

planting, and harvesting if some other crop is used. This vegetation-free strip can be maintained by use of a pre-emergence weed killer, such as Simazine, and a post-emergence weed killer, such as Paraquat or Phytar 560.

Some provision for grafting rootstock must be made immediately. The seed you collect now (1968) will produce 1-1 rootstocks for grafting in the spring of 1971. If the rootstocks are needed by spring 1970 (a year earlier), the seed must be planted at a wide spacing and grafted in place. In addition, if seedlings of the desired species are available or can be purchased immediately, they should be planted 3 to 5 feet apart in rows wide enough to accommodate a tractor. A third planting, in the proposed seed orchard area, should consist of one (maybe two) seedling at each spot where a tree is to stand.

When scionwood is finally collected it will first be grafted on the 1-1 lined-out seedlings. This will be followed by topworking the wider spaced seedlings. In late *July* and early August, buds from the topworked planting will be transferred to the seedlings planted in the orchard. (If all grafting, including topworking, on a particular clone fails, then additional buds can be obtained from the parent tree). The following spring all bud failures in the orchards will be replaced with successful grafts (if available). If needed, additional grafting or budding will be done with material from the topworked area or from successful grafts, or any other successful buddings in the orchard. The important point is, that unless strong incompatibility is present, scion collection should be required only once and instead of relying on spring grafting only, you are providing for other means of vegetative propagation.

Seed collection is something you won't have to worry about immediately, but it should be kept **in** mind when you establish and maintain the orchards. Hardwood crowns tend to extend more horizontally and, therefore, orchard grafts must be pruned to at least 8 feet in height to allow machinery movement under the crown. Future hardwood seed harvesting will require very short grass or no grass at all under the trees. Shakers will probably be used and possibly vacuum cleaners similar to those used in nut orchards. These considerations all point to row plantings with trees fairly close in rows up to 40 **or** 50 feet apart.

We should all be thinking about the future. What you plan in the way of orchards today will be just beginning to yield seed about 1980 with significant crops coming 5 to 10 years later. We need to look at least 15 or more years ahead and try to anticipate innovations that may occur.

Let's look at pollination. Right now the only way we can influence this is by ramet arrangement in the orchard. We may be able to graft 2-3 clones on one rootstock to increase pollination between

them. (This would be particularly true if the species was insect-pollinated). Or, possibly, just planting two, three, or even four grafts at each planting spot would accomplish the same thing. A giant fan to dispense selected pollens throughout the orchard might be feasible. Perhaps an entire orchard could be covered with cloth like they cover tobacco in the northeast. Maybe covering individual trees, groups of trees, or rows of trees would be reasonable. Liberating insects in these enclosed areas would practically insure desirable pollination in a species, such as yellow-poplar or black-cherry.

If the crown characteristics of a particular species could be manipulated by mechanical pruning or chemical spraying, this would greatly facilitate covering part or all of an orchard. We need to know how each species will respond to such treatments. Such control would allow for easier spraying and harvesting also. Why not plant sweetgum or blackcherry, or maybe even oak grafts, 8 feet apart in rows about 30 feet apart? Then restrict height growth to 15 to 20 feet and crown diameter to about the same dimensions. You end up with a hedge. Although seed production would be somewhat limited by crown size restrictions, the increased number of crowns and fuller utilization of the site should overcome this deficiency.

Sound ridiculous? A fogging machine that would cover a tree like a cocoon is possible. If, as Diet Smith suggests, humans can harness magnetism and little space chariots become available, two or three men could pick up corners of a large isolation net and then, like ushers unrolling the tracking down the church aisle at a wedding, they could speed down a hedgerow of grafted trees in an orchard and the covering job could be accomplished in a few minutes. Large-scale controlled-pollinations would then be possible.

COMMENT (Zobel): The only crop we can't seem to harvest mechanically is pine cones. If you have 200 acres to harvest in 3 weeks, a person tends to panic. It is difficult to get men to do this type of work, which includes climbing.

Another approach to harvest of loblolly pine seed being worked on by our cooperators is a vacuum machine. The cones open naturally on the tree, the trees are bumped with a shaking machine, and then the vacuum machine picks the seed up from the ground. The machine is now assembled and will be tried this year. It may or may not work, but the engineer building it is a specialist in developing new machinery and the idea sounds good. We're going to see if the collection problem of loblolly and Virginia pines can be handled this way.

Now that the orchards are coming into full production, there are many problems in harvesting from them. The harvesting of slash pine is pretty well solved as it is for longleaf pine where the standard

shaker can be used. We need to develop something for our own particular needs in loblolly pine. The big equipment companies have not been interested because of the relatively small market potential. One thing is certain--we must have an efficient way of harvesting cones or seed from seed orchards.