SEED ORCHARD MANAGEMENT PRACTICES

Donald H. Viele, Forest Statistician
International Paper Company, Camden, Ark.

This presentation is intended to be on orchard management practice without getting into much detail, since specialty topics are covered by other speakers.

It seems best to try to point out some of the pitfalls orchard managers meet, and explain a few of the alternatives available for getting the more important parts of the work accomplished.

In a final portion of this paper an attempt is made to assemble some facts and personal beliefs to indicate how your nursery activities may be influenced by tree improvement work as its effects are combined with expected developments in other aspects of commercial forestry.

If any one factor other than tree selection can be singled out as most important in successful management of an orchard, it is the site. Orchards are almost a permanent thing, and the chosen site is one to be lived with for many years. Site figures large in plant survival and growth, insect and disease attacks, and eventually cone production.

Soil conditions within the overall orchard site are one item about which an orchard manager should be well informed. Two cases are known in which, after a few years of operation, the entire orchards were moved out of a heavy soil and perched water table to normal pine soils. Heavy, poorly drained soils give low plant survival as well as a poor surface for equipment movement in wet weather.

Actually, sandy loam on a gently sloping terrain with moderate drainage is the ideal.

Isolation possibilities must be considered important. At present, 400 feet of open ground is commonly thought to be sufficient. Quite often an orchard can be located down wind from hardwood bottomlands to improve isolation. In this instance, much advantage can be gained over the bare minimum 400 feet.

Vandalism must be considered when a site is chosen. Swapping tags from plant to plant, or destruction of trees, can do much to set back a tree improvement program.

Expansion room may be important to a good site since ideas are changing rapidly toward complete artificial regeneration. Many orchards are already larger than planned a few years ago.

Ordinary, but important, factors such as labor supply, accessibility, and water supply are not discussed since they are factors well understood by most people who have management responsibilities.

After the site location and development is settled, it is time to consider superior tree material which is costly at best. Most industries with large professional forces can locate a few superior trees each year. The special costs for locating and working these few trees would amount to several hundreds of dollars per tree if the cost be distinctly identified.

Exchange of material from selected trees often can be accomplished to reduce cost. Exchanges should be made with as many different donors as possible to avoid extensive duplication which would tend to result in identical orchards.

One of the snags in exchanges can result from unwillingness to share injury liability, or other unbalanced requirements by a participant. Generally, little difficulty develops along this line but it is a problem to be worked out in some cases.

Next, grafting methods must be chosen. Originally, pot grafting was most popular. Eventually, however, a shift was made to field, or bed grafting. Either pot or bed grafting has the advantage of holding plants in one small area to protect and cultivate. Pots have the disadvantage, in some cases, of curling the root system so badly that the plants are never able to recover. On the other hand, field grafting of scattered plants in a large orchard involves a tremendous amount of walking time between plants. Bed grafting on strong plants that have been root pruned several times seems the best compromise between convenience and plant condition.

Source of stock plants should be investigated. Generally, nursery—run plants are used. There is no factual data to support this idea but it seems preferable to use stock plants that developed from seed collected locally within 150 miles of the selected trees. Pines of the South can be grafted to different species of southern pines. In practice, grafts should be put on stock of the same species to avoid possible loss in later years.

Some trees are largely incompatible with almost any stock they are grafted to. In the occasional cases of this sort, an attempt should be made to grow seed from the selected tree to use as root stock for its own scions. This is not a sure cure but is the best suggestion made to date.

After grafting, there are numerous protection problems--many of which diminish with age. Large animals such as cattle, hogs, goats, all seem to be a threat only when the trees are below head height. However, compaction of soil by livestock could cause difficulty in later years.

Fencing is the only practical solution. In cases of heavy population, the fence must be high enough to exclude deer which sometimes appear to prefer pine stock plants to newly established grasses.

Rabbits have been reported an orchard nuisance for the first 2 years after grafting. Quarter-inch mesh cylinders 2 feet in diameter surrounding each tree will keep rabbits from damaging them.

Birds can do very serious damage to an orchard in two different ways. In the spring when each twig has put on 6 to 12 inches of weak, succulent growth, birds perching often break off the tree leaders. No practical solution has been found as yet. A more serious damage is done by members of the woodpecker family when they peck closely spaced holes over the entire limb-free stems of the trees. In International Paper Company's orchard at Springhill, a majority of the trees on several acres were damaged in this fashion. "Roost No More" bird repellent smeared on the tree stems ended the pecking entirely for a whole growing season. Incidentally, trees so pecked produced many times more cones than unpecked trees from the same source.

Sleet, particularly soon after grafting, is another threat to orchards. Until now, the only protection practical has been to knock the ice off the trees by hand as soon as possible.

Fire protection. is one of the prime considerations to an orchard manager. Both fuel reduction by way of mowing, and bare soil fire breaks, should be used. The contentional breaks commonly used around S15-per-acre plantations are not enough. Grader maintained breaks, 15 to 30 feet wide, seem justified by the high value being protected.

Homo sapiens of the vandal variety can be another threat to orchards. Several kinds of damage has been experienced after visits by the following types of men:

1. The "Wild Bill Cody" type which specializes in demonstrating marksmanship by shooting off cones and limbs, using shot guns.

2. The "practical joker" type who removes identification tags, or swaps them between trees.

3. The "frustrated modern" who can't resist the urge to slash off limbs with a pocket knife.

4. And, finally, the "do-gooder" outdoor type who, at Christmas time, goes out roughing it to harvest a tree for those who are sick or needy.

Seriously though, people do constitute a threat at times. Quite often a casual visit to an orchard area on weekends and evenings is necessary, particularly if the orchard is located in a remote area.

Plant care after grafting is a sizeable management concern aside from protection. This work includes such activities as are necessary to keep the plants vigorous, including fertilizing and watering which is covered in another talk.

After plants recover from grafting, stock plant limbs must be removed so flowering of the ordinary quality stock plant won't occur. There is some disagreement between orchard specialists concerning the timing of the pruning process. All things considered, it seems that early pruning is desirable. Plants sometimes do not definitely show incompatibility (the blockage of food movement at the graft area) until all of the stock plant limbs are removed. Early pruning causes incompatibility symptoms to appear early--thus, time is saved by forcing the weakness to show up.

Maintaining orchard ground cover, or turf, is a job related to grafted plant growth.

In some ways, keeping grafted plants in good condition is directly opposed to keeping a good ground cover, particularly if the ground cover is a grass that spreads by runners, such as Bermuda. In case of Bermuda cover, any fertilizer applied to the turf causes the grass to compete strongly against the trees. Knee-high grass may even entirely smother out 2-year-old plants. The entire problem seems best handled by weeding out all vegetation around the tree for a a-foot radius, applying as much fertilizer as a tree can use within its drip area, then applying only enough fertilizer in the turf area to encourage the grasses to grow faster than the weeds which compete with the grass.

There are two reasons for working toward getting weed-free grass. First, the grass is saleable for $0.05 to 50.25 per bale if it is heavy enough on the ground to bale. Second, the weeds are much more of a threat to trees than are the grasses, particularly the weeds such as ragweed which reaches 5 to 6 feet in one season.

Weeding around plants has been mentioned but some clarification is warranted. Hand weeding is extremely costly! in using a hoe, on the other hand, there is little liklihood of plant damage. In several instances, chemicals have been successfully used to reduce cost and control weeds for one season better than hand weeding. Mulching with straw has been tried but, in most cases, brings on complications of nitrogen starvation, and is a cover for pests.

Surface cultivation between rows has been investigated by the Texas Forest Service and was reported as related to the amount of

flowering, being a stimulant for producing male flowers. 1/ The practice of cultivation between plants should be approached with caution. Certainly, cultivation that would expose injured roots in pine is undesirable because of the possibility of getting a Fomes Annosus epidemic started.

Orchard care has one other chore that comes up now that Fomes Annosus has been mentioned. Removal of unnecessary but healthy trees and/or dying trees should include removal of the roots. When roots can't be removed, the exposed parts should be treated with household borax, sprinkled on in the dry form, as a fungicide.

Pruning lower limbs has been mentioned but there is some interest in top pruning as a means of keeping cone collection costs at a minimum. Several trials have been attempted and reported. Each of these has indicated top pruning reduces a tree's cone production.

More experimentation is needed along this line to at least arrive at a satisfactory balance between cone collection costs and cone producing capability of the trees.

Care of an orchard includes predicting crops of cones, as well as harvesting them. Recently, several orchards were studied to learn cone production related to tree age from grafting. For loblolly pine, tree records up to 9 years old were used, supplemented by yields reported in Australia. When data was curved, the following yield by age of tree was predicted (table 1).

Table 1.--Cone bearing at various ages from grafting

(Loblolly)

Year	Number cones/tree	Year	Number cones/tree	Year	Number cones/tree
1	rare	8	33	15	360
2	rare	9	50	16	410
3	0.1	10	75	17	450
4	0.5	11	110	18	475
5	4.0	12	160	19	490
6	11.0	13	220	20	500
7	20.0	14	290		

1/ Twelfth Progress Report of Cooperative Forest Tree Improvement Program (Texas Forest Service - Sept. 1964).

Knowing the number and ages of all trees in an orchard, it is possible to calculate the yearly crop for that particular orchard.

The data gathered tree by tree also indicates a way to increase orchard production by eliminating trees which refuse to bear a favorable number of cones.

The tendency to bear cones is closely related to that trait in the selected tree. One clone being worked with at Springhill, Louisiana, produces very few cones at 7 years from graft: actually less than two cones per ramet at age 7 from an average of 7 grafted trees.

Another good producer averages 30 cones per ramet at age 7.

The average production of forty-one 7-year-old trees is 15 cones per tree for 1966. Orchard cone production can be increased many fold by eliminating poor producers. This is a practical step providing other tree qualities are held high. A sacrifice of quality to raise cone production would be a step backward.

One more hopeful sign in cone production appears. Injured trees, both those injured by woodpeckers and those injured by bark borers, produce many more cones than uninjured trees. If orchard managers can learn the type and extent of injury needed, cone production can be stepped up to double or triple normal tree production.

Record keeping is yet another major orchard management chore. Ten to 20 percent of all time spent working an orchard goes into record keeping and analysis during the first few years. Each tree must be listed and its progress known in order to plan work. If it dies, a replacement must be planned for in the next season's work budget. Its production of cones must be learned for future use and for planning cone collection. Susceptibility to insects or disease must be accounted for to have a basis for culling certain susceptible trees. Much more than this must be accumulated to use as a basis for planning work a year in advance.

Still another activity is extremely important to the welfare of tree improvement programs in industry, as well as state programs. This is in getting other people interested in and acquainted with orchard development. Industry needs the interest of others because most of the raw material used comes from land owned by others. What is good for forestry is usually good for forest industry. In the case of Government orchards, the taxpayer's interest and sympathy is essential.

It can be seen that orchard development has been a growing thing, and soon will be ready to produce a commercial amount of seed. Orchards are on the "ready line."

Economic conditions are also on the "ready line" for making the years ahead the golden years for forest regeneration. By 1970 there will

be several new paper mills within this conference's boundaries, according to official announcements.2/ These new mills, along with expansion of existing mills, will increase pulpwood drain by 100 percent or more to say nothing of the added demand of veneer and other wood using industries.

Knowledge of the coming increase in competition for raw material has already begun to have an effect on management attitudes. There is no reference here to a particular organization, but from personal observations of several industrial organizations, it is obvious that certain changes in thinking are shaping up.

With the expected pressure for growing space, some organizations are shifting away from the idea that reasonably full stocking is something that can be waited for. Time has become as important as money. When conditions indicate more money can be earned by spending now to artificially regenerate than might be earned by waiting for nature to do the job, the likelihood is that artificial regeneration, either planting or seeding, will be used.

The time has come when a stand of undesirable trees can be cleared and the area planted with economic justification. This was not considered profitable in the recent past or at least was not generally considered the best investment for available funds.

Another idea that gets looked at closer each year is that of "seed tree" cutting for regeneration. There is little doubt that if an area would take several years to regenerate from seed trees, and there is money available for artificial regeneration, the seed tree choice is usually a money losing proposition.

Changes in logging methods toward heavy equipment may eventually make all random spacing of trees impractical regardless of any other factors. With heavy machines, both uniform size and row arrangement can be important.

Yet another important factor determining regeneration practices remains: that is the availability of money for forest capital investment and the choice of how to spend it to best advantage. Several years ago permanent forest industries, particularly pulp companies with large capital investments, moved in buying lands that were being sold by the fading large lumber companies. The permanent industries wanted emergency supplies of timber to insure continuous operation.

These permanent industries, at one time, had two choices for securing an emergency source of raw material. They could either spend available money to get full stocking of land already held or they could purchase merchantable timber on land and improve the stocking later as time and money permitted.

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a/ Pulp and Paper Magazine (Dec. 6, 1965).

Large commercial forest tracts available for purchase are getting scarcer. It seems logical then that soon owners with large understocked holding will turn their attention and available money away from land purchase toward developing full stocking on the land they already own. This will involve the nurseryman.

During the forthcoming period of striving toward full production, nurserymen can expect an increase in demand for seed, or seedlings grown under increasingly rigid controls on seedling quality.

A personal opinion is that efforts will be made to fully stock at least 75 percent of all commercial forest land with a site index of 75, or better, within the next 15 or 20 years.

The two ideas already stressed, namely that improved seed will soon be available in large amounts and that seedling quality as well as number of seedlings to be demanded will increase, both imply that nursery managers should come up with some reactions.

First consider the idea of intensifying culture of plants. One company, and probably more, already requires that seedbed areas used to grow improved seed must be fumigated before seeding. This practice is expensive on a per acre basis, but why not provide this insurance when it will only raise the per acre cost of planting seedlings $0.20 to 0.25.

Another thing to consider, if not act on, is furnishing seedlings better protection from damage that might result from water, hail, excess heat, or other physical injury.

Most of the nurseries could also improve seedling quality control by making more frequent soil tests, particularly those related to available nutrients. Somewhere there is an ideal range of available nutrients. If it is practical, nutrient level should be carefully controlled by several tests made during any single growing season.

Soil moisture may be another place for improvement with a possibility that subsurface irrigation can reduce damping-off as the soil moisture is held at a high level. This also may have possibilities for distributing soluble fertilizers and other chemicals without surface disturbance of beds.

Some nurserymen may consider direct seeding as being beyond their ordinary duties, but really here lies an opportunity to reach out with something small landowners need. Using this method, a "do-it-yourselfer" can save SE or S7 per acre over machine planting if he will collect his own seed and have nurseries process them. This is one of the least exploited of nurserymen's opportunities.

Finally, consider the possibilities nurserymen have of developing the most desirable seed through an improvement program. Nearly every tree in the mid-South is available for state orchard use. An orchard of trees holding only the cream of all selections should provide seed that excells in quality and should have much appeal to customers, particularly those with holdings too small to support an orchard.

These are just a few ideas. which are offered, hoping they will grow with you and even inspire some questions.

I want to thank you for the interest you have shown in tree improvement and hope you take with you the impression that there are great opportunities ahead for increasing nursery production and seedling quality.

Discussion

Q. (Fisher) You mention injury increases seed production, especially on seed orchards. I wondered if you ever saw any partial tree girdling or tree banding work?

A. (Viele) No. I haven't seen anything being attempted in a seed orchard. Of course, a grafting wound is one type of injury and seems to have something to do with cone production. The only injuries I have known in orchards have been unintentional but the effect is definite. We have trees that are 6 or 7 feet tall that have cones on nearly every twig, after they have been injured by wood peckers or bark borers.

Q. (Fisher) I guess it was out in the western states where they tried this? I just wondered if it had every been tried in the South?

COMMENTS (Lang). I recall that Jacobson did work on partial girdling. I wonder if it has every been checked into.

COMMENTS (Hall). The Gulfport Lab did some in Ashby County.

COMMENTS (Carter). Mann or Derr did some at Alexandria about 15 years ago.

COMMENT. Some done at Olustee, Florida, too.

COMMENT (Viele). It hasn't been dependable enough then to justify doing it. I've read articles by horticulturists who have done "bark inversion" on apples and other fruit trees and have fairly consistent increased production.

Q. (Engstrom) What is "bark inversion?"

(Viele) It's making two parallel incisions around the tree about one-half inch apart, taking that strip of bark off in the spring, turning it upside down and putting it back on the same place.

COMMENTS (Washburn). I had a dogwood that didn't bloom for years and I cut that band around it and didn't take it out, just left it there but the next year she flowered all over the place. I don't know whether it changed the cycle or whether it was going to do it anyway, but it surely does bloom now.

COMMENTS (Viele). That's an example of the thing I pointed out about an injury. We just don't know how extensive an injury will be needed, but some injury seems to have the effect that we would like to have on cone production.

Q. I was wondering on this injury relationship, how many years in sequence have you found this effect? Would not the injury to the tree over a long run be more detrimental than the short apparent burst in cone production?

A. (Viele) I think it might be. Trees that I have observed that were injured 3 years ago, mainly, are recovering and getting more vigorous each year. Still, they are producing cones--that's the reason I gather that it might be helpful in some cases.

Q. (Williams) Do you take into account in your scoring system the cone production of your candidate trees?

A. (Viele) I believe you are speaking of the tree selection scoring system.

(Williams) Yes.

(Viele) No, we don't. We do on seed production areas but not on orchard selections.

Q. (Washburn) Is anyone using black plastic to keep down the grass and weed competition?

A. (Viele) We tried using a 5-foot diameter piece of plastic, but it interferred with the water that had to be applied in the dry part of the year. Then, too, it makes a cover for pest to hide and pupate under. I think the most effective way of controlling the weeds that I have seen thus far is being done with chemicals at the Bluff City Nursery.

COMMENTS (Plyler). DSMA on Johnson grass