HARVESTING AND PROCESSING SEED ORCHARD SEED

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Abstract.--Harvesting and processing seed orchard seed presents new problems for the seedsman. If he is to harvest every available seed and to use up-to-date harvesting techniques, he must give close attention to cone maturation dates and seed biology. The standards for quality processing must also be the highest possible to realize the full value of the seed. This goal may require the replacement of cutting tests with x-ray analysis and the adoption of new types of processing machinery. The Eastern Tree Seed Laboratory can help identify seed processing problems and propose solutions.

INTRODUCTION

Seed orchards have unique environments that present special opportunities and problems that differ from the job of collecting cones and seeds from forest stands. Also, the high financial value of seed orchard seed has mandated some changes in processing. This paper presents some examples, from southern pine seed orchards, of harvesting and processing problems that might occur in the Northeastern Area's conifer seed orchards.

HARVESTING

Cone Maturity

Cone collection in forest stands is usually begun when the cones have reached an average degree of maturity. A similar schedule in a seed orchard could result in substantial seed loss because the maturation date is a clonal trait. Seed will fall from some trees while others still possess green cones. If cones are harvested from all clones at one time, the early maturing cones will have already shed their seed; late maturing cones would case-harden upon drying because they were immature.

Cone maturity can be evaluated from the extraction efficiency. Extraction efficiency is the ratio of the potentially sound seed (Fully developed and completely filled seed which has not yet been tested by germination.) extracted to the total potentially sound seed produced by the cone (Karrfalt and Belcher, 1977).

$$\text{Extraction Efficiency} = \frac{\text{Potentially sound seed extracted after drying}}{\text{Total potentially sound seed produced by cone}}$$

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Extraction efficiency is part of the cone analysis procedure in which the cone is dismantled. A more complete explanation is given by Bramlett et.al. (1977) and Karrfalt and Belcher (1977).

A cone analysis service is offered by the Eastern Tree Seed Laboratory. Extraction efficiencies determined in this service program are illustrated in figure 1. In the orchards tested, cone harvests appear to have been initiated when the first cones matured. Consequently, most orchards obtained an average extraction efficiency below 95 percent--which is below the minimum value for good management. The highest clonal value within each orchard was generally above 95 percent, showing that cones will open fully when mature.

Seed orchard seed is valuable because of high production cost and because it can produce trees that yield more wood than average trees. A value of $100 per pound is a reasonable figure to place on southern pine seed orchard seed (Zobel, 1974). With these facts in mind, the cost for poor extraction efficiency can be seen by a simple example. If only 80 percent of a potential harvest of 1,000 pounds of seed is extracted, than 200 pounds of seed, or $20,000, are lost. A careful determination of cone maturation dates is, therefore, very important. Cone analysis would be a good procedure to help in this effort.

Harvesting Systems

Seed orchards require many years to reach seed production age. Once seed is produced, it is not financially sound to collect cones by cutting the tops out of the trees nor to cut them down. Climbing has not proved to be very efficient or thorough, but sometimes necessary. Innovative systems have been developed to meet the requirements of the seed orchard. Tree shakers are used to knock cones to the ground where possible. The cones of some species, such as loblolly pine (Pinus taeda), cling tenaciously and must be picked individually. Another practice is to collect the seed on netting or pick it up with a vacuum harvester. Seed collected directly from the ground must be harvested soon after seed fall to minimize bird and rodent predation and to avoid damage from adverse weather conditions.

Barnett and Hall (1977) found that freezing partially or fully imbibed seed would reduce germination from 10 to 20 percent. Substantial losses might result if seed on the orchard floor is subjected to freezing weather following prolonged damp conditions.

We observed a substantial loss because of poor handling in one orchard where seed was collected from the ground. Germination of this seed was as much as 35 percentage points lower than germination for seed extracted from cones collected in the same orchard. Corrective action is now being taken to shorten the collection period and improve handling techniques.

PROCESSING

High Quality

The highest quality seedlings come from the highest quality seed lots. Because improved seed is so valuable, each viable seed sown should produce a plantable seedling. It is most important, therefore, to clean seed orchard seed to the

greatest extent possible. It is better to risk throwing away a few good seed with the empty and damaged seed, than to leave too many bad seed and produce poorer seedlings because of poorly regulated nursery bed densities. Fungal infections might also be introduced into the nursery by damaged seed left in the seed lot.

Monitoring Procedures (Quality Control)

Processing plants previously cut or cracked seed to determine when the empty seed had been removed. All filled seed were considered worth keeping. However, heavy insect attacks occur regularly in the seed orchards, resulting in more insect damaged seed in orchard collections than are found in wild collections. These damaged seeds may not be detected by a cutting test. X-ray analysis is required to make a proper evaluation (Rowan and DeBarr, 1974). If these seed are not removed, the germination will be reduced and fungal infections might result.

New Techniques

Some insect damaged seed is difficult to remove because they have weights very close to those of potentially sound seed. Air cleaners will not be able to efficiently remove them. Properly adjusted gravity separators, however, are able to make separations on the basis of small differences in weight and can solve the problem nicely.

A similar problem occurs with the seed and cones collected from the orchard floor. Many small stones of nearly the same weight and size as the seed can be collected with the seed. A gravity separator can correct this problem. However, the narrow band of stones on a separator is difficult to control. A destoner, which operates in a similar manner to the gravity separator, is a better machine because only two separations are made, with the stones and seeds moving in opposite directions.

Assistance

By small tricks, solutions generally have been found to the new and often complicated problems that arise in harvesting and processing seed from seed orchards. The equipment that might be required is often expensive but is worth the expense because of the high value of the seed. To assist in proper selection of the types of machinery, the Eastern Tree Seed Laboratory maintains a collection of processing equipment. Those who desire this assistance should supply the laboratory with a 10 pound sample of their seed and a full description of the problem. Every effort will then be made to propose a procedure which will solve the problem.

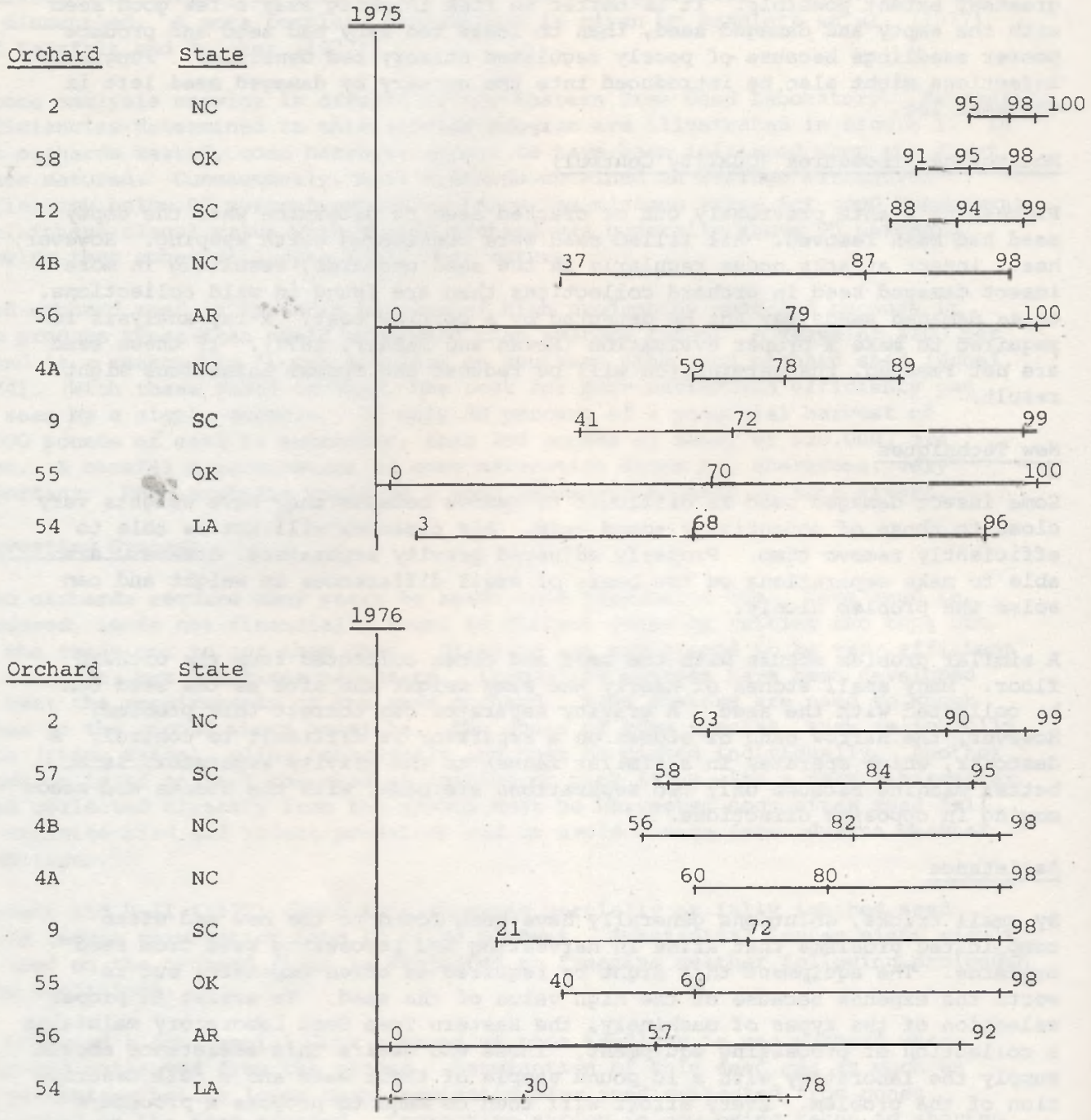

Figure 1.--Loblolly pine extraction efficiencies. Left value is lowest clonal mean in the orchard. Middle value is orchard mean. Right value is highest clonal mean.

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