SEED HANDLING AND TESTING

Earl W. Belcher, Assistant Director
Eastern Tree Seed Laboratory
U. *S.* Forest Service, Macon, Georgia

The topic of seed handling and testing is **a** broad area; therefore, I have broken it into three sub-topics: (1) recommendations for handling seed, (2) hardwood seed findings, and (3) mlscellaneous findings.

RECOMMENDATIONS FOR HANDLING SEED

Seed samples

Some seed samples, in glass jars, have arrived broken at the Eastern Tree Seed Laboratory. The seed were scattered throughout the package. If two jars are broken, seed become mixed--then the only thing we can do is to request another sample from these lots. In order to prevent this, we suggest one of the following:

--Polyethylene bottles are excellent and quite easy to obtain. If you are interested in polyethylene bottles but can't find vendors, let us know and we'll give you some names and addresses.

--Disposable polyethylene containers or freezer containers are also suitable, provided the lid is sealed.

Remember, if you want the moisture content of a sample to be representative of the lot from which it was drawn, the sample must be sent in a moisture-proof container.

Testing before planting

Latest results show that annual testing is not necessary if the seed are to remain in storage and you have good storage facilities and if the seed have a moisture content suitable for storage. There are two times, however, when a test should definitely be made. This is following extraction and prior to planting. Otherwise, there is no way of assessing the value of a lot, nor what it will produce. It is also wise to test seed if they have been subjected to unusual conditions or have not been tested during the past 2 years.

Stratification requests

Many nurserymen and seed handlers now stratify their seed in polyethylene bags. If you use them, please note this in the space provided on the Test Request Sheet. We want to use the same method that you use to stratify your seed. When a new procedure is used, we conduct comparison tests to determine its effectiveness. Findings show that, generally, germination of seed stratified in polyethylene bags and moss are the same; however, this has not always been true for long stratification periods. *As* an example, last year we received a sample

of Eastern white pine seed from North Carolina, with a request to stratify in polyethylene bags. Without this request, we would have stratified the seed in moss by the conventional method. Our tests showed that those lots needed a 60—day stratification and that polyethylene stratification was best.

	Lot 1	Lot 2
Polyethylene	91	73
Moss	88	54

Although comparative results may be expected, variation between seed lots due to the method of stratification is occasionally found.

HARDWOOD SEED FINDINGS

Acorn fumigation

With increased interest in hardwood seedling production, we are getting requests for information about fumigation methods to kill insect larvae in acorns. Some people have recommended methyl bromide; however, experiments at the Eastern Tree Seed Laboratory have shown that doses high enough to kill insects also often kill the seed. Forestry Associates of Allentown, Pennsylvania, uses one of the more promising methods of fumigation. They use Serafume 1/, a liquid fumigant which becomes a heavy gas on exposure to air. Safety precautions are necessary in handling Serafume, as with any fumigant; however, it is easier to handle than methyl bromide. It also has a low fire danger rating. The procedure presently used is this:

--Collect acorns and place in loosely woven cloth bags (such as potato sacks, onion sacks, etc.) about 50 pounds per sack.

--Place sacks in a 55—gallon drum with an empty coffee can (or equivalent) on top of the sacks.

--Pour 3/4—inch of Serafume into can.

--Cover drum with a burlap sack and place in slight draft.

--After 24 hours, remove burlap, take sacks out, and let aerate for a couple of hours.

--Spread seed on wire mesh trays in chill—room for 3 weeks (seed should not be over 6 inches deep on the trays).

--Store in drums with heavy polyethylene liners at 38°F.

1/ Product of the Dow Chemical Company, Midland, Michigan, 48640.

The temperature of the seed is important for fumigation and should be above 60°F.

Further investigation of this product is necessary to determine the optimum length of fumigation and the proper amount of fumigant to use.

Acorn storage

The increased interest in the fumigation and storage of oak seed prompted the Taboratory to initiate a study with cherrybark oak. Through the cooperative assistance of the Arkansas State Forestry Commission, Kentucky Division of Forestry, Louisiana Forestry Commission, Mississippi Forestry Commission, Tennessee Division of Forestry, and the Southeastern Area, State and Private Forestry, U. S. Forest Service, and the Georgia Forest Research Council, seed and financial support were provided.

Fumigation treatments were methyl bromide, Serafume, and DDT disolved in DMSO (Dimethyl Sulfoxide). The seed are stored at three temperatures and in three types of containers. The study will be complete in March, 1967.

Also, through the cooperative assistance of Tennessee Valley Authority, Louisiana Forestry Commission, South Carolina Forestry Commission, and the Tennessee Division of Forestry, storage studies on sweetgum, yellow-poplar, and sycamore are underway at the Eastern Tree Seed Laboratory. The seed are stored in sealed containers at three temperatures, with four moisture contents and will be tested annually. The Southern Hardwoods Laboratory at Stoneville, Mississippi, is also conducting similar studies.

Cleaning dogwood seed

The pulpy material must be removed prior to germinating flowering dogwood seed. Samples of a Georgia source of seed were depulped *by* screens and by hot water. The results show that removal of the pulp is important in order to obtain maximum germination. Also noted was the fact that seed viability was reduced when the pulp was removed with hot water.

Treatment	(Unstratified)	(Stratified 90 days)
	Percent germination	
Fresh seed with pulp	0	7
Heated to depulp	0	15
Fresh seed without pulp	18	60

A minimum of 90 days stratification is necessary to get germination and 120 days is better.

Repellent-treatment of yellow-popular

By request, a large sample of yellow-poplar seed was stratified for 60 days. Part of the seed was then coated with Arasan 42-S and both parts were sampled for germination at the Seed Laboratory. This bird and rodent repellent-treatment had no effect on germination.

Baldcypress storage

An Illinois nurseryman collected baldcypress seed from the same area in 1962 and again in 1964. The seed were stored either in an open container at air temperature or in a tight container at 34° - 38°F., and tested annually from January 1965. Seed stored in the open air lost their viability in less than 2 years from collection. Seed stored at 38°F. with 12 to 16 percent moisture content maintained viability of more than 80 percent for 3 years. Further tests will be made next year.

Cherrybark oak stratification

Seed collected from one source in 1963 and a composite of 5 sources of 1965 were tested after various intervals of stratification. Both total and rate of germination leveled off after 60 days of stratification. An additional 30 days of stratification had no effect on germination; therefore, if planting conditions require leaving the seed after the initial 60 days, little change in the germination may be expected. Most of the seed germinated in stratification when left for 150 days.

MISCELLANEOUS .STUDIES

Systemic insecticides

There is the possibility that nursery stock can be protected from mites, grubs, and other pests by direct-seed treatment with a systemic insecticide. Unfortunately, these carbamate and organophosphorous chemicals are extremely toxic and, therefore, should be screened in the laboratory before field trials are made.

In cooperation with the Department of Plant Pathology, Bacteriology and Entomology, West Virginia University, Morgantown, West Virginia, a study was prepared to evaluate the effect of 10 systemic insecticides on 3 species of pine seed. The insecticides used were: Di-Syston, bayer 25141, Thimet technical, Thimet D-44, Bidrin, Dimetilan, Thiocron, Zinophos, nia 10242, and Azodrin. These were applied at the recommended dosage, which was in most cases 2 ounces of active ingredient per 100 pounds of seed.

The results indicated that germination of Virginia pine was significantly surpressed by Thimet technical, Di-Syston, bayer 25141, and

Thiocron EC-3. Eastern white pine germination was significantly inhibited by Azodrin, and promoted by nia 10242. Loblolly pine germination was significantly promoted by Thiocron, nia 10242, Thimet D-44, and Zinophos, over that of the controls, and significantly reduced by Bidrin, bayer 25141, Thimet technical, Di-Syston and Azodrin.

Some of these insecticides did not reduce germination--instead, they promoted total germination. Further studies are needed to determine the amount of chemical required to eliminate a particular pest, how long they are effective in the plant, and the duration of residual effect in the soil.

Hail damage

The use of history plots has been promoted for determination of many nursery factors, but I don't believe it has ever been suggested for studying the damage of a hail storm.

During the 1965 sowing season, 20 history plots were established in a slash pine seed lot at a Georgia nursery to obtain germination data. Less than 5 hours after the 30-day seedling counts were made, a 10-minute storm passed over the nursery dropping golf-ball-sized hail stones. The hail beat the seedlings into the ground. Counts 2 days after the hail storm showed that 7 percent of the seedlings suffered broken tops. The rest were parallel with the ground.

The results at lifting time showed that there were 17 seedlings per foot out of an expected 30, of which 86 percent were plantable. An examination of the plantable seedlings indicated that two-thirds of them still possessed noticeable, but acceptable, stem crooks. An examination of the culls indicated that 57 percent were culls due to excessive stem crook and 15 percent due to forked tops. The remaining 28 percent could not be definitely attributed to the storm.

These results indicate that some seedlings can be salvaged from an expected total loss. In this case, 15 seedlings per foot were plantable. The findings also illustrate the importance of history plots for gathering factual nursery data.

X-ray

In our continued progress to improve seed testing, we are searching for ways to get accurate information in less time, as well as ways to reduce the cost. A promising possibility to these goals is X-ray.

Through the cooperative assistance of the Georgia Forestry Commission, Georgia Forest Research Council, and the Southeastern Area, State and Private Forestry, U. S. Forest Service, we are now operational with a Softex X-Ray Unit. This compact unit was designed especially for X-ray of soft tissue and it has a fluoroscope. This machine offers the following possibilities:

--Full seed percent: By either examining the seed through the fluoroscope or examining the radiograph of the seed, the internal structure can be seen without destroying the seed. Partially filled seed can be determined more accurately than by cutting tests. Empty seed are dark in color- deteriorated seed appear fuzzy or distorted; and full seed are white with distinct detail. A more accurate determination of full seed percent can be made without destroying the seed. This means that seed orchard specialists can determine full seed percent without losing a single seed.

--Insect damage: Insect damage can be easily evaluated by X-ray. A distinct outline of insect larvae and amount of damage it has done can be seen.

--Mechanical damage: Broken seedcoats and/or internal tissue damage is visible on radiographs. Cracks which may be overlooked in a visual inspection are very noticeable on X-rays. Also internal damages which do not show evidence on the outside may be seen. An example of this is autumn olive. The leathery seedcoat has sufficient elasticity that extraction damage may not be apparent by visual inspection: a radiograph will show the destruction, if present, of internal structures. Bruised areas or dying cells may not, however, show on radiographs of southern pines. Detection of such areas can be accomplished by first soaking the seed in an organic agent containing iodine. The impregnating agent enters the dead cells through the process of diffusion and may be seen by contrast on the radiographs. This technique offers more accurate determination of mechanical damage for the seed customer.

--Maturity: Development of the embryo of southern pines can also be studied. The pro-embryo becomes apparent on a radiograph about the middle of July. From this time on, the growth and development of the embryo may be followed with X-ray.

--Abnormalities: Initial findings do not appear promising in attempting to determine which seed will produce abnormal seedlings during germination. Abnormalities during the development of the seed, such as twin embryos, twin archegonial development, unusual embryo shapes, and incomplete seed development can be easily seen in a mature seed.

--Germination: Initial findings indicate that X-ray with the use of an impregnating agent will give accurate estimates of seed viability.

We are continuing investigation into the use of X-ray. It offers the possibility of a reduced testing time, with increased accuracy.

Discussion

Q. (Vande Linde) Was the DMSO used as a carrying agent?

A. (Belcher) Yes. DDT disolves readily in DMSO. This makes the DMSO very dangerous to handle.