

IDEAS REGARDING SEED ORCHARD MANAGEMENT

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INTRODUCTION

Nurseries and seed orchards are very compatible as one is an extension of the other. I am sure that we shall see a greater dependence of nurseries on seed orchards and vice versa as time passes. In other words, the tree improvement programs may keep the nurseries in business and the nurseries will be using seed--the only product of tree improvement.

Let me say at the beginning, I do not pretend to know all the answers regarding seed orchard management. However, I can assure you of one thing--anyone who happens to be lucky enough to manage a seed orchard and to run a nursery at the same time will never be bored because he has nothing to do. Believe me, this combination can be challenging and most rewarding. Also, I honestly believe you nurserymen are the best qualified people on earth to establish, maintain, and bring to fruition the vast tree improvement efforts being expended.

ESTABLISHING THE ORCHARDS

Selecting parent stock.--In order to establish orchards worthy of being called a tree improvement program, intensive and extensive efforts must be made toward selecting the individuals to be used as parents. Perhaps most of you will have these selected for you. If so, you are in some ways lucky because this is a tedious and far reaching aspect of tree improvement. However, very outstanding individuals do exist in natural stands and one is entitled some "crowing" when he locates an outstanding parent tree.

To select such parent trees takes someone trained in the art of evaluating the features of the tree in relation to its neighbors, the site, species, use of resulting wood, and cultural methods to be used with its progeny.

Site selection and preparation for the orchard.--Selection of the seed orchard site is a very important phase of establishing an orchard. The success or failure of an orchard can be, and often is, determined at this point.

Following are a few things to think about when selecting the seed orchard site:

1. Will the site grow trees?
2. Does it have proper natural drainage?
3. Is a hardpan present?
4. Does the soil have good moisture holding capacity?
5. What is the depth of top soil?
6. What is the pH? Is the pH tolerable for the species being established?
7. Is it in the right location? Is it convenient for labor, equipment, and management?
8. Is the site availability permanent? (Flooding? Urban development? Rights of way? Industrial site?)
9. Is the site in an ice belt or a hurricane belt?

Preparation of the site is vital to the success of the orchard. The following things need consideration after the site is selected and before rootstock is established or transplanting is done:

1. Check topography and drainage. It is easier to conform to natural drainage patterns where possible.
2. Clear area thoroughly.
3. Cultivate and level soil. If in doubt about the need for subsoiling, do it.
4. Lay out and construct convenient and adequate road system.
5. Plan for turning space for equipment.
6. Consider necessary isolation strips or the possibility of buffering with orchards of some other species.

Propagation of the orchards

1. Installation: As most propagation of orchards is currently being done by some form of grafting, these remarks will be toward this form only. The grafting techniques perfected during the last 15 years have proven fantastically successful. There are minor problems, such as incompatibility of scions and rootstock of certain clones. However, no major problems have appeared that have stalled progress in this realm.

Many variations of techniques of grafting have been tried and are in use. Potted stock in lath or greenhouses have been used extensively. Grafting on seedbed stock is successful. Probably the most consistently successful method has been field grafting on 1-year-old vigorous rootstock of the southern pines. The vigor of field grafted ramets is amazing and some of the problems associated with transplanting root bind, etc., are not experienced. Some programs are so extensive until it is understandable why other techniques are used.

2. Release: Probably more failures of grafting can be traced to poor "follow through" during release of scions from their covering and becoming climatized than to poor grafting.

Proper release is extremely important. Almost continuous care is required during this period. If the grafting is done just as the buds of the pines show the first signs of breaking winter dormancy, then one can expect feverish growth activity of the scions from 4 to 7 weeks following grafting. This is the critical time. Each graft must be inspected once per week and careful treatment given as required by each individual graft. This requires time and a feel for the necessary action by the one doing such work.

I cannot pursue this subject further. However, let me urge you to prepare to do this before establishment of an orchard is attempted; else, dismal failure may be the result.

3. After care: "After care" may be confusing terminology to you as release is actually part of this process. What I mean here is the care during the first and second growing seasons following grafting.

Special attention is needed through the first growing season. During release, the top is removed from the rootstock if the side cleff grafting method was used. During the first and second growing seasons, the rootstock foliage must be kept pruned so that the scion

assumes dominance. By the end of the second growing season all the rootstock foliage should be removed allowing the ramet to depend on the scion's foliage to form the crown.

Close inspection for insect damage, especially tip moth and *Dioryctria*, should be maintained. Aphids and sometimes red spider appear. Of course, these insects are always a threat, even after this period; but at this stage of scion development they can be fatal. Hence, insecticide applications are necessary. Some orchard managers follow a strict spray routine at weekly or bi-weekly intervals during the first 2 years in the field. Others do not. This will be discussed further under insect control.

Weed control adjacent to the ramets is beneficial. Mowing the orchards is desirable for better appearance and ease of working in the orchards. Mulching the rootstock helps conserve moisture and helps growth and vigor before and after grafting. Pine straw, shavings, sawdust, leaves or any similar material serve as good mulching. Three-foot plastic squares, or any material such as dryer felt or canvas, work well as mulch and controls grass and weeds adjacent to the plants.

Caution.--Be careful if hoeing is done near the rootstock.

A nick on a loblolly or slash pine usually becomes infected with *Cronartium fusiforme*.

Mineral spirits can be used on and around the rootstock without damage to pines.

Another caution.--Do not spray diesel fuel, either mixed in mineral spirits or full strength on base of pine or hardwoods in the juvenile stage. Diesel will penetrate the bark and kill the cambium if bark is saturated.

SEED ORCHARD CULTURE

Cultivation.--Under site preparation, subsoiling was mentioned as possibly a part of preparing the site. A critical look at the status of compaction, internal drainage (percolation) and aeration of the top 2-foot near the surface will indicate whether subsoiling is needed. Subsoiling will probably prove beneficial except on very deep sandy soils. Just remember that when the ramet is placed, it will not be disturbed for a long time. If you conclude that I am a believer in subsoiling for seed orchards, you are right. In fact, I am very much convinced that subsoiling pays on heavy or poorly drained soils from personal experience.

Roots of trees will tend to come near the surface as compaction increases. You may have noticed this on lawns with trees that have

been growing in place for many years.

With traffic in the seed orchards, the above condition can develop within 3 or 4 years so that the roots are being clipped or skinned by rotary mowers. This situation must be corrected even if drastic action is required; root rot diseases, such as fomes, can enter such wounds but even worse, if a drought occurs, the orchard will "poodle-tail" very quickly. Don't feel badly if this is new terminology to you. It is strictly mine. I will try to describe what happens. The ramet ceases height growth; lateral limbs elongate; limbs are weak, growth on terminal leaders is retarded; second season foliage shed prematurely, leaving the tuft of new foliage resembling a poodle's tail in appearance; hence, my name for it. To prevent poodle-tailing, some suggestions follow.

If you have access to irrigation water, this can be prevented or at least delayed; but a better preventative is subsoiling and then leveling with a disk on a scheduled basis. As the roots of the ramets grow toward the middles, keep middles subsoiled annually so the roots will grow under the surface of the soil. For the first and second year following grafting, subsoil middles in both directions to within 3 to 4 feet of each tree, to a depth of at least 2 feet; the third year, subsoil middles in one direction only and then subsoil middles at 90 degree angles the fourth year. This will tear the roots, so a colter is needed ahead of the subsoil plow to minimize the damage to older tree roots. Disk to level middles behind subsoiling. Keep tab on the condition of soil and root systems as years go by and treat as needed. Late fall or early winter seems to be best time to do such treatments.

Fertilization.--Mixed responses from elements have been observed to date. Nitrogen seems to have more influence on vigor of ramets and flower and conelet set than other elements. Up to 200 pounds N per acre of orchard per year has given increased flower set. So far as I know, the limit of response to nitrogen has not been established.

It appears that if any element is low, it should be corrected by the addition of the low element. Actually, complete fertilizer (NKP) might be desirable to keep all aspects of the ramets in a healthy, growing condition. As most orchards are young, sufficient fertilizer treatments over a period of time have not been conducted to determine the long-term effects of various fertilizer components. The minimum amount of fertilizer desirable on orchards 5 years old or older appears to be 400 to 500 pounds of 10-10-10 (or equivalent) per acre per year. Hill fertilization works well for the first few years and requires less fertilizer. However, when hill fertilizing, spread fertilizers evenly to beyond crown line and avoid applying globs close to the plants.

Remember that phosphorous moves downward by leaching very slowly, if at all, so that surface application of P does little good unless worked into the soil. Hence, if the site is low in P, an initial application of P to bring the site up to at least fair availability could well be applied prior to seed orchard establishment. The P could be incorporated into the top soil easier at this time.

As to time of application of fertilizers for greatest benefit and response, Dr. Charles Davey at North Carolina State says, "That will depend on reasons for fertilizing. There are several times of the year when they can be beneficial. Mid-summer applications stimulate production of flower primordia. Late fall applications stimulate root growth and spring fertilization enhances bud elongation."

Mowing.--Mowing is desirable for several reasons as given by Dr. Bruce Zobel:

1. Reduces fire hazard.
2. Facilitates cone or seed harvest.
3. Recycle nutrients used by the grass and to make added nutrients more readily available to the trees.
4. "Looks"--for public relations benefits.

A good rotary mower driven from a power take-off on a tractor does the job satisfactorily.

Most orchards are mowed several times a year, but the number of mowings above two will be dictated by point number four above.

Cover crops.--Cover crops form a more uniform ground cover than native weeds and grasses and if legumes are used, some nitrogen is added to the soil. The clovers, fescue, Bermuda grass, centipede, or a combination of grasses are being used as cover crops in seed orchards. A good cover of any of these helps prevent compaction and gives a good appearance to the orchards.

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Regal clover is beautiful and with good moisture will stay green all year. In addition, it has the advantages of a legume.

Fescue will form a very dense sod but has the disadvantages of being tough to mow and it heads out, forming profuse seeds that are hard to curtail, if not mowed regularly. In other words, it spreads to areas where fescue becomes a nuisance.

1/ Regal is a strain of Ladino (white) clover developed at Auburn University, Auburn, Alabama, in recent years.

Cover crops appear to have advantages that offset any disadvantages they have in the seed orchards.

Pruning.--Initial pruning has been discussed under "After Care"; however, pruning does not stop there. Low limbs must be removed to a height of at least 6 feet to allow passage of tractors, trucks, and seed harvesting equipment and sprayers. Where limbs are pruned according to prescribed techniques and then painted with a tree seal, few problems seem to appear. Mixing liquid BHC with the tree seal seems to discourage *Diodryctria* and bark beetles. Incidentally, this concoction also discourages sap suckers when painted on sap sucker-infested wounds.

Top pruning is being tried but appears to have little beneficial effect toward curtailing height growth of slash and loblolly pines. Virginia pine may respond favorably.

Insect control.--Prior mention has been made of insect control in young orchards and in relation to pruning wounds. In addition, any skinned places on ramets should be treated with tree seal immediately. As indicated before, some managers spray with various insecticides, such as BHC, DDT, Sevin, or Guthion, at regular intervals. This is a very expensive way to control insects.

With weekly close inspection of the orchards, it appears that less than half the insecticides required with regular sprayings are needed for good control. This requires a very close observer and someone knowing for what to look. Believe me, this is well worth the time of the seed orchard manager himself, if necessary. Indicators, such as a very susceptible clone, can be infinitely valuable in these inspections.

CAUTION: When insect signs appear, don't dally--check it out thoroughly but don't hesitate to spray if necessary.

Another possibility that is looking extremely promising is the use of Thimet or Di-Systemon as systemics. Thimet seems especially useful for this purpose. Thimet should be applied by February in most of the South so that it will be taken up by the trees before insect activity begins in early spring. At least 3 weeks are required for a systemic to oxidize and be absorbed by the plant tissue. Light disking or preferably irrigation helps get the systemic into the soil and available to the roots of the trees.

For older orchards (over 5 years) about 1/2-pound per tree of Thimet applied in the drip line seems to give good control of *Dioryctria* and tip moth. Three ounces per tree on smaller trees apparently gives good results. Fully stocked older orchards can be treated broadcast and then disked.

CAUTION: Thimet (phorate) and Di-Syston are very toxic, so handle accordingly.

HARVESTING

Problems.--There are several factors related to harvesting the seed that are creating problems. Some of them are:

1. Short time span when cones are ripe and can be collected.
2. Loblolly, Virginia, and shortleaf pine cones must be clipped. They cannot be shaken from the trees with present equipment.
3. Due to height of trees, special rigs are needed to reach the cones.
4. Care must be exercised to minimize damage to twigs and 1-year conelets.
5. Most cherry pickers, ladder rigs, or fork lifts are too expensive, too inefficient, and often too cumbersome to do the job economically and in the time allotted.

Recently, North Carolina State-Industry Cooperative Tree Improvement Program embarked upon a new approach that will solve a great many of the problems listed--if it works. A prototype of a vacuum machine is being built that will pick pine seed from the surface of the ground. Hence, the seed will be allowed to shed (probably assisted by a tree shaker) and then picked up with the vacuum. The open cones will remain on the trees in the orchards.

Undoubtedly, special manicuring of the orchards will be required prior to use of the machine to get the surface prepared for seed harvest. Let us hope that no more serious problem than this one arises.

CONCLUSION

There are many things left unsaid that are important. One of which is record keeping and is essential. This means maps of the orchards, clonal dispersion, fertilizer treatments, etc., and other forms of records. Another is the progeny testing phase, which is a vital area that must be done with utmost care so that the parent trees may be properly evaluated as to their worth.

Thinning, roguing, and pollination are other functions directed toward supporting the aim of developing the best strains of trees possible from the available parentage. The functions of thinning and roguing are--as Dr. Bruce Zobel terms it--"A very traumatic

experience." After it is done, the results are usually gratifying, however, as the appearance of the orchards is enhanced by the removal of the least desirable trees. Prepare yourself for the removal of your most productive clones, and if this does not happen, you will feel so happy--knowing it could have been worse.