CERTIFICATION STANDARDS FOR FOREST TREE SEED

Georgia Crop Improvement Association
University of Georgia Athens, Ga.

The State of Georgia has adopted Certification Standards for Forest Tree Seed. The Standards (revised for the 1960 crop) are modified and outlined below for your convenience.

I. Application and amplification of general certification standards.

A. The General Seed Certification Standards as adopted by the Georgia Crop Improvement Association are basic, and together with the following specific standards, constitute the standards for certification of forest tree seed.

B. The term "field" as used in the General Seed Certification Standards shall be interpreted to include "stand" and "orchard."

II. Land requirements.

Site index (50 years) shall be at least 75 feet for pine species. III.

Inspections.

A. Field inspections.

1. An initial field inspection must be made at least 21 months prior to seed collection. A second inspection must be made within 90 days prior to cone collection. During the second inspection, the inspector will make an estimate of cone production, which will become confidential information to the GCIA.

2. Inspections will be required only in years in which certified seed production is planned after the initial *inspections,* provided that subsequent inspections shall be not more than 5 years apart.

3. Inspections may b e made at any time during cone collection, seed extraction, and cleaning without prior notice.

B. Off type trees.

1. Off type trees must be marked at the time of inspection and felled while the inspector is on the area. If these trees are felled at a later date, a re-inspection will be required.

2. Crook will be acceptable in trees only if it is accountable.

3. Sweep will be acceptable if it occurs in one plane only and deviates from a line from the center of a 4-inch merchantable top to the outside of the butt, NOT MORE THAN ONE INCH FOR EACH TEN FEET IN TOTAL HEIGHT.

C. Final dates for filing.

October 15: Forest trees initial inspection at least 21 months prior to seed collection.

June 1: Forest trees; annual inspection.

D. Annual inspection.

Inspection for Forest Tree Seed is required only in years in which seed collections are to be made, provided that the last inspection prior to this was within 5 years.

E. Official testing.

Forest tree seed will be tested by: Region Eight Seed Testing Laboratory, P. 0. Box 1183, Macon, Ga.

F. Inspection fees. Fees are payable at the time of application for inspection.

1. Membership fee--GCIA	$1.10 per year
2. Farm fee (covering all production under a single managership)	8.25 per year
3. *Acreage fee--first 25 acres in one county..	2.00 per acre
In excess of 25 acres in one county....	1.00 per acre

(*Where individual trees are inspected, the minim= fee shall be for one acre. The acreage fee may be figured at the rate of one acre per tree or the gross acreage occupied by all trees inspected. The lower figure will be used to determine the total acreage fee.)

G. Specific requirements.

1. Seed producing areas.

a. Stand selection.

The stand must initially contain a minimum of one hundred (100) trees per acre of the desired species that are at least 10.0 inches d.b.h., or a minimum basal area of 50 square feet. The stand shall be even-aged and shall not have been previously thinned except where a record is available to show that thinning was from below.

b. Stand treatment.

(1) Roguing.
All pest infected trees are to be cut and removed from the area. All trees of below average vigor (growth rate) and form must be removed. A11 trees having above average branch size must be cut. All trees having spiral stems or forks must be removed.

(2) Stand composition.
Only trees of average or above in vigor and form, and average or below in branch size, and free from pests shall remain.

(3) Isolation strip.
The area shall be free of contaminating pollen. An isolation strip shall be maintained. A strip 400 feet wide adjacent to the production area shall be free of all species of trees which will cross pollinate naturally with the species of the production area. Exception: This strip may contain trees of the same species providing that it meets the standards of roguing and stand composition of the production area.

2. Seed orchards.

a. Stand composition.

The stand will be composed of at least 15 clones of trees. The identity of each tree shall be known and records of the ortet (or parentage in the case of seedling stock) shall be available for inspection. The arrangement shall be such as to maximize cross pollination between clones.

b. Progeny tests.

All clones in a seed orchard must be progeny tested before certified seed, Class I, can be produced. The records of each progeny test shall be available to the Georgia Crop Improvement Association, and at their discretion they may refer these records to proper authorities for evaluation.

The field plots of the progeny tests must be maintained until such time as the requirements of the Georgia Crop Improvement Association are satisfied.

c. Certification.

Prior to completion of progeny tests and qualification for certified seeds, Class I, seed which are produced in seed orchards, may be sold as certified seed, Class II, provided that all ortets or individual trees meet the standards for "select trees."

d. Isolation.

A minimum of 100 feet surrounding the orchard shall be free of all trees producing contaminating pollen.

3. Superior or elite trees (including varieties).

a. Individual characteristics.

A tree must possess certain characteristics, such as superior growth, gum yield, specific gravity, etc., which can be described and must be capable of being differentiated from other trees of the same species.

b. Progeny tests.

All trees must be progeny tested before certification. The progeny tests and records shall be handled as for seed orchard clones.

c. Certification.

Open pollinated seed may be certified Class II if a 100foot isolation strip is rogued of all diseased and defective trees (seed producing area standards). Controlled pollinated seeds may be certified Class I provided the cross presented for certification has been progeny tested.

d. Identification.

Each tree shall be marked with a band of paint not less than 6 inches wide containing identifying numbers and/or letters. The records for each tree shall contain a complete description of the tree and a map showing its exact location.

4. Select or plus trees.

a. Selection.

A tree mist possess certain characteristics, such as superior growth, gum yield, specific gravity, etc., which can be described and must be capable of being differentiated from other trees of the same species. This category shall be the phenotypic equivalent of "Superior or elite trees" prior to progeny testing. This will be phenotypic selection.

b. Stand treatment.

An isolation strip 100 feet wide around each tree shall be rogued of all diseased and defective trees (seed production area standards).

IV. Field standards.

A. General.

1. Definitions.

The term cone shall include the seed contained therein. The term scion shall include all materials for vegetative propagation of a clone.

2. Unit of certification.

An area or a portion of an area may be certified. The portions of an area not meeting certification requirements shall be delineated with a painted boundary mark (color contrasting with other boundaries), and cones produced on the disqualified area may not be collected. A clear and distinct boundary line will be marked with paint between an area and its isolation strip.

3. Isolation requirements for pine species:

	Isolation required for certified class		
	I (feet)	II (feet)	III (feet)
Seed producing areas	---	---	400
Seed orchards	400	400	---
Superior or elite trees (including varieties)	0	100	---
Open pollinated select trees	---	---	100

V. Seed standards.

A. Germination tests.

Tests will be acceptable only from laboratories approved by GCIA. Tests must have been completed within 6 months prior to shipment of seed and the seed must have been stored in airtight moisture proof containers at moisture content less than 10 percent and temperature below 32°F. from the time of sampling until shipment.

B. Lot sire.

No lot of tree seeds may contain more than 1,000 (plus or minus 100) pounds.

C. Specific requirements.

Factor:	Standard (percent)
Pure seed (minimum)	98
Other species or varieties (maximum)	0
Inert matter (maximum)	2
Germination (minimum apparent)	75
Stratification	1/
Percent full seed	1/
Speed of germination (as percent of total germination):	
Loblolly pine (*Pinus taeda* L.) at 14 days	95

	Standard (percent)
Longleaf pine (P. palustris Mill.) at 12 days.	90
Shortleaf pine (P. echinata Mill.) at 14 days.	95
Slash pine (P. elliottii Engelm.) at 14 days..	95
White pine (P. strobus L.) at 20 days.........	95

1/ Specify on tag.

VI. Approved seed.

A. Seed may be collected from designated individual trees. These trees shall be equivalent in growth, quality, and pest resistance to those permitted in seed production areas.

B. No isolation strip or waiting period before seed collection shall be required.

C. Field inspection will be required prior to seed collection..

D. These seed shall meet the Seed Standards (Section V) for Certified Seed.

E. The Association will issue a tag marked "Approved Seed" for this class of material.

VII. Seed and cone processing.

A. Seed and/or cones should be so handled as to prevent mixture and maintain identity. Each lot of cones or seed shall be identified at all times throughout processing.

B. Lots of cones shall be isolated in drying by seed proof barriers to prevent mixing of seed as the cones open. All drying racks, bins, areas, etc., shall be thoroughly inspected and cleaned prior to use.

The basis for this program and its administration is described in an article printed in the Journal of Forestry, vol. 57, No. 2, February 29, 1959. Excerpts from it are reprinted below:

February 8, 1958, marked the final acceptance of Certification Standards for Forest Tree Seed by the Georgia Crop Improvement Association. This action climaxed more than 2 years of work by a committee of the Georgia Chapter of the Society of American Foresters. These Standards provide the means for the introduction and control of high genetic quality tree seed in the Georgia market.

In 1956, the Georgia Legislature passed two bills which encouraged the establishment of Certification Standards. One bill (H.B.195) provided for the licensing of seed dealers and the labeling of seed. H.B.1Ot established the College of Agriculture of the University of Georgia as the legal certifying agency, with the Georgia Crop Improvement-Association as its agent to administer the program. The Crop Improvement Association is a nonprofit corporation, and is supported and controlled by its members. Most States have similar associations, which deal with agricultural seed. The Crop Improvement Association is organized into 6 commodity groups, 1 of which is forestry. Each group has a Crop Improvement Committee, which considers any changes in the standards and the addition or deletion of species or cultivars from the eligible list. Their annual meeting is open to the public and anyone can enter the discussions. The Committee recommendations are then transmitted to the Board of Directors for final action. A Certification Committee rules on disputes between producers and the Association, and an Advisory Committee aids in guiding the long-range objectives of the Association. Representatives of forestry interests are members of these committees and of the Board of Directors.

Inspection fees are set to cover the cost of the inspection and are kept as low as possible. Basic membership and farm fee total $9.35, and an acreage fee is assessed at the rate of $2 per acre for the first 25 acres in *one* county and $1 per acre for those above 25. Fees must be paid at the time of application for *in*spection. At present *only* the four major species of southern pines are eligible for certification; other species will be added as the need arises.

The goal of this program is to have all seed and seedlings planted from material of highest genetic quality. As Class I seed become available, Class III and finally Class II seed will be dropped from the Standards. The final exclusion of Class III and Class II seed will require a waiting period of several years, pending the completion of progeny tests. New techniques in progeny testing are expected to speed up the completion of tests, especially in the field of wood quality, and these developments will make possible the large-scale production of Class I seed in the not-too-distant future.

Further information about Georgia's program can be obtained from The Georgia Crop Improvement Association, Hoke Smith *Annex,* University of Georgia, Athens, Ga.

PORTABLE AUTOMATIC CONE KILN

Karl B. Lanquist
Nurseryman, Shasta Nursery, U. S. Forest Service Mt. Shasta, Calif

Editor's note. U. S. Patent No. 2,825,153 has been assigned to the United States of America by Karl B. Lanquist, for a portable automatic cone kiln that he invented (fig. 1). The kiln consists of an electrically heated metal box enclosing a tumbling cage for the cones. A time clock on a motor automatically causes the cage to revolve for a desired interval, such as 10 minutes during each hour (fig. 2). Infrared bulbs generate heat controlled by a thermostat.

The novel patentable feature of this kiln lies in its having double sheet metal walls about 1 inch apart. Since the outer wall is always cooler than the inner one, moisture driven from the cones condenses on it and runs to the bottom of the box where it drains through weep holes.

Seed shaken from the cones collect in a tray lying in the bottom on the inner wall.

The portable automatic cone kiln can be made smaller or larger depending on the circumstances. It takes about 8 to 10 hours to dry pretreated cones. The capacity of the kiln is 3 bushels of Jeffrey pine, 31 to 4 of ponderosa pine, or 5 of Douglas-fir or similar sized cones. The cones should not be put in green, but should be dried in sacks for 2 or 3 days. The kiln is entirely automatic: a time clock turns the tumbler on once an hour. It runs for about 10 minutes, and then shuts off. This operation is repeated during the process. The thermostat is set at 120F., apparently a good drying temperature. The thermostat is adjustable, as is the time clock.

The kiln is portable so that it can be moved from place to place on a stake-side truck. The capacity of the present kiln is not great, but if more kiln space is needed, a similar larger kiln could be made, or a battery of small kilns could be set up and operated efficiently and economically. We have manufactured several kilns lately in California, and the bid price for construction was somewhat over $1,000 each.

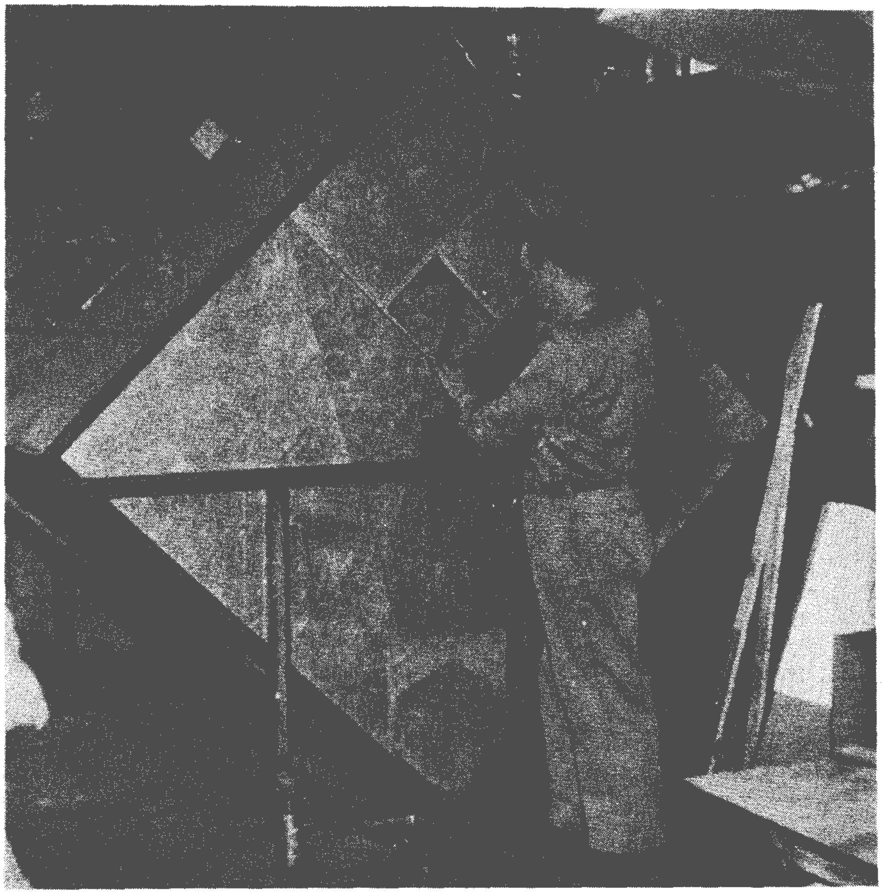


Figure 1. End view of kiln.

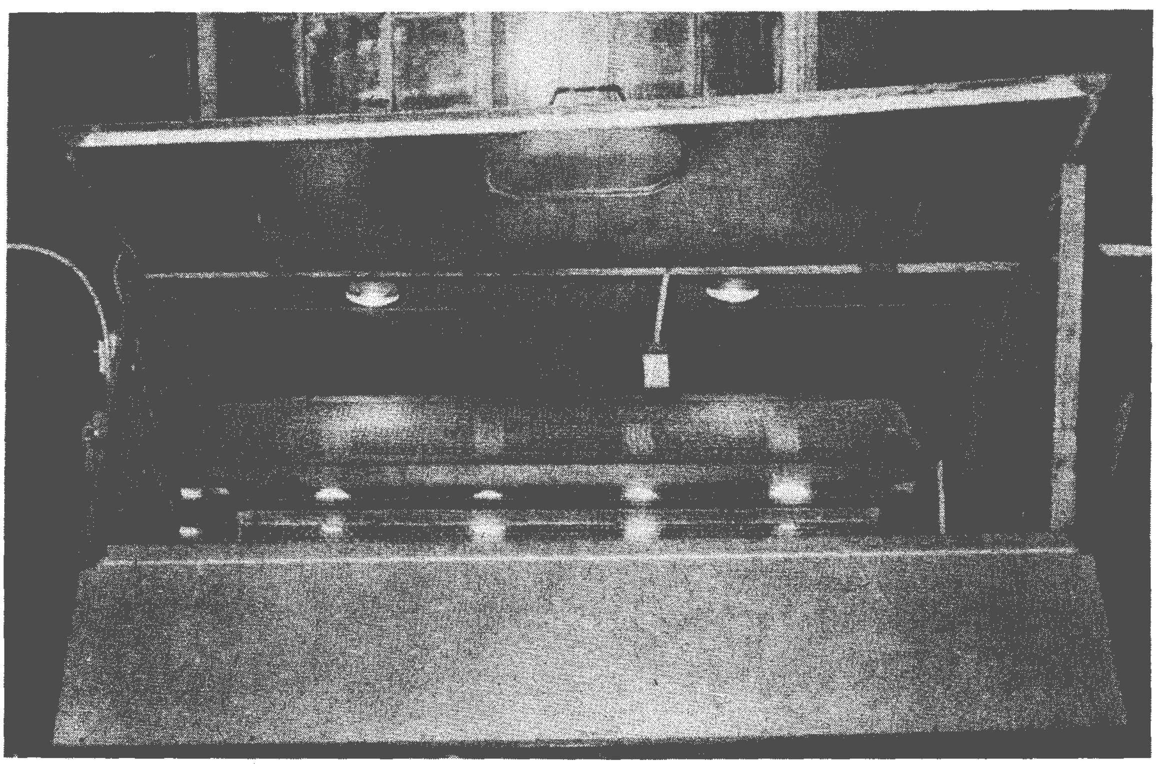
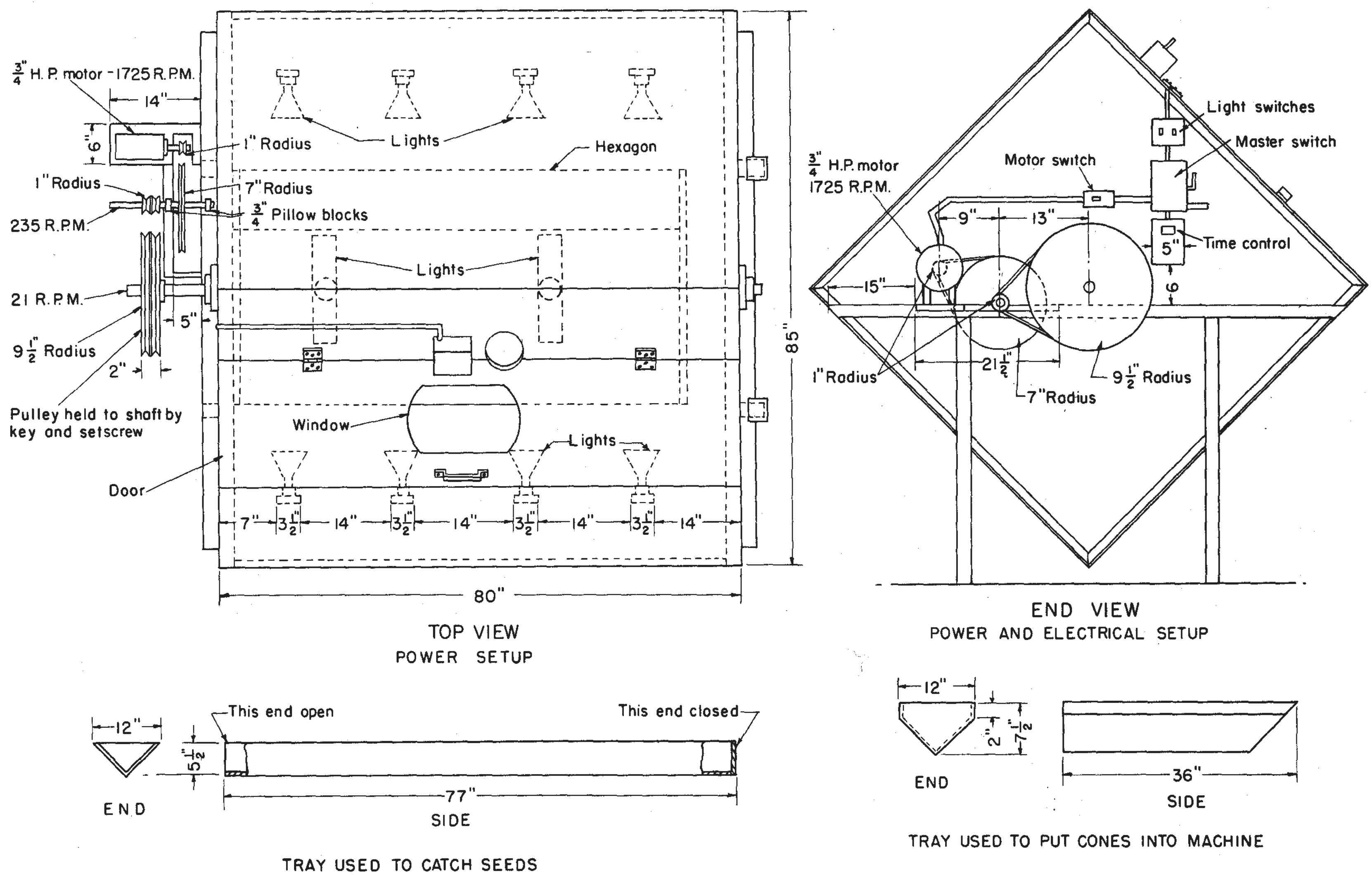


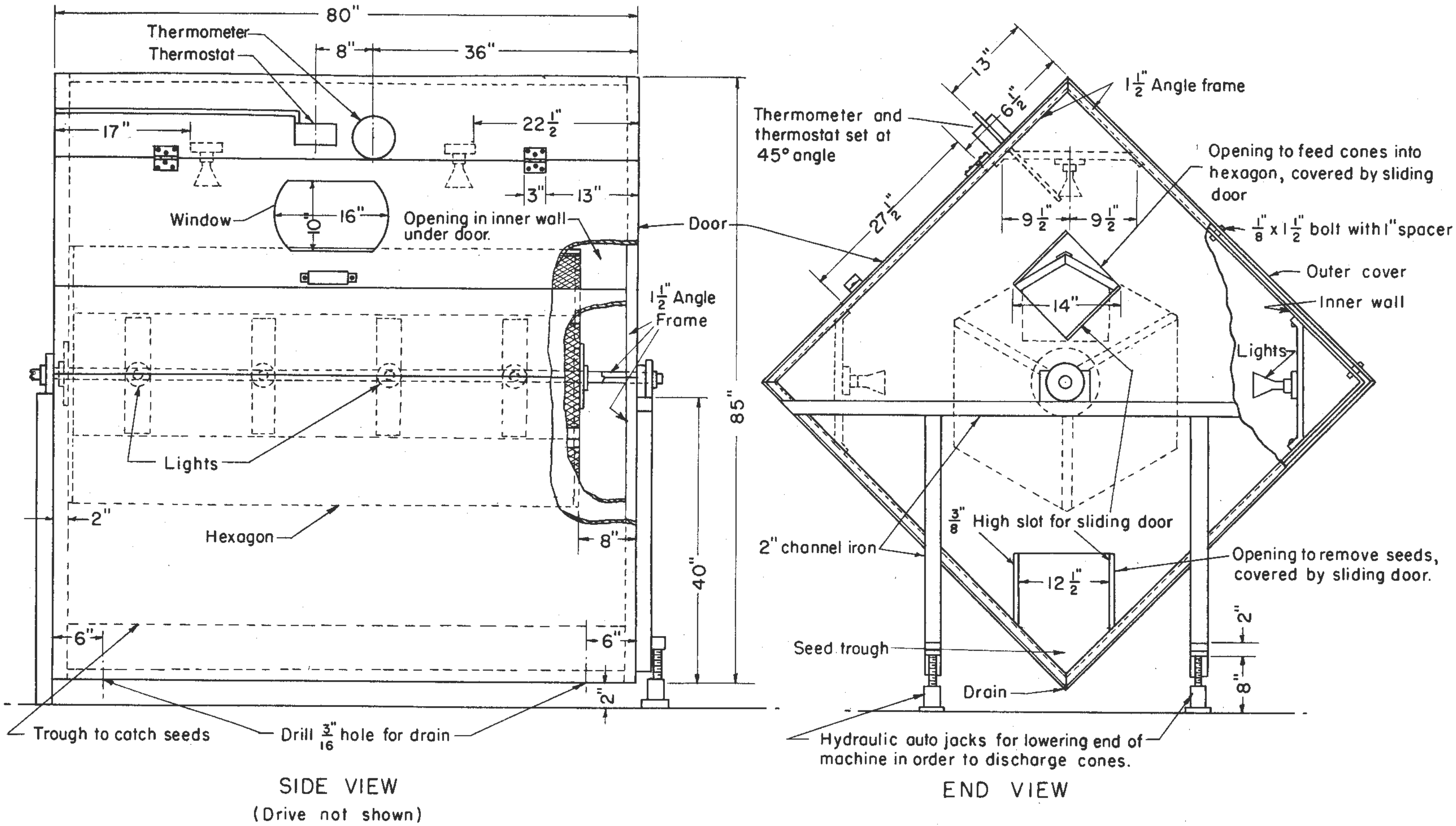
Figure 2. Interior view of kiln showing portion of hexagonal tumbling cage for cones and some of the infra-red heat lamps.

12



$\frac{3}{4}$" H. P. motor - 1725 R.P.M.
14"
6"
1" Radius
Lights
Hexagon
1" Radius
7" Radius
$\frac{3}{4}$" Pillow blocks
235 R.P.M.
Lights
21 R.P.M.
5"
$9\frac{1}{2}$" Radius
2"
Pulley held to shaft by key and setscrew
Window
Lights
Door
7"
$3\frac{1}{2}$"
14"
80"
85"
TOP VIEW
POWER SETUP
$\frac{3}{4}$" H.P. motor
1725 R.P.M.
Light switches
Master switch
Motor switch
9"
13"
15"
5"
Time control
6"
1" Radius
$21\frac{1}{2}$"
7" Radius
$9\frac{1}{2}$" Radius
END VIEW
POWER AND ELECTRICAL SETUP
12"
This end open
This end closed
$5\frac{1}{2}$"
END
77"
SIDE
TRAY USED TO CATCH SEEDS
12"
2"
$7\frac{1}{2}$"
END
36"
SIDE
TRAY USED TO PUT CONES INTO MACHINE

Figure 3.

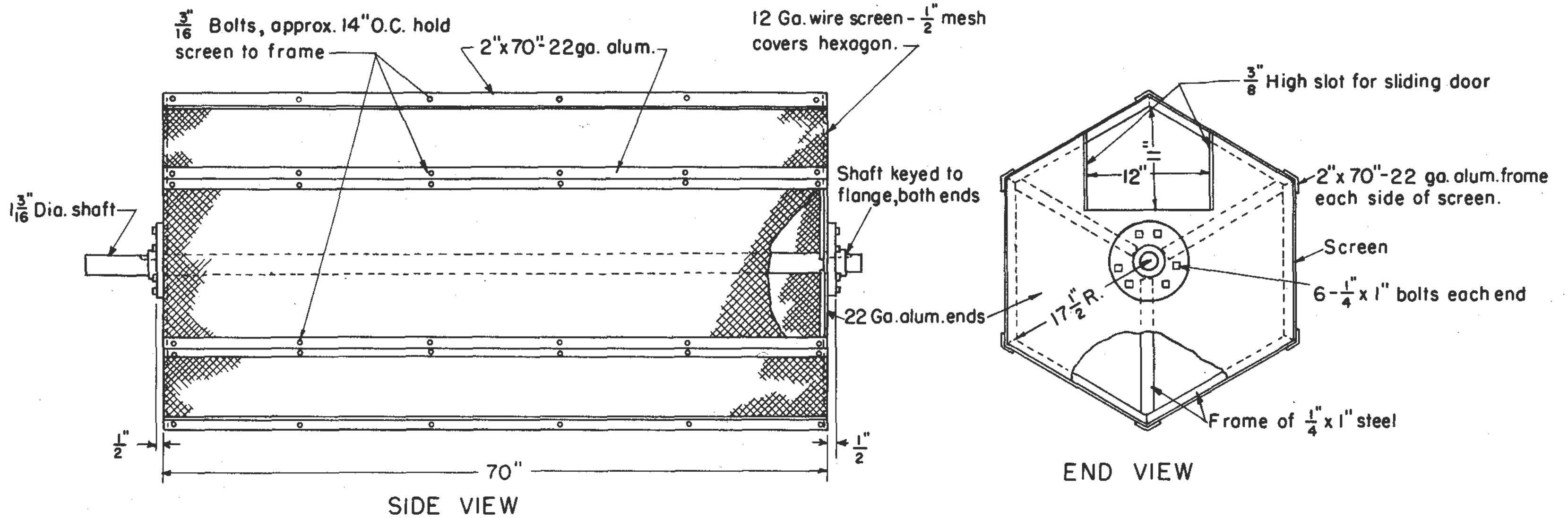


Notes: Outer covering of 22 ga. galv. steel, held to angle iron frame by 1/8" stove bolts 12" apart.

Inner wall of 22 ga. aluminum, spaced from outer cover by 1/8" x 1 1/2" stove bolts with 1" spacers, this space needed for condensation.

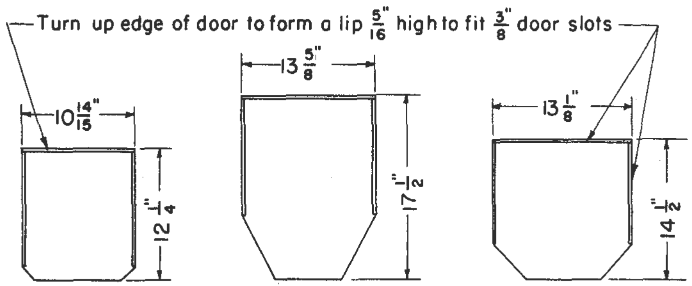
Light fixtures held to inner wall by 4 sheet metal screws. Each fixture holds a G. E. 250w infrared pyrex bulb.

Figure 4.



HEXAGON REMOVED FROM MACHINE

Note; Capacity of hexagon.
3 Bu. Ponderosa pine
5 Bu. Douglas-fir



SLIDING DOORS
ONE EACH SIZE REQ'D.
22 GA. GALV. STEEL

BILL OF MATERIAL OF STOCK ITEMS			
QUANTITY	NAME	SIZE	REMARKS
2	Link belt	1 3/16"	
10	Infrared bulbs		250 watts
1	Temp. guage	5" dia. dial - 12" stem	Weston heavy duty
2	Pillow blocks	3/4"	
1	Time control		Form Master
1	Pulley	1" R. - 3/4" bore	Two groove
1	Pulley	9 1/2" R. - 1 3/16" bore	Two groove
1	Pulley	1" R. - 3/4" bore	Single groove
1	Pulley	7" R - 3/4" bore	Single groove
1	Electric motor	3/4" H.P.	1725 R.P.M.

Figure 5.

ELIMINATION OF EMPTY OR BLIND CONIFEROUS SEED BY SPECIFIC GRAVITY SEPARATION[1]

George L. Switzer[2]

The removal of empty or blind seed in the processing of large lots of coniferous seed is an old problem, mainly because such seed are difficult to distinguish from those that are sound or full. As a consequence, they are not classed as impurities in the seed lots. However, their removal is common practice in processing most agricultural seed. One method employs a specific gravity-separator, commonly called a gravity table. This note presents a short report on the application and results of such separation with a lot of loblolly pine (Pinus taeda L.) seed.

A 440 pound lot of dewinged and cleaned seed collected on the Northeast Mississippi Experimental Forest in 1957, and averaging 65.8 percent sound seed, was passed over a gravity table employing a wire deck. Welch[3] describes this separator. Essentially the seed pass over an inclined reciprocating deck where two motions shake them up and down and back and forth. Air passing through the deck floats the seed so that they become stratified with the heavier seed on the bottom. These seed move up an incline and thus are separated. Seed were collected at six different positions as they passed off the deck. These seed separates were then dried to 7 percent moisture content, and samples of each separate taken before the lot was placed in storage.

The results of cutting tests conducted on 100-seed samples from each of the gravity table separates and replicated six times are reported as follows:

Gravity table separate:1/	Sound seed (number)
1	100.0
2	99.7
3	96.2
4	84.5
5	35.7
6	0.0

1/ L.S.D. to compare separate means at the 0.05 and 0.01 levels are 4.5 and 6.1 respectively.

1 Mississippi Agricultural Experiment Station, Journal Contribution No. 749.

2 Associate professor, Mississippi State University, School of Forestry. The author is indebted to personnel of the Mississippi State University, Seed Technology Laboratory, for assistance in the separation.

3 Welch, G. B. Seed processing equipment. Miss. Agr. Expt. Sta. Bul. 520, 22 pp., 1954.

These data show the effectiveness of the process as a means of empty or blind seed removal. If desired, further refinement of the fourth and fifth position separates could possibly be effected by again processing these separates.

Further results from average weight-per-bushel (Winchester) determinations of the gravity table separates are as follows:

Gravity table separate: 1/	Weight per bushel (pounds)
1	47.3
2	43.0
3	39.7
4	36.4
5	32.3
6	25.0

1/ L.S.D. to compare separate means at the 0.05 level is 1.6.

These data when combined with those given for sound seed by gravity table separates have meaningful implications on storage and sowing problems and results (table 1). For example, they show, for this seed lot, that through the elimination of seed collected at position 6 alone, a reduction of approximately 11 and 18 percent, respectively, is made in the weight and volume of seed requiring storage. Nonassessable is the value of this removal in lots used for nursery sowings or direct seeding.

This further processing of seed is not lengthy or laborious, the entire 1140 pound lot being processed in less than 30 minutes. In view of the above cited data, the process appears to warrant adoption by the tree seed extractories.

Table 1. The relationship of gravity table separates to the weight and volume of the original seed lot

Gravity table separate	Weight		Bushels	
	Pounds	Percent	Number	Percent
1	144	32.8	3.1	27.7
2	134	30.5	3.0	26.8
3	53	12.0	1.3	11.6
4	27	6.1	0.8	7.1
5	33	7.5	1.0	8.9
6	49	11.1	2.0	17.9
Total	440	100.0	11.2	100.0

COLLECTING CAN FOR SMALL TREE-FRUIT

John W. Andresen
Department of Forestry Michigan State University
East Lansing, Mich.

Many forest trees, as well as a great variety of ornamental trees and shrubs, bear fruit that is rather small and difficult to collect. The pomelets of numerous species of the Rosaceae; the small woody or semi fleshy cones of Juniperus, Tsuga, Anus, and Chamaecyparis; and the drupes of Cornus , Sassafras, and Viburnum are representative groups of small fruits. Collecting may be difficult because of stiff, sharp thorns, excessive height or crown spread, and brittle or flexible branches that would be risky to climb

The collecting can illustrated in figures 1 and 2 is designed to facilitate easy *and* rapid collection of small fruit with a minimum of damage to the tree. Actually the idea for the can occurred to me while watching the gathering of cranberries with a cranberry-cradle. Standard 1/614-inch waffle-pattern aluminum sheet was used for the can and cutters. The tines and crossbars were made from 1/8-by 3/14-inch aluminum-bar stock. Total cost of materials was $$3.00, plus 5 hours of labor. The following describes how to construct and assemble tines and can:

1. The Tines.

   a. Cut one 11-inch and six 9-inch bars from an 8-foot piece of 1/8-by 3/4-inch aluminum stock. Taper four of the short bars and the 11-inch piece with a hacksaw or bandsaw and file the lower side of each cut to a 45° angle. The two remaining bars, which will be the outer guides of the tine, assembly., should be cut and beveled on only one edge (fig. 3).1/

   b. Cut two 72 inch bars from the same stock as the tines for the tine braces.

   c. Cut a 4-by 72 inch piece of aluminum sheet. Cut seven 1/8by 2-3/4-inch slots in this piece to form the cutting edges (fig. 3). Snip the ends of the cutters to harmonize with the angles of the tines.

   d. Drill 1/8-inch holes in the tines and tine braces, as indicated in figure 3. The cutters must also be drilled as indicated to receive the rivets, which will fasten them to the tines. In addition, drill three 1/11-inch holes in the 11-inch tine, as shown. During final assembly, drill four 1/8-inch holes in the outside edges of the tine guides to receive the rivets joining the tines and the can. (Location of these rivets can be seen in figure 2.) Postponing the drilling of these four holes will help to allow for error in folding the can.

1 Drawings are by Emil V. Falasky, Jr., graduate student, Department of Forestry, Michigan State University.

2. The Can.

a. From the aluminum sheet, cut a piece 21 by 19-1/8 inches.

b. Lay out pattern of can (fig. !t) on the sheet and after cutting it to shape, score or indent it slightly along dotted lines.

c. Drill the sheet according to the pattern. A wooden backing will prevent the drill from tearing the sheet.

d. With tinshears, snip along the solid lines at B, Bl, C, and C^1.

e. Fold outer tine-tabs along lines D-D1 to form a 90^0 angle, and then fold sides and tabs of the top and back along lines $A-A^1$ to form another 90^0 angle. It may help to start bending the metal on a straight edge of a workbench or a board.

f. Next fold top along line $C-C_1$ and back along line $B-B^1$ at 90^0 angles. A five-sided box will thus be formed. The tabs of the back should be on the outside of the sides, and the tabs of the top should be on the outside of the back tabs (fig. 2).

3. Assembly.

a. Rivet tine braces to tines with 1/8-by 3/8-inch rivets. Then rivet the cutters to the tines with the same size rivets.

b. Fasten the can sides, back, and top together, using the same size rivets.

c. Finally join the tine subassembly to the can by riveting the small tabs to the tine guides.

For field use, the collecting can is bolted to an aluminum or wooden pole, the latter being pierced with 1/1t-inch holes spaced to match those in the can.

To collect pendant fruit, use the can in the position shown in fig. 1. If the fruit is in an upright position, invert can so that tines are toward the ground. In use, the tines should pass close to the fruit clusters and so avoid cutting the twigs. The cutters at the base of the tines will shear the peduncles of the fruit, allowing the fruit to drop into the can. Since the aluminum is "waffled," the fruit will not roll out easily unless the can is tipped forward. A pound or more of small fruits can be collected in the can at one time and then deposited in a larger receptacle.

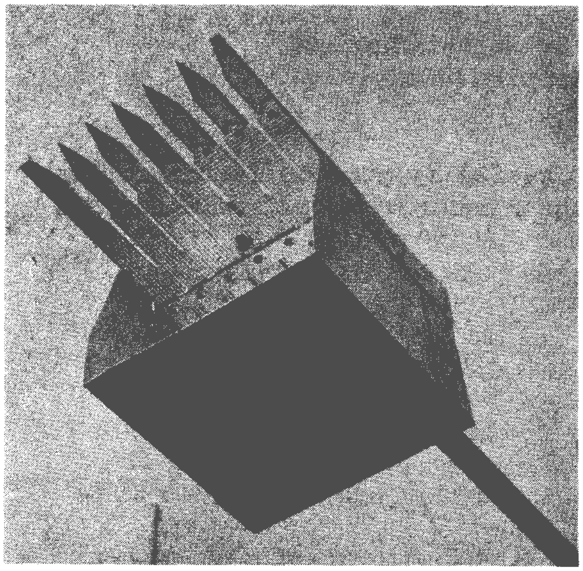


Figure 1. Collecting can showing details of the tine-cutter assembly and open end of can.

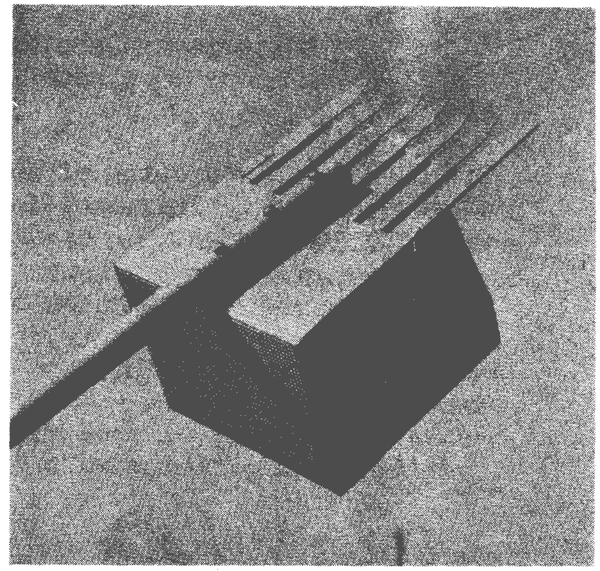


Figure 2. Collecting can showing detail of tabs and pole.

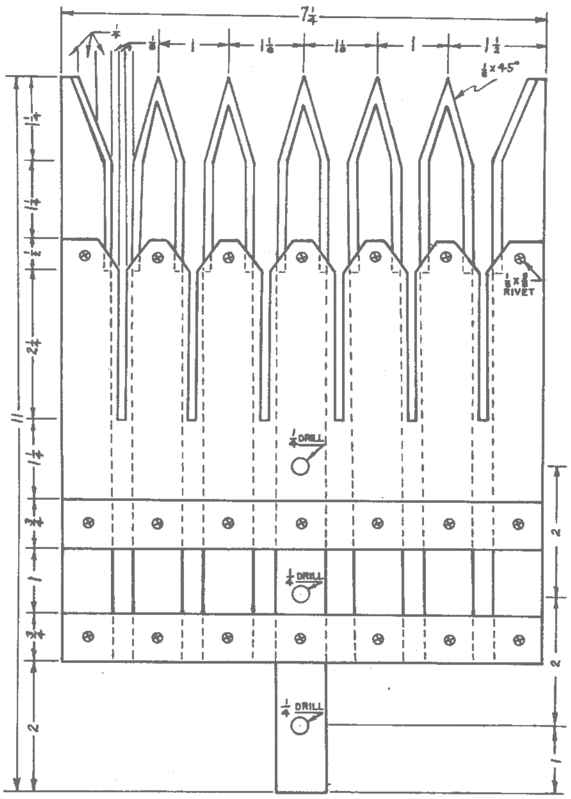


Figure 3. "Inside" plan view of the tine-cutter subassembly. (Dimensions are in inches.)

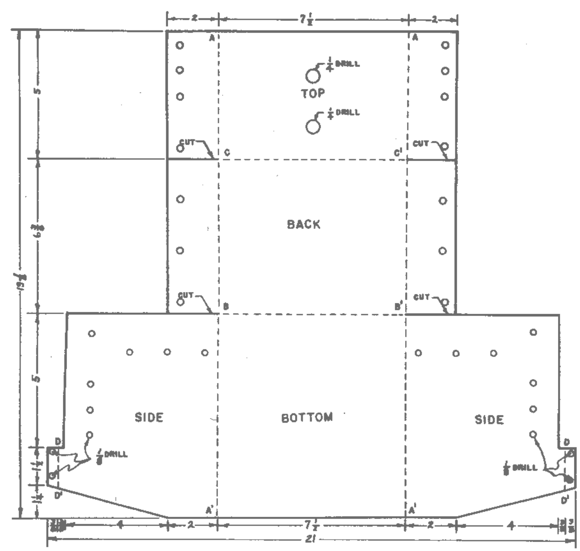


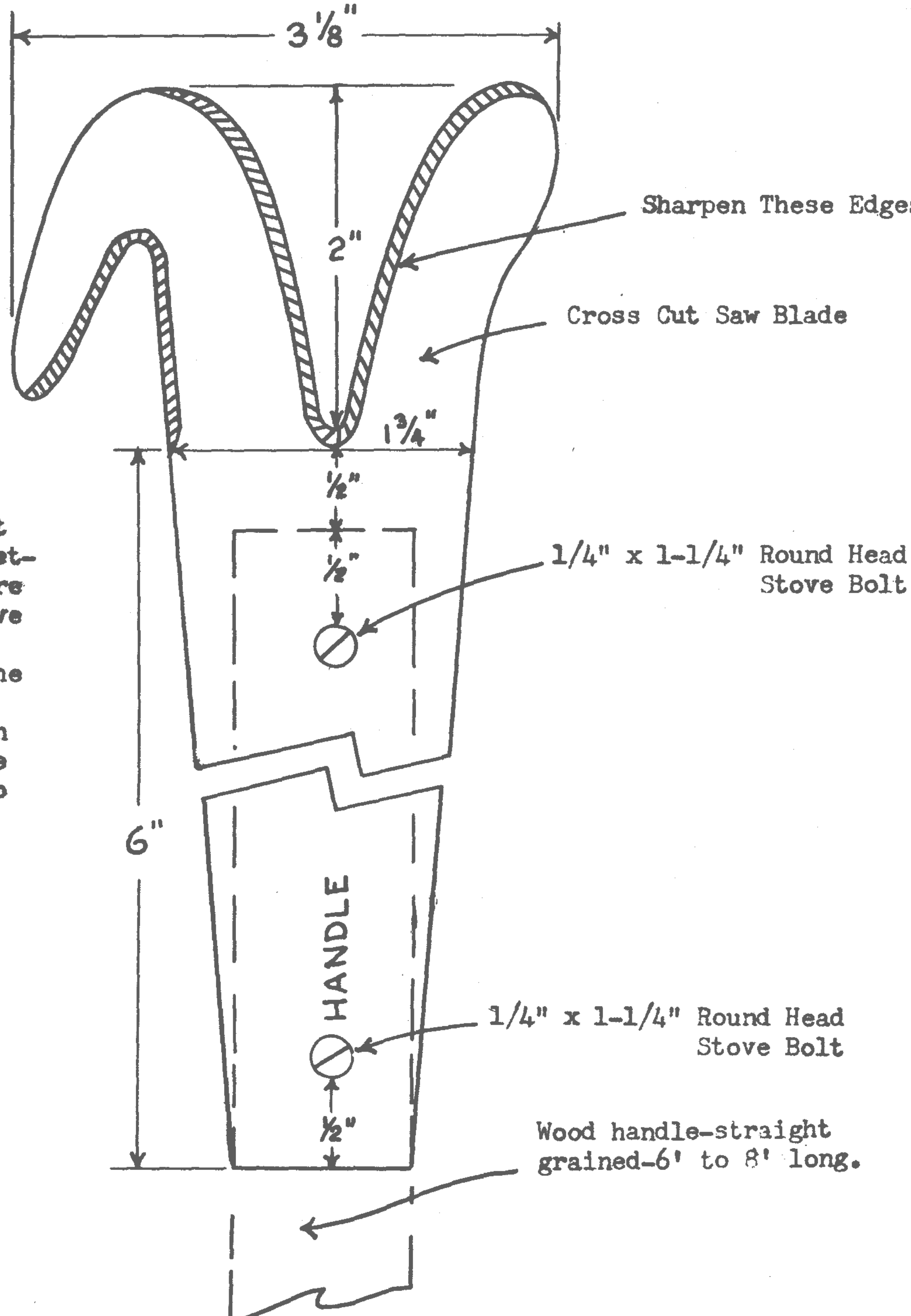
Figure 4. Pattern for can. (Dimensions are in inches.)

ASHE NURSERY CONE HOOK

Johnsey King
Nurseryman, Ashe Nursery, U. S. Forest Service Brooklyn, Mississippi

Given below is a drawing of a hook found useful by cone collecting crews at Ashe Nursery. This tool is made in the nursery's shop from discarded crosscut saw blades.

The cone hook is cut from an old cross cut saw blade with an acetylene torch. Holes are drilled for 1/4" stove bolts. The handle is drilled to fit and the blade bolted to one side. The edges shown are sharpened and the cone hook is ready to operate.



A SIMPLIFIED GERMINATION TEST FOR AMERICAN SYCAMORE

Charles B. Briscoe and Adrian P. DuBarry, Jr.
Louisiana State University School of
Forestry Baton Rouge, La.

As recently as 1951 Putnam (3 p. 37) stated that no seed of bottom land hardwood tree species would germinate under water. A year earlier Baker (1, p.237) had made a similar statement concerning all forest tree seed. In 1957, however, Hosner (2) reported the underwater germination of cottonwood (Populus deltoides and black willow (Salix nigra); the senior author has since confirmed Hosner's work. During recent studies of presowing soaking of sycamore seeds at room temperature (70°-75°F.) underwater germination began after 10 days. Thus another species was added to the list of riverfront species capable of germinating under water when conditions are satisfactory.

Because germination tests in water obviously require less space and equipment than "standard" methods, a study was begun immediately to determine comparability of results. Seed used had been stored approximately 9 months, one lot at 5°F. and the other at 41°. Seed sowed in sand flats was presoaked 48 hours in tap water, our normal presowing treatment. Water used in the underwater tests was tap water, changed at 4-day intervals after germination began. Figures below represent the average of four replications of 100 seed each of American sycamore in sand flats and under water, and give the percent of germination through the thirtieth day after sowing:

Temperature of presowing storage (°F.):	Sowing Medium: Sand (percent)	Sowing Medium: Water (percent)
5	7.25	16.00
41	9.75	23.00
Average	8.50	19.50

Germination tests of sycamore seed in water required less space, less equipment (test tubes instead of bulky seed flats), fewer man-hours (no sterilizing of medium and no daily watering). They yielded a percent of germination highly significantly greater than in sand, providing a more accurate indication of the germination capacity of the seed lot.

LITERATURE CITED

(1) Baker, F. S. Principles of silviculture. McGraw-Hill Publishing Co., Inc., New York. 414 pp. 1950.
(2) Hosner, J. F. Effects of water upon the seed germination of bottom land trees. Forest Science 3(1) 67-70. 1957.
(3) Putnam, J. A. Management of bottomland hardwoods. Southern Forest Experiment Station Occasional Paper 116. 60 pp. 1951.

NURSERY PRODUCTION OF ASPEN SEEDLINGS

D. W. Einspahr
Silviculturist, The Institute of Paper Chemistry
Appleton, Wis.

The introduction of improved aspen (Populus tremuloides and P. grandidentata), polyploid aspen and aspen hybrids, has increased interest in aspen, and made it desirable to work out a method in which large numbers of seedlings can be produced at reasonable cost.

Conventional nursery techniques, satisfactory for large-seeded species, are not suitable for aspen. Aspen seed is extremely small, loses viability rapidly, is susceptible to damping-off and mold damage, is slow growing when small, and can easily be washed from the soil during early growth by raindrop action. These characteristics make development of special handling methods desirable.

Most tree improvement programs working with aspen in the United States and Europe use a method similar to the system described by K. R. Shea and J. E. Kuntz (1956)[1]. Satisfactory germination and survival can be obtained in the greenhouse by planting the seed on small plots or flats using sterilized sand (pH 4 to 5) or sand and sphagnum moss mixtures. The germinating medium is kept moist the first 2 weeks, and when the seedlings are 1 to 2 inches tall, they are transplanted into plant bands, and when they reach a height of 5 to 8 inches, into the field. This has been a very satisfactory procedure for experimental material but does involve considerable labor and greenhouse space.

METHODS

A preliminary field trial made in the summer of 1956 indicated that suitable germination and survival could be obtained if the seed was started on sterilized acid sand, watered regularly, and the young seedlings protected from the washing action of rain.

Based on this preliminary trial, 11 seedbeds were established in the spring of 1957. The seedbeds were shaped up by using side boards (fig. 1), and nursery soil was fumigated with methyl bromide prior to the application of the sand-germinating medium. After fumigation, the surfaces of the beds were leveled and covered with a layer of acid sand (pH 4.5 to 5.0). The sand-germinating medium in five of the seedbeds was sterilized in an autoclave (15 pounds, 45-minutes) prior to application. Untreated sand was used in the remainder of the seedbeds. In six of the beds, water was provided by a gravity system employing a muslin-wrapped, rigid plastic soaker hose running down the middle, and in the remaining 5 beds, water was applied manually by spraying the beds periodically with a fine spray nozzle attached to a garden hose.

1 Shea, K. R., and Kuntz, J. E. Prevention of damping-off of poplar seedlings. Forest Sci. 2:514-57. 1956.

The beds were 12 feet long and 2 feet wide, and a plastic-covered screen protected the seedlings from raindrop action. Daily watering was required when the days were sunny, and after the covering frames were removed in early July, watering was required about twice a week. Soluble fertilizer was applied each week after the seedlings reached a height of 1 to 2 inches.

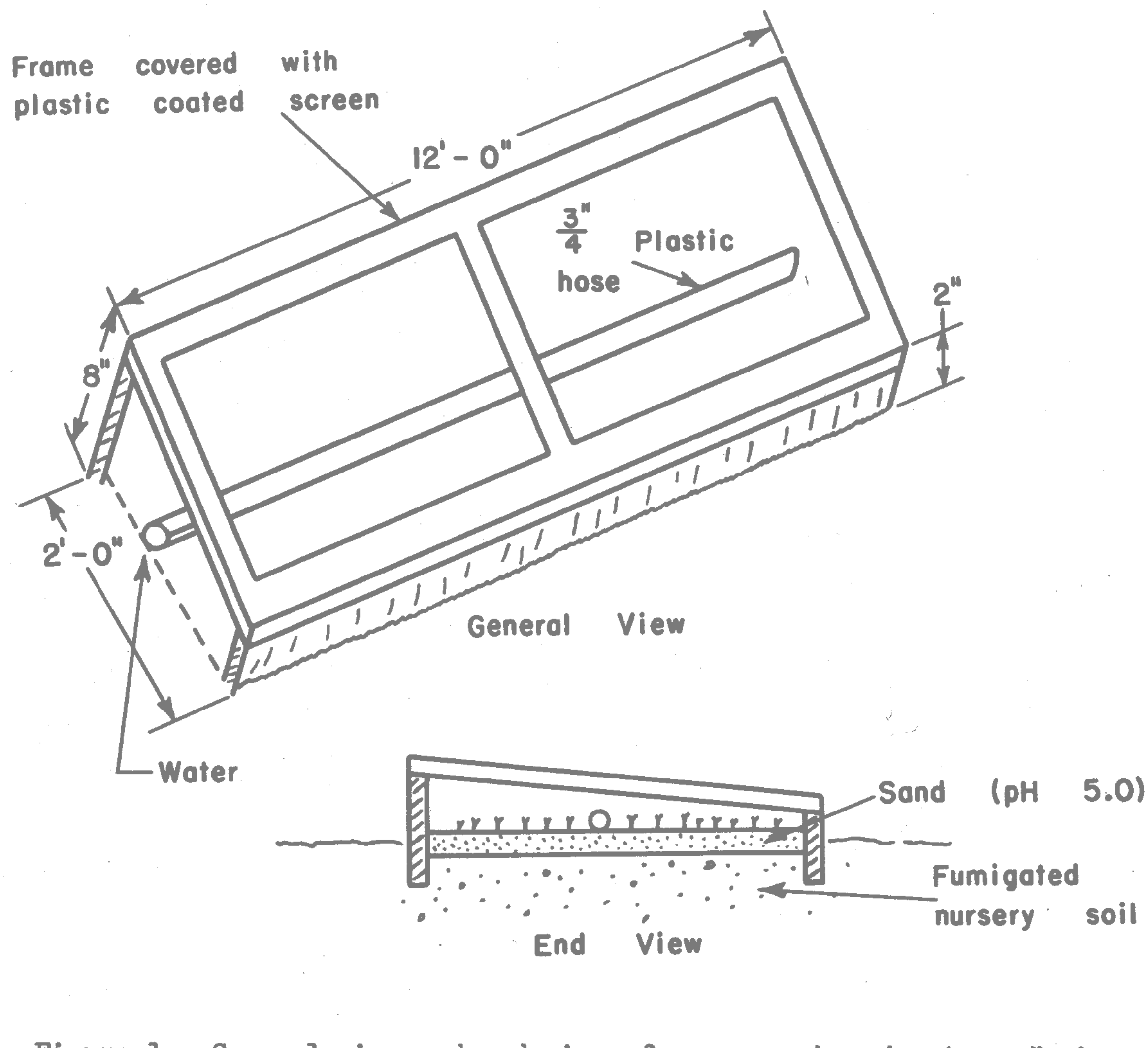


Figure 1. General view and end view of an aspen broadcast seedbed.

RESULTS

Observations on growth and survival indicate that seedlings suitable for field planting can be produced in one season by the above, described method. Seedbed densities ranged from 15 to 20 trees per square foot, and seedling heights varied from 12 to 18 inches for quaking aspen and 14 to 20 inches for bigtooth aspen (fig. 2). Further observation in this trial indicates that sterilization of the germinating medium is required for bigtooth aspen. For quaking aspen, sterilization gives satisfactory results but does not appear to be absolutely necessary.

Manual watering with a fine spray and the use of a soaker hose were the two watering methods employed. The results obtained indicate that manual watering is superior. Although the time required was a little greater, the fine spray method resulted in more uniform germination and growth.

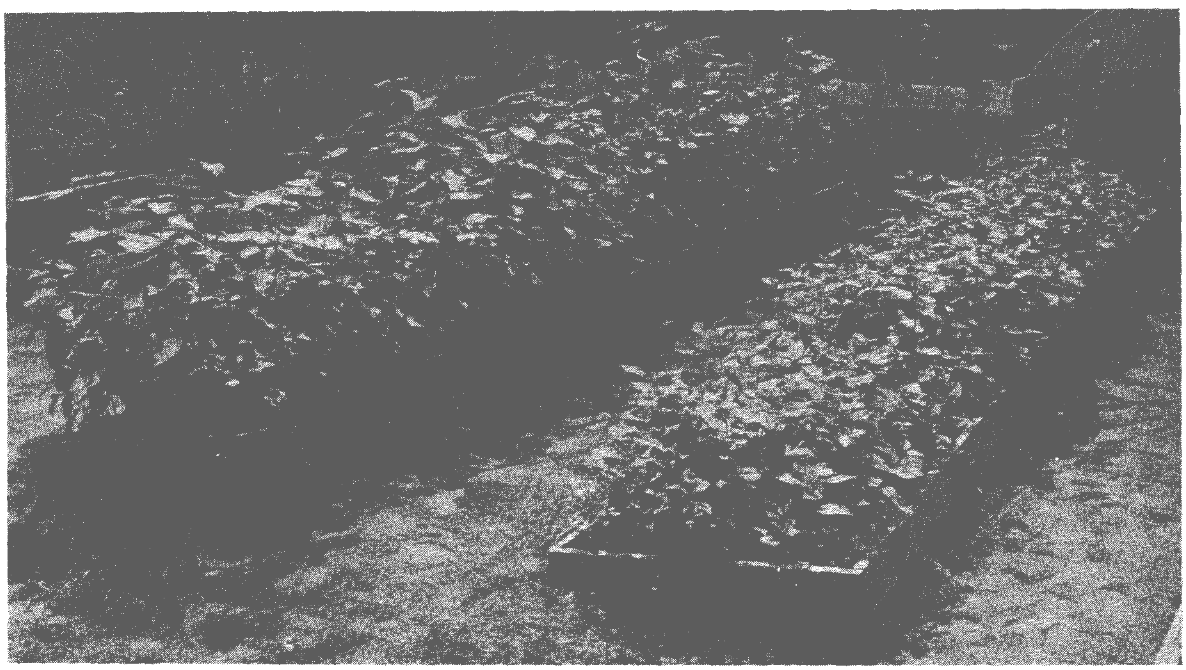


Figure 2. Seedlings: Left, bigtooth aspen; right, quaking aspen; growing in broadcast seedbeds in late August.

ROOTING OF SLASH PINES IN OPEN HOTBEDS[1]

J. T. Greene and M. Reines
Forest Genetics Research
School of Forestry
University of Georgia
Athens, Ga.

Seeds very often offer the easiest and least expensive means for the-reproduction of species. Seedlings, however, usually vary more or less in their characteristics and, therefore, cannot be depended upon to develop as plants that are genetically identical to their maternal parents.

Cuttage is used to reproduce like plants. A plant so reproduced is similar in all respects to the maternal parent, although bud variants or sports appear occasionally. The production of uniform plants by cuttage would be a valuable tool in the establishment of seed orchards and in studies of site relationship and clonal performance, if it could be accomplished-with facility. However, slash pine cuttings are generally difficult to root.

An extensive literature review appears in Mergens' report on vegetative propagation of slash pine.[2] The present paper reports results from investigations on rooting of slash pine (Pinus <u>elliottii</u> var. <u>ellottii</u> Little and Dorman) in open hotbeds.

All cutting material was obtained from slash seedlings growing in the University of Georgia Forestry School Nursery at Athens, Ga. Stem cuttings from 37 two-year-old slash pine seedlings were inserted in open beds on June 17, 1957. A wound was made on one side at the base of the cuttings. A 1-inch slice of bark was removed immediately before treatment. The wounded tissue was dipped in a 0.3 percent indolebutyric acid in talc.

The outdoor propagating beds were 8 feet long by 4 feet wide by 2 feet deep. Three inches of crushed stone were spread in the bottom of the pit for drainage, and over this three inches of stable manure. The manure was a source of heat. The beds were then filled with 2 parts of sifted soil (old field), 1 part of sand, and l part of old sawdust (25 years).

The cuttings were inserted in the soil to a depth of 15 inches and watered twice weekly. A solution of fermate (1 tablespoon of fermate power to 1 gallon of water) was applied immediately after watering. The cuttings were shaded with plastic screening that gave approximately 40 percent shade. After 170 days, cuttings were examined and 77 percent had rooted.

This method presents an alternative to expensive greenhouse installation.

1 In cooperation with the Georgia Forest Research Council, the Georgia Forestry Commission, and College Experiment Station, University of Georgia, Athens, Ga.
2 Mergen, F. Vegetative propagation of slash pine. U. S. Forest Service, Southeast Forest Expt. Sta., Station Paper 54, 63 pp. 1955.

REPRODUCTION OF LONGLEAF PINE OUTSIDE ITS NATURAL RANGE

J. T. Greene and M. Reines
Forest Genetics Research
School of Forestry
University of Georgia
Athens, Ga.

Longleaf pine (Pinus palustris Mill.) is one of the valuable southern pines. The outstanding advantages of this species in timber growing are its resistance to such destructive agencies as fire and certain insects and diseases (e.g., tip moth and rust canker), and its tolerance of poor soil and heavy working for turpentine. The tree develops a thick fire-resistant bark early in life. Relatively rapid natural pruning, a pronounced dominance beginning in the sapling stage, and adaptability to the production of large clear timbers are other important desirable characteristics.

The natural range of longleaf pine, however, is limited to the South Atlantic and Gulf Coastal Plains extending to the foothills of the Appalachians in Northern. Alabama and Georgia (1, 4).

According to Tourney and Korstain (3), "The limits of the natural range of a species are largely a matter of its capacity to reproduce. The range of a species can usually be extended by planting, but when so extended, it does not reproduce, and in time the natural range is reestablished, although the trees may live and grow to fair size."

Slash pine (Pines elliotttii var. elliottii Little and Dorman) has been reported capable of reproducing itself, outside its natural range (2, 1).

Plantations of longleaf pine were established at the George Foster Peabody School of Forestry, Athens, Ga., in 1936. Athens is approximately 60 miles northwest of the nearest natural limits of longleaf pine. Records show that the seeds used at Athens originally were collected near Cameron Hill, Harnett County, N.C. in 1935.

During the fall of 1955, cones were collected from three of the trees in the plantation. The seeds were extracted and planted in the spring of 1956, and an average of 56 percent germination was recorded. The seedlings were outplanted in 1957 for further observations. In 1956, naturally regenerated seedlings were growing under one of the longleaf pines on the border of the plantation (fig. 1).

The production of cones, germination percentages, and the natural reproduction of the seedlings indicate that longleaf pine can produce viable seed and may establish itself outside its natural range.

1 Work done in cooperation with the Georgia Forest Research Council and the Georgia Forestry Commission. A contribution from the College Experiment Station, University of Georgia, Athens, Ga.

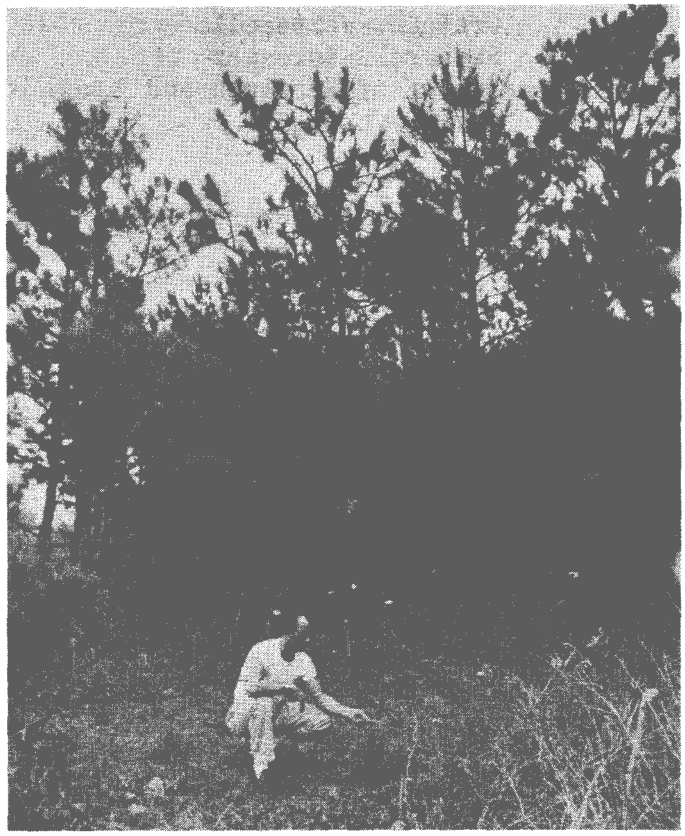


Figure 1. A naturally regenerated longleaf pine.

LITERATURE CITED

(1) Harlow, W. M. and Harrar, E. S. Textbook of Dendrology, Ed. 2. McGraw, Hill Publishing Company, Inc. 1941.

(2) Livingston, K. W. Reproduction of Slash Pine Outside Its Natural Range. Jour. Forestry 54: 532. 1956.

(3) Tourney, J. W. and Korstain, C. F. Foundations of Silviculture Upon an Ecological Basis. Ed. 2. John Wiley and Sons, Inc., New York. P. 47. 1937.

(4) Wahlenberg, W. G. Longleaf Pine. 429 pp. illus. Washington, D. C. 1946.

(5) Weddell, D. J. Extending the Natural Range of Slash Pine in Alabama. Jour. Forestry 37: 342-343. illus. 1939.

STEM GIRDLING BY ICE

Craig D. Whitesell
Research Forester
Maryland Department of Research and Education
Annapolis, Md.

An unusual type of stem girdling was observed while measuring 2-yearold Virginia pine seedlings during January 1958, on the Eastern Shore of Maryland. When several seedlings. whose stem diameter was just a little less than that of a common lead pencil were found partially or completely girdled at a point from 1/2 to 1-inch above the ground, blame was placed on nice. Then the real cause of the damage was discovered. Skim ice had formed around seedlings growing in low spots, and wind action caused the seedlings to rub against the ice. This abrasive action was sufficient to damage the seedlings. Once the ice melted, the cause disappeared.