

In closing, good cultural practices are essential to successful seed propagation. The recent invention of the HAV fans in the propagation house have greatly reduced disease pressure. This is one good example of many simple ideas that can be utilized in the “art” of seed propagation.

Status of the Commercial Micropropagation Industry[©]

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In 1996, a comprehensive survey was made of U.S. commercial micropropagation laboratories to determine the extent of the industry (Zimmerman, 1996). Industry interest in the results of this survey prompted us to update the information with a new survey, which was started in 2000 and completed in 2001. As in the previous survey, data were collected by doing telephone interviews with the owner or manager of each laboratory.

To maintain confidentiality of production figures, we grouped labs into 5 areas as follows: (1) Florida, (2) California and Hawaii, (3) Oregon and Washington, (4) Eastern U.S. (all states east of the Mississippi River except Florida) and (5) West-Central U.S. (all states west of the Mississippi River except those in (3) and (4) above). Similarly, we grouped crops produced into the following categories: (a) foliage plants, (b) greenhouse flowers and orchids, (c) herbaceous perennials and annuals, (d) trees and shrubs, (e) vegetables, (f) fruits and (g) miscellaneous crops.

A total of 93 commercial micropropagation laboratories are currently active in 28 states, down from 111 in 1996, and most still are located near important production areas of the horticultural industries they serve. Florida and California continue to have the most labs (13 each). Other states leading in numbers of labs are Colorado (7), Connecticut (7), Montana (5), Oregon (5) and Washington (7). The remaining states have four or fewer labs, with 13 states having only one lab. Of the total, 79 labs were active in both surveys, 32 from the earlier survey are no longer active and 14 new ones have opened.

Laboratory production varied from a few thousand units to more than 10 million units per year. We categorized the laboratories (in units per year) as small (<500,000), medium (500,000-2,500,000), large (2,500,000-6,000,000) and very large (>6,000,000). Small labs totaled 54 with 19 producing fewer than 50,000 units per year. The remaining labs were 27 medium, 5 large, and 7 very large. Very large labs account for 58% of the total production, large labs for 14%, medium labs for 23%, and small labs for only 6%.

Total production for 2000 was 130,613,000 units (shoots, plants, bulbs, mini-tubers), up from 120,862,000 units in 1996. Foliage plants (ferns, *Spathiphyllum*, *Syngonium*, *Dieffenbachia*, *Ficus*, *Calathea*, *Philodendron* and many other genera) are the largest category at 63,102,000 plants, down about 1% from 1996. Trees and shrubs (including ericaceous plants) were the next largest category with production of 21,550,000 plants, up 41% from 1996. Ericaceous species (azalea, *Rhododendron*, *Kalmia*, *Pieris*, *Leucothoe*) now account for 30% of the total, shrubs (e.g., *Nandina*, *Syringa*, *Fothergilla*, *Hydrangea*, *Photinia*, *Viburnum*, and many other genera) are

¹Retired

49% of the total and shade and ornamental trees (*Acer*, *Betula*, *Magnolia*, *Malus*, *Prunus*, *Ulmus*, and other genera) are 21% of the total.

Production of herbaceous perennials (and a few annuals) increased 36% from 1996 to 12,821,000 plants with *Hosta* and *Hemerocallis* the major ones but many other genera are micropropagated including *Stokesia*, *Gypsophila*, *Heuchera*, *Leucanthemum*, and *Rudbeckia*. Greenhouse flower crops and orchid plant production increased less than 1% to 11,395,000 plants. Increases in orchid production to 42% of the total more than offset reduced output of other crops. In vitro orchid seed germination was not surveyed, but is done on a larger scale than micropropagation. *Gerbera* production is roughly equal to that of orchids with *Anthurium* and bromeliads also important crops.

Vegetable crop production of 10,919,000 units represents a decrease of 15% since 1996, primarily because of decreased demand for potato minitubers. Most producers view this decline as temporary. Other crops produced include asparagus, garlic, rhubarb, and sweet potato. Fruit crop production grew 57% to 5,852,000 plants, mainly blueberry and raspberry with an increased number of strawberry mother plants for runner production. Fruit tree rootstock production remains limited. Miscellaneous crops, which include a wide assortment of ornamental crops, tropical fruits and vegetables, and specialty crops such as mints, had a production increase of 9% to 4,974,000 units. Production of bulbs, corms and tubers, including *Lilium* and *Gladiolus*, accounts for at least a quarter of this category, an increased proportion since 1996. The demand for spearmint and peppermint is currently down, but about 500,000 plants were produced. Other crops include banana for home garden use and sugar cane.

Florida continues to produce the most plants, 66,085,000, up 15% from 1996, and these are in all crop categories. Foliage plant production was up 4% from 1996 to 49,900,000 of the total. Greenhouse flower crops and orchids, the next largest category, accounted for 6,005,000 plants, up 16% from 1996. Herbaceous perennial production was 4,365,000, up more than 320%, and miscellaneous crop production was 3,105,000, up 218%. The remaining production was primarily in trees and shrubs with relatively little increase from 1996.

California and Hawaii, with production of 23,568,000 units from 16 laboratories, was the second leading producing area. However, production was down by 11.5% from 1996. The main crop area continued to be foliage plants at 12,160,000 plants, down 16%. Greenhouse flowers and orchids accounted for 5,035,000 plants, down nearly 6%, whereas production of trees and shrubs was 2,845,000, up 34%. Production of herbaceous perennials and annuals was 1,820,000 plants, up almost 190%, but production of the remaining crop groups was 1,708,000 units, down 135%.

Oregon and Washington produced 20,550,000 units from 12 laboratories, up nearly 44% from 1996. No foliage plants or greenhouse flowers and orchids were produced. The main crops are trees and shrubs (including ericaceous plants) at 12,275,000 plants, up 56% from 1996 and fruit crops at 4,225,000 plants, up 114%. Herbaceous perennials and annuals totaled 2,760,000 plants, up 33%, but vegetable and miscellaneous crops dipped 46% to 1,290,000 units.

Production in the Eastern U.S. declined to 10,504,000 units from 31 laboratories, down nearly 16% from 1996. However, this is the only region with an increase in the number of labs, up from 30 in the previous survey. Vegetable crops, primarily potatoes, are the largest category with production of 3,575,000 units, down 3% since

1996. Herbaceous perennial plant production was 2,346,000, down 47%, whereas trees and shrubs at 1,910,000 plants was up 33%. All other crop groups combined were down 9% to 2,673,000 plants.

West-Central U.S. production increased 1% to 9,906,000 units from 21 laboratories. Vegetable crop production was 5,666,000 units, primarily potatoes, up 17% from 1996, while trees and shrubs totaled 2,000,000, up 43%. Herbaceous perennials, fruit, and miscellaneous crops accounted for the remaining 2,240,000 plants, down 27% mainly as a result of lower production of some specialty crops such as mints. No foliage plants, greenhouse flower crops, or orchids were produced in this region.

Although a number of changes in the industry occurred in the 4.5 years between surveys, the core industry remains strong with production continuing to increase slowly. The industry trend is for further concentration of production in the largest laboratories. A number of labs have production increases planned and several additional labs will move into the very-large category in the next several years. It may be that foliage plant production in U.S. laboratories has now reached a plateau and further demand from growers for micropropagated plants will be met from offshore labs, which now account for perhaps 20,000,000 plants per year or more. It will be interesting to see whether or not production of micropropagated trees and shrubs, herbaceous perennials, and orchids continue to increase as they have done since 1996.

LITERATURE CITED

Zimmerman, R.H. 1996. Commercial micropropagation laboratories in the United States. *Comb. Proc. Intl. Plant Prop. Soc.* 46:623-625.