Hydrangela macrophylla	hydrangea
Rhododendrons	azaleas
Morus alba	mulberry
Ficus spp	ficus
Simondsia chinensis	jojoba
Citrus	
Panax gingseng	gingseng
Araucaria cunninghamii	hoop pine
Cryptomeria japonica	japanese cedar
Picea excelsa	spruce
Pseudotsuga menziesii	douglas fir
Sequoia sempervirens	redwood
Thuja plicata	western red cedar
Tsuga heterophyla	hemlock
Pinus spp	pine

PECAN TISSUE CULTURE

Stem cuttings from pecan seedlings are presently being cultured in modified WPM liquid media. Shoot development has been very uniform and some cultures with multiple shoots have been obtained.

Acknowledgement: The author wishes to acknowledge information obtained through research studies by Ms Karen Ringhoffer and Mr Keith Hansen

DEVELOPMENTS IN DIRECT ROOTING

SIDNEY B MEADOWS
Flowerwood Nurseries
Mobile, Alabama 36600

For generations nurserymen have rooted cuttings in beds. When the cuttings rooted, they were uprooted and planted in soil beds. When these plants were large enough to transplant they were uprooted again. All of this uprooting put growth on hold and took time and effort.

In the last decade direct rooting has become standard procedure with many nurseries throughout the century. No particular nursery or nurseryman could claim the distinction of originating the system because a considerable number of nurserymen embraced the concept at the same time. Evidently the time for this significant development had arrived and many saw fit to give it a try. There is no particular time when one could say direct rooting was born because there have been isolated instances of the practice going on for some time. In a meaningful way the system was basically born during the seventies.

From the beginning there was a considerable saving of

time and labor. There have been many refinements and developments since 1970 that have contributed greatly to the merit of the system

Essentially direct rooting is the process of taking a cutting and sticking it directly in a pot filled with growing medium. The cutting roots in the growing medium and continues to grow without potting or interruption until the transplant stage.

The area expanse inherent in this system always presented a staggering problem of humidity control. Generally speaking the poly houses provide excellent humidity and temperature control in the cool fall and winter months. During the warmer spring and summer weather intermittent mist gives excellent humidity control and prevents temperature control from being a serious problem.

The first big plus for the system is the rooting percentage. It is usually excellent. Cuttings are not only quick to root but quick to get off to growing. The system is highly versatile because we can stick a large cutting and have a full-size liner as soon as it becomes rooted, or we can stick multiple cuttings in a pot and arrive at the full-blown liner stage in short order.

For years it was felt that top dressing with fertilizer when the rooting process started was sufficient. In recent years mixing 6 pounds Osmocote* 18-6-12 and 1 pound of Micromax* per cu yd of the soil mix has been very rewarding. The cuttings appear to benefit from nutrition even before roots begin to form. This makes the cutting stronger and certainly makes for a quicker take off.

At first cuttings were cut, stripped, dipped in a fungicide, dipped in a rooting powder and then stuck in the pot. Today, cuttings in most cases are cut, dipped in a fungicide and stuck without ever passing through the stripping shed. There is little or no stripping. What little stripping is necessary is performed during the cutting operation.

Cuttings of most cultivars root readily without the application of rooting compounds. If a particular one proves to be difficult, then experimentation with hormone preparations are in order. *Photinia fraseri* is a good example of where a hormone dip has proven beneficial. A soft cutting dipped in an alcoholic solution of 10,000 ppm IBA will usually root very quickly rather than spend a great deal of time developing a large callus before rooting.

---

* Osmocote — a slow-release formulation of macronutrients
Micromax — a slow-release formulation of micronutrients
Both products manufactured by Sierra Chemical Co , Milpitas, California 95035

In the beginning round plastic pots were placed in beds between base boards. Today square plastic pots are placed in a square (18″ × 18″) plastic flat. The square pots prevent loss of soil between them during filling. The flat with the pots is run through a flat filler and then placed in the mist area or poly house. A worker will handle the 3-inch pots in multiples of 36. The same flat will hold 64 2¼-inch pots. These flats are a real plus when planting time comes around. Instead of needing 6 or 8 people to get up plants for the planting crew, it takes only 2 workers to pick up flats from the rooting area, deliver them to the planting area, and stay ahead of the planting crew without any trouble.

Peat pots are used for fibrous-rooted species such as azaleas. These come in a 3-inch size in strips of 6, which is a considerable advantage over handling the pots singly. Each flat will hold 36 of the 3-inch peat pots, same as with the plastic pots.

There is great variety in the sprinkler head or mist head being used for direct rooting. Everyone has a favorite head. This depends greatly upon the individual propagator, the drainage of his soil mix and the material being rooted. It would be difficult to recommend one head over all others, but the following arrangement is economical and very effective. A Ross 24H* head has proved very satisfactory when installed at a 15 × 20 ft spacing. The factory recommends 20 × 20 ft spacing but we find the 15 × 20 ft installation works well for us and certainly doesn't pose any problems. The rated output of the Ross 24H is 3 gal/minute at 40 psi. Ordinarily clocks can be set to cycle at 10- to 15-minute intervals until cuttings are rooted.

Ordinarily when a 30-minute clock is set to cycle every 10 minutes, there are 25 to 30 seconds of watering time on each cycle. If this creates excess wetness, a general purpose relay can be inserted in the system to allow an abbreviated watering period.*

The aforementioned system can be set up to function very well in full sun, but for most species 51% shade cloth appears to give better results. If wind becomes a factor, then heavy shade cloth or polyethylene wind barriers around the perimeters works very well.

The system has now been developed to the point where almost all ornamentals are propagated in this manner. Dwarf

---

* Available from Transphere Corp , P O Box 1564, Mobile, Al 36633
* A suitable unit is available from Dayton Electric Mfg Co , Chicago, IL 60648

yaupon is a good example of a species that could be difficult. However, heavy cuttings stuck shallow (¼ to ½ inch deep) can give results near the 100% mark.

The ventilation and isolation provided by 2- to 3-inch spacing of the cutting stuck in the pots goes a long ways toward controlling leaf disease problems. If decay at the bottom of the stem becomes a problem, shallow sticking or more porosity in the soil mix will usually correct the situation.

Everyone will have his own pet mix. One such mix that works well is:

3 parts finely ground pine bark
2 parts peat
2 parts gritty sand (very coarse)
6 lbs/cu yd Osmocote (18-6-12)
1 lb/cu yd Micromax
10 lbs/cu yd dolomite limestone

Direct rooting is destined to become standard procedure in the nursery business of the future It lends itself well to year-round planting that can support year-round sales, to say nothing of the considerable savings in the time and labor that are critical factors in anyone's future.

PROPAGATION OF UPRIGHT JUNIPERS

THOMAS J. BANKO
Virginia Truck and Ornamentals Research Station
Virginia Beach, Virginia 23455

Abstract. Cuttings of *Juniperus chinensis* L 'Hetzii' were rooted at monthly intervals over a 2-year period with IBA treatments of 0, 2000, 4000, or 8000 ppm Rooting varied greatly over this period, but was consistently poor in early spring (March) IBA did not significantly improve rooting percentages when rooting capacity was low, but did increase numbers of roots per cutting during favorable rooting periods Trimming the upper half of the leaf from the cuttings also had no effect on rooting In another experiment, rooting medium temperatures of 20° and 25°C improved rooting of cuttings of *J virginiana* L 'Skyrocket' and 'Hillspire', and *J chinensis* L 'Kaizuka' *Cupressocyparis leylandii* rooted equally well at 15°C

REVIEW OF LITERATURE

Rooting juniper cuttings has concerned plant propagators for many years. Although some junipers root readily, others are difficult to root, or root well sometimes and poorly at others. Generally, the upright forms are more difficult and erratic in their rooting than the prostrate forms. For many junipers the time of year for taking the cuttings greatly influences rooting. In 1953 Snyder (4) reviewed several references