sold or overwintered for spring sales. The size of the plant's leaves and corms varies greatly. Currently demand outweighs supply and for us production cost are at or above the market price. In the spring of 1998 we will move all of the plants in production to a fabric-lined swale with a compost-based planting medium. It is our hope that this will give maximum production and ease of harvest of the corms.

*Typha latifolia* demand varies widely from season to season. In order to maintain a cost-effective production method we are seeding into plugs that help to slow the aggressive growth of this plant and enable us to have a stable supply. After 1 full year any remaining plants can be composted before they become too large.

*Peltandra virginica* has a very deep root system. In order to be able to harvest it we are seeding into plug trays and growing on for one season. The following year we will plant into a fabric-lined swale with a compost medium. It is our hope this will allow us to produce a healthy, cost-effective plant.

## CONCLUSION

The line of native herbaceous wetland plants we currently produce is a low-end product. In order for it to be successful for us it is imperative that we keep cost low. Our swales enable us to increase quantities of plants for several years while waiting for the right opportunity to market the crop. This helps us weather the plant of the month syndrome that we all are subject to. Each year several new species are added in an effort to adapt to the market needs and expand our product line.

# Micropropagation of Native Plants or Multiplying Some of Mother Nature's Really Good Stuff

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What do I consider to be native plants? By my definition, and I will grant you it is very narrow by design, native plants are herbaceous perennials that are indigenous to the northeastern United States. How do I select the native plants I work with? I make plant lists based on talking with people who propagate, grow, and sell plants for a living. I also talk with people who love plants and gardening in general and have a special interest/knowledge in native plants. I compare the two lists and see what plants come up as "double" hits and then I research these plants. There also has to be some "chemistry" between the plant and me for me to work with it. There has to be a need for the plant to be micropropagated, and there must be a problem using conventional propagation techniques. Chemistry takes the form of leaf color or shape, unique seasonal interest, flower size, shape, or color. Part of the chemistry is the ease with which the plant can be reestablished in urban settings, if the plant has very narrow, specific environmental needs, then there is a good chance I will not work with it.

Micropropagation is propagation on a very small scale. Conventional propagators obtain cuttings and divisions from stock plants grown and maintained outdoors. Micropropagation relies on stock plants too; however, the stock plants are diminutive and maintained in glass or plastic containers under sterile conditions in a

laboratory. Instead of going to the field to collect cuttings or divisions, the propagator goes to a laboratory and, with the aid of some low-tech equipment, collects microcuttings or microdivisions. These micropropagules are rooted using conventional techniques and acclimated to a post-laboratory environment. Rooting can take place in vitro or ex vitro. It is advantageous to root ex vitro due to the economics of 1 less month of laboratory maintenance and due to the fact that the acclimation process starts sooner; however, it is not economical, due to plant loss, to root some plants ex vitro, i.e., *Aconitum uncinatum*.

Micropropagation is a relatively young industry having been commercially entrenched only 15 to 20 years. During this time period, there have been many micropropagation successes. Most foliage plants, many orchids, some fruits, and ornamentals (e.g., azaleas) presently available on the market are derived from commercial micropropagation. In this same vein, there have been some less-than-successful micropropagation enterprises. In most cases, micropropagation is categorized as less-than-successful if it is less economical compared to conventional propagation. Micropropagation is not for every plant.

For micropropagation to be successful, it must meet a number of criteria. The bottom line is that the protocols developed must be economical. To be economical, the plants produced must be clonally identical and exhibit uniform growth habits. Micropropagation must produce plants quicker than if using conventional protocols, quicker to the point that enough plants are produced to make them available for sale at a price that people are willing to pay. Plants produced need to be pathogen free.

For simplicity, I like to divide micropropagation into two stages, a laboratory stage and a greenhouse/field stage. In the laboratory stage, plants are proliferated (axillary shoots are produced) and, in some cases, the microcuttings are rooted. In the greenhouse/field stage, microcuttings are rooted and acclimated. Each of these stages is critical to successful micropropagation. Each step needs to have a high success rate. There needs to be a relatively large number of microcuttings produced that are capable of rooting and acclimating at a high percentage. Native plants are no different than exotics, if there is one difficult step in the process it can be the economical determinant. Some plants are very difficult to establish in vitro, some plants are very slow proliferators while with others the real problem step is root initiation. Some plants need a cold treatment, during or after rooting, prior to moving to the greenhouse/field environment. Proliferation, rooting, and acclimation protocols need to be determined for each plant species and, in some cases, for each cultivar.

Many times plants that are easy to propagate in nature are easy to work with in vitro; however, usually plants that are easy to propagate conventionally are not chosen for in vitro research. Exceptions to this would be newly developed/discovered plants that have a high potential market; micropropagation makes these plants available en masse sooner. It should be no surprise then that many of the plants that micropropagation could really help are difficult to propagate conventionally. It is the hard to propagate plants, for whatever reason: poor or slow seed germination, few divisions per growing season, that frequently get passed on to the tissue culturists. Culturing a plant in vitro does not necessarily transform it from difficult to propagate into easy to propagate. Right? Tissue culturists are many times starting out behind the eight ball.

Just as each plant is a different entity so is each person who works in the field of micropropagation. What one person can successfully micropropagate does not necessarily translate universally to every other person. I have had very poor success with some plants, e.g., *Dodecatheon pulchellum* (syn. *D. amethystinum*). There are plants that I have worked with for years and have not been able to clone using micropropagation protocols.

I categorize the plants I have worked with as being easy, moderate, challenging, or impossible (for me) to micropropagate. Examples of plants I consider easy to micropropagate include *Asarum* spp., *Lilium canadense*, *Heuchera americana*, native ferns, *Sanguinaria canadensis*, *Sarracenia* spp., *Tiarella cordifolia*, *Trillium grandiflorum*, and *Viola pedata*. I consider these plants to be easy because at no stage in the micropropagation process is there a difficulty. They proliferate freely in vitro, microcuttings root with ease, and the resulting plants require little acclimation time. I would rate *Pachysandra procumbens* as being moderately easy due solely to the time it takes for microcuttings to root and acclimate. It takes about 6 weeks for microcuttings of *P. procumbens* to root and then another 8 weeks for the first new, fully acclimated shoot to appear. During this 14 week time frame, the microcutting must not be neglected. More challenging plants include *Spigelia marilandica* and *A. uncinatum*. These plants are easy to proliferate but have special needs during the rooting and acclimation stages. *Spigelia marilandica* has photoperiod requirements while *A. uncinatum* requires a chilling period after in vitro rooting. Plants that have proved impossible for me to micropropagate include *D. pulchellum* and *Galax urceolata*. I was unable to root microcuttings of these two plants. But what is impossible for me is easy for another, and there are plenty of wonderful native herbaceous perennials out there that are, as yet, undiscovered in any commercial sense.