.

Figure 2. Comparison of 'Albion' plants 12 weeks after transplanting in a greenhouse propagation system. Non-chilled plants (left) and plants exposed to 1050 hours of artificial chilling (right).

Figure 3. Comparison of ‘Fronteras' plants 12 weeks after transplanting in a greenhouse propagation system. Non-treated (left) and SD-treated plants (10 h photoperiod, 23 °C for 5 weeks) (right).

[SD treatment for SD-type cultivars]

Short-day treatment before planting in a propagation system is effective for SD-type cultivars to enhance production of branch crowns, runners, and daughter plants. This is because SD conditions initiate floral buds in the terminal meristem in obligate SD plants and induce axillary bud development (that becomes branch crowns). This process requires an optimum temperature to assure photoperiodic responses. We used a 10-h photoperiod at a 23°C average daily temperature for five weeks, to confirm advanced floral bud development in flower mapping (dissection under microscope).

Once plants develop floral buds in their meristem, they are transplanted into the propagation system and grown in the aforementioned 'general conditions' for promote runnering (LD photoperiod at 26 °C average daily temperature). In our research trial, as an example, SD-type cultivar, Fronteras produced 32% and 18% more runners and daughter plants, respectively, when a 5-week SD treatment was applied to the young mother plants (Figure 3). Short-day treatment also increased number of leaves and branch crowns of 'Fronteras' mother plants by 129% and 230 %, respectively. Similar to 'Fronteras', other SD-cultivars 'Ashley Jay', 'Rocco', 'Sensation' and 'Brilliance' showed enhanced production of runners, daughter plants as well as mother plant vigor after SD treatment.

Propagation in greenhouse and other controlled environment systems is a new approach in North America, responding to the increasing demand for high-quality plants used in high value fruit production in CEA. In addition to optimizing environments, more research-based knowledge should accumulate regarding plant health management, pest and disease control, and cultivar-specific responses.

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