MAINTENANCE, ENERGY CONCERNS INCREASE APPLIED TREE RESEARCH

By Douglas J. Chapman, Horticulturist, Dow Gardens, Midland, MI

Applied tree research is a particularly fertile area today. There exists a need for greater plant diversity (tree and shrub) in the landscape.

This could be accomplished by introducing new trees and shrubs, be they native or imported from such areas as the People's Republic of China and the development and introduction of superior cultivars. Regional cultivar introductions propagated by asexual methods, cuttage and/or tissue culture, grown under accelerated growth, should lead to more efficient production. A high degree of emphasis must be placed on stimulating local nurseries to introduce and propagate their own adapted cultivars of trees and shrubs. Traditional forestry has a similar need, yet diversity means developing a practical production technique for seedlings—determining what plants are photoperiodic responsive and breeding programs which will result in plants developed specifically for biomass, disease tolerance, and lastly, clones or cultivars for specific uses or grown under unique conditions, e.g. Sugar Maple and hickory for wet sites.

When considering landscape trees, the selection, production, and introduction of regional clones or cultivars is paramount to the development of the nursery industry. One in Europe would not expect trees to grow everywhere in the European landscape. We in this country should not expect plants developed and introduced in the Great Lakes to thrive throughout the United States. For example, the native range of *Acer rubrum* is from Michigan's Upper Pennisula to Florida. Yet Florida's *Acer rubrum* would not be hardy in the Great Lakes region and a Northern Michigan Red Maple would collapse in Florida. With continued efforts towards asexual production by cuttage or tissue culture or combinations of the two, the industry can expand the introduction of regional cultivars. High on the list of plants to propagate should be selected cultivars chosen for their environmental adaption, e.g. drought tolerance, disease resistance, and desirable aesthetic qualities (outstanding fall color, flower color, or habit of growth). In the development of new selections, one may want an *Acer rubrum* with scarlet or yellow fall color, light or dark bark, and eco-types for droughty as well as poorly drained soils. These selections will be developed and grown in areas where they are native, e.g. the Great Lakes States, the Northeast, or the Southeast.

Propagating these clones by cuttage or tissue culture will mean that the resulting tree will continue to express phenotypically all of the desirable characteristics for which it was originally chosen with no problem of graft incompatibility or incongeniality. Further, since trees native to northern latitudes are more photoperiodic responsive, we can further reduce the time needed for production by growing them under continuous light, thus the tree remains vegetative and growth continues, accelerating the production schedule of *Acer rubrum* liners from three years to one full growing season.

Another method of propagation which could play a major role in the development of regional cultivars is tissue culture. Where applicable, it can result in the propagation of a large number of individuals in a short period of time. Thus, providing the nursery industry with stock plants for additional propagation. Sink at Michigan State University has been a leader with the development of tissue culture for shade trees, specifically *Acer rubrum* cultivars. His techniques, combined with propagation by cuttage, could speed up the production cycle, making regional cultivars a reality within five to six years. Meyer at the University of Illinois, working with tissue culture, has been successful in the propagation of iris *Hosta Lily*, and rhododendron (Rhododendron c. '*Nova Zembla*').

Why consider asexual propagation of trees and the development of regional cultivars? During the past eight to ten years, a disturbing phenomena has been observed. With increasing frequency, grafts of Red Maple (*Acer rubrum* cultivars 'October Glory,' 'Red Sunset,' and 'Schlesinger'); White Ash (*Fraxinus americana* 'Autumn Purple' and 'Rosehill'); European Ash (*Fraxinus excelsior* 'Hessei'); Pin Oak (*Quercus palustris* 'Soveriegn'); and London Planetree (*X Platanus acerifolia* 'Bloodgood') are showing graft incompatibility or incongeniality. Researchers, including Davidson at Michigan State University, feel this incongeniality is a provenance situation, that is the root system on which producers are trying to graft these hardy cultivars is adapted to the Pacific Northwest and not the Great Lakes States or other areas.

During the early development of these cultivars, incompatibility was not a problem because 90% of the trees were propagated and grafted on native seedlings by large local nurseries, e.g. Coles, and production was not concentrated in a small geographic area. However, with the advent of Lady Bird Johnson's Beautification of America campaign, rapid propagation and production of shade trees became paramount. At this point, production shifted to the Pacific Northwest where producers could more rapidly produce a

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straight liner. Since that time, incompatibility of scion and understock have become a problem, resulting in many landscape trees collapsing either soon after propagation or after reaching 3 to 4 inches in trunk diameter. Propagation by cuttage is one way to circumvent this problem.

Why haven't shade tree cultivars been propagated by cuttage in the past? The answer is tradition. Pomologists, specifically European, have grafted or budded apple trees for over 200 years. This tradition then inhibited change and/or research in new propagation techniques.

Recently Dow Gardens initiated research with the goal of propagating shade trees by cuttage. Working with several maple species (*Acer campestre, A. ginnala, A. platanoides, A. rubrum, A. saccharum nigrum*) two linden cultivars (*Tilia cordata* 'Greenspire' and *Tilia americana*), and several crab apple cultivars (*Malus*), we achieved 70 to 98% success.

We found that cuttings of *Acer rubrum* should be taken from spring wood that is no longer actively elongating (late May through mid-June). Usually these plants have completed their rapid growth (elongation) and lateral meristem or cambium seems more active, resulting in better rooting. Cuttings taken earlier in the season show a high tendency toward rotting. The cuttings are treated with Hormodin #3, placed in intermittent mist, and usually root within three to four weeks. Hedge Maple (*Acer campestre*), Amur Maple (*A. ginnala*), and Norway Maple (*A. platanoides*), lindens *Tilia c.* 'Greenspire' and *Tilia a.* 'Redmond,' and 'Snowdrift' Crab Apple were found to root successfully when taken during mid-July through early August. Coincidentally, this is a period of high cambial or meristem activity as reported by Hart and, again, Shigo. These rooted cuttings can be placed in cold storage or grown on and planted out the following spring. The most efficient production techniques must be worked out for each area.

Forestry has a similar problem. They must be researching ways to speed up their production cycle without increasing energy needs (pesticide application). This speed up in production cycle may be accomplished by accelerated growth of seedlings. Why seedlings? Seedlings remain particularly important as they provide genetic variation needed so that insect and disease control is not required or run rampant. Extensive disease and insect control on a scale required in traditional forestry would make the growing of trees almost prohibitory, be it for biomass, pulp, or lumber. New production techniques, resulting in 12 to 18 inch trees at the end of the first growing season, would greatly alleviate problems of the early years in establishment.

For northern areas, work by Hanover, Michigan State University, clearly has shown that accelerated growth concept can speed the production cycle. This accelerated growth is nothing more than using the inherent photoperiodic response (low energy). Plants are put under continuous light shortly after the seedlings germinate during the growing season, keeping them vegetative, i.e. in a state of almost constant cell division and elongation. Thus, we have seedlings 18 to 20 inches in height and ready for rapid establishment. The seedlings can be from collected sources which show genetic resistance or special environmental adaption needed for specific production goals. This combined with the abovementioned asexual propagation for urban trees could improve the quality while reducing maintenance costs of tomorrow's landscapes. One should expect to see only disease resistant crab apples, sycamores resistant to anthracnose, Shagbark Hickories tolerant of urban soil; further, readily-available plants which are easy to transplant yet are competitive with turf, e.g. Bur Oak and Shagbark Hickory. Some of today's dreams and needs will be available for tomorrow's landscapes because of this type of applied plant physiology or horticultural research. **WTT**