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Strawberry Plug Plant Production

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Introduction

Annual hill strawberry plantings are generally established by using either fresh dug or dormant cold-stored “frigo” plants. Both fresh dug and dormant plants are relatively inexpensive. However, fresh dug plants are generally not commercially available until October when they are dug by nurseries for large California and Florida plantings. October is too late for planting in Northern Utah, where optimal planting dates are in late August to early September. Dormant plants are generally dug in the late fall or winter and cold stored for planting in the spring and early summer. However, by September most of the plants have been in cold storage for such a long period of time that plant viability is decreased (Hokanson et al., 2004).

Figure 1 Strawberry Plug Plant

Plug or tray plants (Figure 1) offer an alternative approach for obtaining strawberry starts for use in annual hill and high tunnel production systems. While plug plants are more expensive than fresh-dug or dormant plants, they typically offer the appropriate level of initial vigor for fall planting. However, commercial availability of plug plants is extremely limited. Currently there are no commercial nurseries in the Intermountain West producing plugs and shipping costs for fresh plants make ordering from distant nurseries prohibitively expensive.

Figure 2 Suspended growing system

Plug plants are relatively easy to grow and can be produced in a small greenhouse or cold frame. Dormant cold-stored mother plants are planted in the late spring/early summer to produce runner tips for propagation. If mother plants are ordered in January or

February, there are generally a large number of varieties to choose from. Most suppliers will store plants in their specialized storage facilities at no additional costs until growers are ready to plant.

Producing the runner tips

Site selection and establishment **-** The first step in producing strawberry plug plants is to produce the runner tips. Runners are produced from mother plants, which can be grown either in a greenhouse or field. Plants can be grown in the soil or in peat-filled grow bags placed on the soil or on benches. Runner production is favored by high temperatures and long days, hence outdoor production would be limited to the summertime. With either system (outdoor or greenhouse) care should be taken to prevent runners from coming in direct contact with soil. In the greenhouse, suspended growing systems (Figures 2 & 3) are used to prevent runners from coming in contact with soil. In the field, a combination of straw mulch between rows and plastic mulch within the row will prevent runner tips from contacting the soil.

In the greenhouse, the first runner tips can be expected about 8 to 10 weeks after establishing the mother plant (Durner et al., 2002). The number of runners produced per plant will increase over time and as the mother plants get bigger. However, the number of runners per mother plant and the time from establishment to runner production will vary somewhat by cultivar. In some circumstances it may be advantageous to establish plants 3 to 4 months before runners are to be harvested in order to obtain more runners per mother plant.

Greenhouses provide the ideal setting for runner production. Greenhouses can be managed to provide ideal day time temperatures (above 75˚F) and long photoperiods (about 16 hours). With supplemental heat and light, runner production can occur year round. Elevated planting beds in the greenhouse facilitate runner harvesting. PVC rain gutters filled with a soil-less potting mix provide a simple and efficient elevated production system (Figure 2). Plants are spaced 9 to 12 inches apart in the gutters. The resulting small root volume requires frequent irrigation and fertilizer application. Drainage holes should be drilled in the bottom of the gutters to prevent water saturation of the soil. Irrigation events will vary with different planting configurations; however, the principles are the same.

Figure 3 Suspended growing system with hanging runners

Plants should be watered often enough that the soil doesn't dry out and cause the plant to wilt. Each irrigation cycle will normally last until water starts dripping out the drain holes, which is an indication that the soil profile is full. During peak runner production plants usually need to be irrigated once every 3 to 4 hours, with each irrigation event lasting 3 to 4 minutes. This irrigation frequency can be easily achieved with a simple time clock and automatic valve.

Fertility **-** Runners are a form of vegetative growth and vegetative growth is encouraged by fertilizers with high nitrogen (N) content. For runner production in both field and greenhouse, the recommended method for applying fertilizer is to inject it directly into the irrigation water, and supply the irrigation through a drip system. A water soluble 20-10-20 or similar mix, has proven to work quite well, and should be injected at a concentration of approximately 100 parts per million (ppm) N at every irrigation. Flower clusters should also be removed regularly in order to maintain vegetative growth and runner formation. Maintaining adequate vegetative vigor is particularly important with day-neutral cultivars, as these will stop producing runners if adequate fertility is not maintained or if flowers are allowed to persist.

Tip harvest and propagation

Runner tips should be harvested when root initials (little white or brown pegs, Figure 4) are present on the runner tip. Root initials should not be longer than ½ inch. Additionally, at least two trifoliate leaves (first leaves that appear from the runner tip) are needed and should be between 2½ and 4 inches in length (Durner et al., 2002) (Figure 5). Runner tips where the oldest trifoliate leaf is larger or smaller will have limited success in establishment. Depending on individual needs and desire for uniformity of runner tips, tips are generally harvested every 10 to14 days. Sorting tips by size will prevent larger plug plants from crowding out the smaller ones in the tray (Durner et al., 2002; Takeda and Newell, 2006). Fifty cell plug trays with approximately 7 cubic inches per cell work best for strawberry plug production.

Figure 4 Root Pegs on Strawberry Runner Tips

Figure 5 Properly sized runner tip. Note 2 fully expanded trifoliate leaves as well as extra ½" of runner that is used to anchor the plant (arrow).

Runners should be removed such that the trifoliate leaves are not damaged and approximately ½ inch of the runner is left to be used for an anchor when planting tips into plug trays (Figure 5) (Durner et al., 2002; Takeda and Newell, 2006). Runner tips should be planted immediately after harvest. In commercial operations, runners are usually planted or cooled to 32˚F within 45 minutes. If runner tip storage is necessary, tips should be stored at 32 to 34˚F at 95 percent humidity for no more than 1 week (Durner et al., 2002). Tips should be planted such that the root pegs and anchor are just below the soil surface, with the leaves and as much of the developing crown as possible remaining above the soil surface (Figure 6). The soil should then be pressed lightly around the runner tips to hold the plant in place.

Figure 6 Anchored Runner Tips

Table 1 Approximate runner tip production timeline for a suspended growing system in a greenhouse

Approximate Yields for June Bearing Varieties 'Chandler' and 'Allstar'

Weeks after planting mother plants	8	10	12	14	16	18	20	22
Runner Tips per mother plant	4	5	6	7	8	9		
Finished plug plants per mother plant			4	5	6	7	8	9

After the runner tips have been planted, they need to be protected from the wind, and leaves need to remain moist until the plant can establish a new root system. Maintaining moisture on the leaf is usually accomplished with a misting system. Misting the plants intermittently for 7 to 12 days is generally sufficient. For the first 3 to 4 days, misting should be more frequent and for shorter periods of time (every 5 minutes for about 10 seconds). After 3 to 4 days, the misting time may be increased to 30 seconds every 12 minutes. As time goes by, the misting interval should remain at about 12 minutes, and misting time should gradually be decreased as the plant roots become more established. Protecting plants from wind, heat, and direct sunlight will provide the best results. Shaded greenhouses or shade houses with protection from wind provide the best environment. After the misting regime is finished, plants should be allowed to harden off in the greenhouse for 1 to 2 weeks prior to their establishment in the field or high tunnel (Durner et al., 2002). Generally, a runner tip will produce a well-rooted plug in about 4 weeks.

An alternative to misting is to place wet planted flats in a sealed, slightly perforated white plastic bag, such as a garbage bag (Durner et al., 2002). The white plastic will block some of the radiant heat, and maintain high humidity. Once runner tips have established root systems they can be moved out on to an open greenhouse bench for hardening off as previously described. Although this is a relatively inexpensive alternative to misting, this system is not as consistent and is recommended only when a relatively few number of strawberry plugs are needed.

Case Study – High tunnels have been shown to advance June bearing strawberries yields by approximately 4 weeks. Plug plants are generally used to establish high tunnel strawberry plantings in the fall. The optimal planting date for Chandler plug plants in high tunnels is about 7 September. Approximately 600 plug plants will be needed to fill a 14’ x 96’ high tunnel. Depending on available space and management styles, mother plants should be established 8 to 18 weeks prior 7 September. Table 1 gives an approximate timeline and runner tip yields for mother plants throughout the production season. If mother plants are established on 15 June (12 weeks prior to the 7 September field planting), approximately 150 (500 plants / 4 tips per mother plant = 150) mother plants will be required to produce 600 runner tips. However, if mother plants are planted on 4 May (18 weeks prior to the 7 September field planting date), only about 86 (600/7=86) mother plants will be required to produce the desired 600 runner tips.

Pests

The best way to control pests is to keep them out. Sanitation should be a number one priority. The greenhouse or shade structure should be kept clear of unhealthy plant material, and workers should use caution to keep mud and other potential sources of inoculum out (Louws, 2004). Preventing runners from contacting the soil will help reduce the risk of fungal diseases. Powdery Mildew is sometimes a problem for mother plants grown in a greenhouse environment. Periodic sulfur sprays such as Thionex a will provide adequate control. The high humidity rooting environment is prone to fungal rots. Caution should be used to prevent excessive misting of runner tips (Louws, 2004). Periodic fungicide applications may also be needed to prevent plant losses on the misting bench. Captan works well once the plugs are rooted, but should not be used in

the early rooting phase as it has been shown to inhibit root formation (Louws, 2004). A sulfur spray such as Thionex can also be used at a rate of 1 to 1.5 oz per gallon. Aphids and thrips can also be a problem in greenhouses. Both aphids and thrips can be controlled with insecticidal soap.

Mother plant availability – Some of the newest strawberry cultivars are protected by plant patent. These cultivars cannot be propagated without permission of the patent holder, even for small acreage use. Propagating patented cultivars without permission violates the law. The nursery that supplies your mother plants will know the patent status of the cultivar. Always start with clean mother plants that are certified as disease- and virus-free.

Summary

Strawberry plug plants are an excellent method for establishing fall strawberry plantings either in the field or in high tunnels. Plug plants provide appropriate levels of vegetative vigor for successful spring harvests. One of the drawbacks with plug plants is that they are not commercially available at the correct time for fall planting in northern Utah. However, with some attention to detail, plug plants can be readily produced in a local or on site greenhouse or shade structure.

References

Durner, E.F., E.B. Poling, and J.L. Maas. 2002. Recent Advances in Strawberry Plug Transplant Technology. HortTechnology. 12: 545-550.

Hokanson, S.C., F. Takeda, J.M. Enns, and B.L. Black. 2004. Influence of Plant Storage Duration on Strawberry Runner Tip Viability and Field Performance. HortScience. 39: 1596-1600.

Louws, F. 2004. Disease Management Considerations for Producing Strawberry Plug Plants.

Takeda, F.and M. Newell. 2006. Effects of runner tip size and plugging date on fall flowering in short-day strawberry (Fragaria x ananassa Duch.) cultivars [electronic resource]. International Journal of Fruit Science. 6,: 103-117.

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