In roses, PCP (Propachlor) has shown promise. Trials are in progress to screen several materials on a range of broadleaved seedlings at the Ministry Trial Station in Derbyshire. We ourselves have carried out trials with Simazine, Lenacil, Brasoran, and granular CIPC; none of these can, at this stage, be recommended without reservation. Trials with Lenacil over the past two years indicate that it is perhaps the most promising.

MODERATOR HESS: Thank you very much, Mr. Martyr; you did a fine job of presenting Mr. Humphrey's paper, and we are all sorry that he was not able to be with us.

The next speaker on the program is one who does not really need any introduction; he is a past-president of the Eastern Region and a well known seedling grower, Mr. Hugh Steavenson.

SEEDLING PRODUCTION IN THE FIELD

HUGH STEAVENSON

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Some of our Western Region friends may wonder about the purpose of field-grown seedlings. I have visited many west coast nurseries, particularly in California, where trees and shrubs grown from seed never hit the "ground" until finally installed in their ultimate landscape location. There is obvious merit in container production and even some field production in starting seedlings in flats in the greenhouse, pricking off into pots and shifting to larger containers or field rows as growth advances; but there are also some limitations and some disadvantages to this procedure as against bare-root production of seedling liners in the field.

For some time — perhaps a few decades — arborists have projected that virtually all trees used in landscape plantings would be of selected clones. This, of course, would necessitate asexual propagation, usually by budding or grafting. Such propagation requires seedling understocks, except in those rare instances in which the clone is grown on its own root or grafted to a vegetatively-produced understock.

Though asexual selections are increasingly moving to the forefront in both shade and ornamental trees and though the merit of many such cultivars over the species is beyond question, it is remarkable that so much current production of trees, particularly shade trees, is of seedling rather than asexual origin.

Several years ago one of the leading arboriculturists of our area pointed out that approximately 80% of the major trees planted in the

St. Louis region were either pin oak *(Quercus palustris)* or sweet gum *(Liquidambar styraciflua)*. The picture has changed in the meantime, but not much. This is by no means a healthy situation. For insurance against catastrophe, not to mention esthetic appeal, the distribution among species and cultivars in use should be much, much wider.

Again, though clones of both pin oak and sweet gum have been introduced, they have not really come into the picture in this central region. It is like "gilding the lily" to come up with something better than our native north Missouri pin oak. We have tried introducing the west coast cultivars of sweet gum with disastrous results — they proved tender in our harsh climate.

At our nursery we grow around 100 acres of caliper or "specimen" trees. We try to keep in production nearly all of the better asexual selections and patented varieties suited to our climate and we do not for a minute discount their merit; but from a strictly economic stance, we make more money from our seedling-produced specimens than we do our clonal varieties.

I much prefer a shade tree grown from a seedling rather than a graft **unless there is a marked improvement in the clone.** Among the major trees, no one questions the superiority of several clonal honeylocusts, maples, beeches, ashes, male ginkgo, willows, poplars, lindens and sophora, to mention some. But unless this superiority is definitely established, the problems arising from grafted trees offset minor "improvements."

In a recent meeting, one of our midwest nurserymen exploded in wrath when he described how a windstorm had neatly laid down a whole street planting of grafted trees, toppled right at the graft, after they had flourished for several years. We all know that compatibility problems may not be manifest for years after propagation.

Our mid-Mississippi valley region is rich in beautiful oak species that have been little exploited for landscape usage. We have grown several cultivars of sugar maple, but I can tell you that we have made our money on our seedling-grown sugars. The same is true with such species as amelanchier, white birch, Chinese chestnut, redbud, sweet gum, tulip tree, mountain ash, *Elaeagnus spp.* pines, firs, semi-dwarf maples, certain dogwoods and bald cypress.

We have tried just about all the recommended *Crataegus* varieties. The upshot of all this testing is that the easy winners in our region are the native species, especially Washington *(C. phaenopyrum)* and cockspur *(C. crus-galli)* hawthorns.

Some of the clonal lindens stand out head and shoulders — 'Greenspire', 'Redmond' and 'Princeton's Silver', for example. But we also have done very well with seedgrown American linden and the European *Tilia platyphyllos.*

Something else about field-grown seedlings of trees, shrubs and vines: growing under open field conditions, exposed to all the elements

and full sun (we use no shade whatsoever) they are well suited for growing on in the field or container. We are convinced that a one-year seedling, size for size, is far superior as a "liner" to an older seedling. For example, a one-year 12 to 18 inch silver maple *(Acer saccharinum)* will simply run away from a two-year 4 to 5 foot liner. For that reason, we attempt to provide optimum growing conditions to produce a seedling liner of suitable size in one year. This entails a soil building program plus continuous feeding, irrigation, and a disease and pest control program. Needless to say, we strive never to let weed competition become a deterrent to growth. Because of the increasing demand for larger, heavier caliper seedlings, we continue to decrease stand population. We used to shoot for about 25 seedlings per square foot of bed. Now we are down to around 10 or 15.

We are mightily impressed with what some of our northwest friends are doing with electronically-controlled automatic solid-set irrigation and we are moving in this direction as fast as we can.

Many one-year seedlings, properly grown, harvested, stored, shipped and planted, yield amazing growth response. Certain species (by no means all!) can be planted in a 5 gallon container in the spring and grow into a 5 to 6 foot or even a 6 to 8 foot tree by autumn. While field lining is rarely this spectacular, we can point to a number of cases at our nursery where such seedlings have overtaken 5 to 6 foot or 6 to 8 foot branched tree liners within 2 or 3 years.

Another point anent field-grown vs. container-grown plants, whether seedlings or specimen: we in the East are getting a beautiful indoctrination into a problem long cognizant among western landscape planters — container-grown tree roots are loathe to leave their soil ball and grow out into the surrounding soil in which planted. This situation, commonly referred to as the "interface" problem, is supposed to be overcome by growing the container plant in a medium similar to that of the planting site and by allowing the plant to remain in a given container a minimum period.

Even with these safeguards many of us are having "the devil's own time" in getting container-grown tree roots to leave their soil balls. The problem is pernicious even with trees that have been in a container but a single season. Such trees will often desiccate and die while the surrounding soil is saturated. (This illustrates the fact that soil moisture moves vertically, not horizontally.) We can slit the ball in several places to discourage the encircling roots; we can devise elaborate means of injecting water into the soil ball, and still have trouble. Once the roots start encircling the container wall (and this can happen in a few weeks) the prognosis is for root girdling some years in the future.

Such difficulties with container trees have created renewed interest in field-grown bare-root or balled stock. We also observe that plants grown in containers with permeable walls such as peat pots,

fiber containers, and possibly boxes, are less subject to the pot-bound condition associated with solid-wall containers. (If I sound a little uptight on container-grown trees, let me hasten to add that we grow, buy and sell them at our nursery. Their advantages are obvious and I only hope some genius will solve the interface and root-girdling problems.)

I will briefly cover some techniques for field seedling production. Seed source is obviously vital. If you cannot harvest your own fresh seed you must depend upon reliable collectors or suppliers. There is excellent literature available on the storage, pretreatment and after-ripening requirements of just about any species you might care to propagate. Even so, we run into sticky problems with certain species and have been aided greatly by communicating with our research fellow members, such as Al Fordham, Henry Heit, Harrison Flint and others. Certainly the basic guide in handling seed and securing satisfactory germination is to observe Mother Nature. You won't go far wrong in sowing when she normally disseminates. Of course, if she has arranged to perpetuate the species by having germination strung out over 10 years, you will prefer to fall back on one of the man-devised techniques for securing more prompt and uniform germination.

I have been growing seedlings for some 30 years, but I am happy to see the young fellows in our organization improve on my practices so we can usually count on regular stands of the so-called "two-year" species and other toughies; not that we come through with flying colors on all items we would like to grow. For example, we know how to germinate such desirable natives as paw-paw *(Assimina triloba)* and sassafrass *Sassafrass albidum* var. *molle;* Syn *S. variifolium)* but we have a frustrating time coming up with economic stands. We would like to hear from those who are successful with these species.

MODERATOR HESS: Thank you, Hugh. Our next speaker is Mr. Bruce Usrey who will speak on seedling production in structures.

SEEDLING PRODUCTION IN STRUCTURES

BRUCE USREY

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The seed propagator prior to 1945 believed that the only things that affected seed germination were viability, water, free oxygen, heat, age and maturity of seed, and it was with these things the seed propagator worked with to improve his stand. Once the seeds had been received, treated and sown, the propagator had only heat, and water to