Control Your Larger Liners, Shorter Crop Time

The Young Plant Research Center studied time saved on production of finished plants using a larger liner.

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INCREASING fuel costs have focused attention on improved production efficiency. For growers of finished plants, one option is to purchase larger or pre-finished liners and seedling plugs for transplant into pots and baskets. The benefit of a large or pre-finished liner is shorter time after transplant.

Liners finish quickly after transplant when they already have a large shoot and root size, are developmentally mature (grown for more weeks

Finish Date

Liner Size	Transplant Date		
	2-March	16-March	30-March
20mm (144-count)	7-April	15-April	24-April
23mm (125-count)	5-April	13-April	23-April
25mm (105-count)	6-April	10-April	30-April
30mm (72-count)	5-April	5-April	23-April
40mm (50-count)	5-April	4-April	11-April
50mm (32-count)	4-April	3-April	10-April

Days From Transplanting Rooted Liner To Finished 4.5-Inch Pot

Liner Size	Transplant Date		
	2-March	16-March	30-March
20mm (144-count)	36	31	25
23mm (125-count)	34	29	25
25mm (105-count)	35	26	32
30mm (72-count)	35	20	24
40mm (50-count)	34	19	12
50mm (32-count)	33	18	11

Days From Sticking Unrooted Cutting (Feb. 2) To Finished 4.5-Inch Pot

Liner Size	Transplant Date		
	2-March	16-March	30-March
20mm (144-count)	64	73	81
23mm (125-count)	62	71	81
25mm (105-count)	63	68	88
30mm (72-count)	63	62	80
40mm (50-count)	62	61	68
50mm (32-count)	61	60	67

Table 1. Effect of liner size and age on finished time in 4.5-inch pots. All unrooted cuttings were stuck into liners on the same day (Feb. 2), and then were transplanted on three dates (March 2, 16 or 30). The colored cells indicate normal "transplantable" crop age for different liner sizes (4 weeks for 20 to 23-mm liners, at least 6 weeks for 25 to 40-mm liners, and at least 7 weeks for 50-mm liners).

Energy Costs

during the liner stage), and when early flowering of long day crops, such as petunia or calibrachoa, has been initiated using supplemental or daylength (photoperiod) lighting.

Rapid finishing time improves space use efficiency by allowing an additional crop turn (and extra revenue). Alternatively, heat savings result from transplanting later and opening up greenhouses during the warm months of spring. Our research aimed to measure how much time would be saved for finished plant production when transplanting large or small liners.

Research Methods

Calibrachoa 'Superbells Red' unrooted cuttings provided by InnovaPlant Costa Rica were stuck on Feb. 2, 2006 into Ellepot liner cells ranging from 20 to 80 mm in diameter (144- to 10-count trays). Throughout the liner and finished plant stages, calibrachoa were grown at 72°F day/67°F night air temperature. Photoperiod was 16h and 9.4 moles of PAR light per square meter per day were provided from combined sunlight and supplemental lighting from high-pressure sodium lamps at 575 foot candles in a glass greenhouse at the University of New Hampshire, Durham, N.H. Liners were sprayed with Sumagic at 5 ppm three and five weeks after transplant (Feb. 23 and March 6).

When liners were four, six or eight weeks old (March 2, March 16 or March 30), we transplanted these cuttings into 4.5-inch pots or 12-inch hanging baskets, continuing with the same climate settings. One liner was transplanted per 4.5-inch pot, using 20- to 50-mm diameter (144- to 32-count) liners. Each 12-inch hanging basket contained five liners, using 20- to 80-mm (144- to 10-count) liners.

We then measured how long it took to produce a "finished" 4.5-inch pot, defined as having at least five open blooms and foliage covering at least 90 percent of the media surface. A "finished" 12-inch basket had at least eight stems overlapping by more than 8 inches (20 cm) from the edge of the pot and at least 50 open blooms.

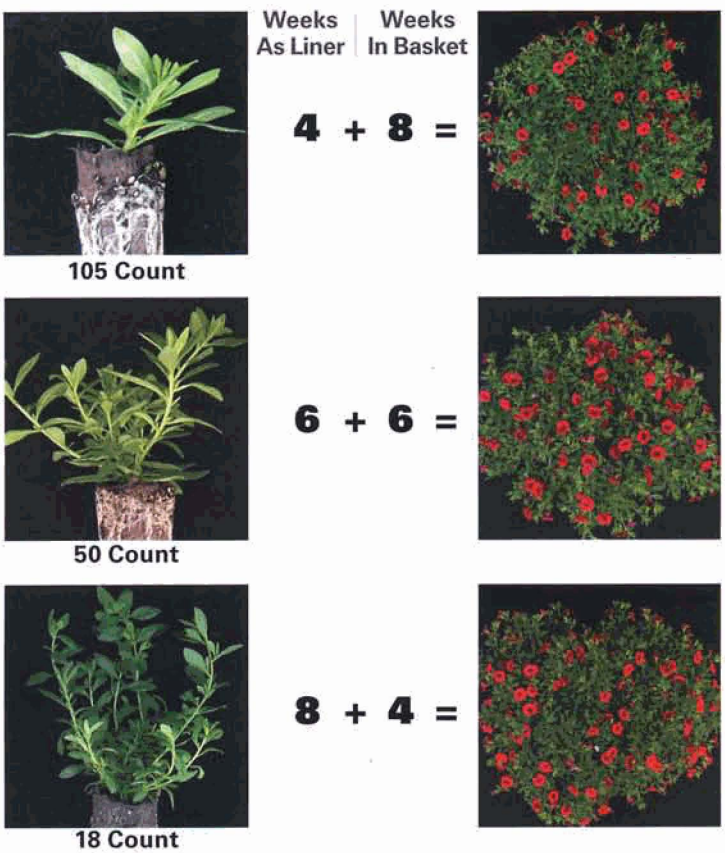

Figure 1. Three ways to achieve a total crop time of 12 weeks from sticking unrooted cuttings to producing a finished 12-inch hanging basket (5 liners/basket). The photos of hanging baskets at right was taken 12 weeks after sticking unrooted cuttings. The three liner sizes [25-mm (105-count), 40-mm (50-count), and 70-mm (18-count)] are shown at left, at the stage when they were transplanted into hanging baskets.

Results: The Finish Line

All liners, regardless of size, finished in 4.5-inch pots about the same if they are planted early (four weeks

old), because the root zone in the liner cell was not limiting to growth. When liners were planted on March 2, four weeks after planting, the finish date in 4.5-inch pots (Table 1) was similar across liner sizes.

At six to eight weeks, plants in large liners finished up to two weeks earlier than small liners because of root-zone restrictions in small liners. When liners were transplanted at six or eight weeks of age, the finish date in 4.5-inch pots occurred earlier as liner size increased (Table 1). By six to eight weeks of liner age, root growth in a 20- to 25-mm liner limited shoot growth during the liner stage.

Small liners also dry down more quickly than large liners, resulting in air-pruning of roots. In contrast, cuttings grown in large cells have more area for root growth and are usually grown for six to eight weeks so that roots, shoots and flower buds are well developed at time of transplant.

The results demonstrate that it would be better to hold plants in large liners compared with small liners to avoid root-bound liners with delayed finishing. If producing your own large liners, it also means excessive shoot growth could be a problem during liner production and growth retardants or other height control methods are needed.

Large (30 to 50 mm) liners that were six weeks old, transplanted into 4.5-inch pots on March 16, finished around the same date as four-week-old small (20- to 25-mm) liners planted two weeks earlier on March 2.

The shortest finish time from transplant to finished pot (11-12 days) occurred with 40- to 50-mm liners planted at eight weeks of age (Table 1). The minimum time from sticking to finished pot occurred with any liner size planted at four weeks, or with 30- to 50-mm liners planted at six weeks.

We saw similar trends with 12-inch hanging baskets compared with our results with 4.5-inch pots. The same finished date in a hanging basket could be achieved with any liner size planted early (four weeks old) or using a large liner planted late (six to eight weeks old). For example, an eight-week-old,

50-mm liner finished in the pot by April 19, 20 days after transplant. In contrast, a six-week-old, 25-mm liner finished in the pot by April 15, 44 days after transplant.

In Conclusion

Similar final finished quality could be achieved in different ways (Figure 1), using either a small liner that requires more time in the finished container or by using a large liner that finishes rapidly. Time in the large container can be substituted with extra time in the liner stage, especially if large liners are used that do not excessively limit shoot growth. The most efficient use of space occurs by transplanting a large, pre-finished liner at six to eight weeks of age, because there is low space requirement per cutting during the liner stage.

In the October issue of *Greenhouse Grower*, we follow up this research with a financial analysis of the economic costs and benefits of large and small liners. **GG**

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