EARLY LOBLOLLY PINE CONE COLLECTION IN A SOUTH CAROLINA SEED ORCHARD

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Abstract.--In the fall of 1978 and 1979, loblolly pine cones were collected from 14 seed orchard clones at the South Carolina State Commission of Forestry's seed orchard located near Sumter, South Carolina. Cones were collected on September 6, 12, 20, and 26 in both years. On each date, the collected cones were subject to the following five treatments: (1) shade with burlap cover and sprinkled, (2) shade without cover and sprinkled, (3) cones sealed in plastic bags and refrigerated at 38-40 ^{0} F., (4) cones placed in burlap bags and airdried in sunlight, and (5) cones placed in burlap bags and airdried under 50% shade. Seeds were then extracted and cones were rated for degree of opening. No single treatment or date of collection clearly yielded the highest germination or greatest degree of cone opening. However, treatments 1 and 5 gave the best results throughout and more importantly, were the best treatments on the earliest collection dates giving nearly complete cone opening and germination averaging over 80%. It was concluded that loblolly seed orchard cones given the proper treatment may be collected up to 4 weeks earlier than the normal cone ripening period with good to excellent seed yield and germiation.

Additional keywords: Pinus taeda, cone opening, seed yield, seed germination.

Loblolly pine (Pinus taeda L.) is one of the most important reforestation species in the Southeast. Hundreds of millions of seedlings are produced annually and this figure is increasing yearly. All loblolly pine seed is currently collected by hand because no mechanical means of collection has been perfected.

Optimum cone collection time for loblolly pine has been found to occur from the first to about mid-October for a period of 15 to 20 days (Wakeley 1954). This short collection period has proven to be a serious problem for the seed orchard manager, especially when large amounts of seed are desired. Currently, cone collection is very expensive because a large concentration of equipment and manpower must be made available in one short period.

Extending the cone collection period by early collection (10 to 14 days) would allow more seed to be harvested and reduce the amount of labor and equipment needed. This would also reduce overall cost and allow for a more orderly procedure in preparing cones for drying and seed extraction. This paper reports the results of an early cone collection study and five after-ripening treatments on seed production and quality under field conditions.

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METHODS

Two loblolly pine seed orchards were selected from the Fulton B. Creech Seed Orchard complex located near Sumter, South Carolina. Three clones were selected from the Piedmont orchard and 11 clones were selected from the Coastal orchard. The Piedmont clones were selected on the basis of previous outstanding performances regarding cone production and seed germination. The Coastal orchard has a history of highly variable cone yields among individual clones; consequently, a larger sample of clones were selected. Both orchards range in age from 14 to 16 years old and have been producing seed for about 10 years. In each orchard, several ramets of each clone were selected but no distinction between ramets was made at the time of collection.

Cones were collected from each clone on September 6, 12, 20, and 26 in 1978 and 1979. In 1978, 50 cones were collected from each clone on each date. Due to a poor cone crop and to facilitate the experiment, only 25 cones were collected from each clone on each date in 1979. The 1978 cones were randomly divided into groups of 10, and the 1979 cones were randomly divided into groups of five cones each. The following treatments were applied to each of the five groups:

1. "Shade-with cover" - Cones were placed under lath shade, covered with burlap, and sprinkled with water intermittently (every 3 days).

2. "Shade-no cover" - Cones were placed under lath shade without burlap cover and sprinkled with water intermittently (every 3 days).

3. "Cold" -cones were placed in sealed plastic bags and refrigerated at 38-40° F.

4. "Sun" - Cones were placed in burlap bags and airdried in sunlight.

5. "Orchard" - Cones were placed in burlap bags and airdried under 50% shade.

Four weeks after the last collection date, the treatments were ended. The cones were placed in paper bags and put into a forced air-dry kiln for a period of five days at 120° F. When the cones were removed, each cone was individually "bumped" so that all available seed was extracted. No attempt was made to remove seed by cone dissection or any other forceable manner. The cones were inspected for degree of openness and a numeric value of one through five was assigned to each cone. A value of one was considered to be fully closed, and a value of five was considered to be fully open. All 1979 seed samples were weighed and germination tests were begun immediately. Two samples of SO seeds each were drawn and stratified for three weeks at 40° F. Germination procedures were followed as suggested in Seeds of Woody Plants of the United States (1974).

RESULTS

Germination

The orchard treatment produced the highest overall germination mean for the 1979 Coastal orchard (table 1), but the plot of germination by date illustrates that the orchard treatment did not prove to be superior for all collection dates (fig. 1). In general, all treatments produced poor germination.

The cold treatment for the 1979 Piedmont orchard averaged only 65.0% germination for all dates while all other treatments averaged 80.5% or greater (table 2). A plot of mean germination by date for each treatment illustrates several important trends (fig. 2). The sun, cold, and shade-no cover treatments had the lowest germination on the first collection date. However, the sun treatment had the highest germination on the second and last collection date.

Degree of cone opening

Clearly, the orchard treatment had the best overall mean and proved to be superior on all dates for degree of cone opening for the 1979 Coastal orchard. It should be noted that good results were obtained on the first collection date using the orchard, shade-no cover, and shade with cover treatments (table 3 and fig. 3).

The orchard treatment and the shade with cover treatments had the highest overall means for degree of cone opening for the 1979 Piedmont orchard. Excellent results were obtained using these treatments and the shade-no cover treatment on the first collection date (table 4 and fig. 4). For this publication, only 1979 data are presented. The data for 1978 are available upon request.

DISCUSSION

No single treatment or date clearly proved to yield the highest germination or greatest degree of cone opening for either orchard for either year. However, there are several trends that can be noted. In 1979, the orchard treatment gave excellent results on the first collection day and had the highest overall mean for degree of cone opening for both orchards. Also, the orchard treatment had the highest germination me[a]n for the 1979 Piedmont orchard on the first collection day and had the highest overall germination mean for the Coastal orchard. The sun treatment tended to give good results for germination from the second collection date until the last; however, it did not prove to do well for cone opening. In 1978, the shade-with cover treatment performed the best overall dates for both orchards for degree of cone opening. The shade-with cover treatment also gave good results in the 1979 Piedmont orchard.

Obviously, different treatments performed better for each variable on different dates. However, on all dates for both orchards in both years, the shade-with cover treatment gave slightly higher germination results (80%) than the orchard treatment (76.5%) and resulted in a slightly lower degree of cone opening (4.56) than the orchard treatment (4.84). Depending on facilities, one of these two treatments would have to be considered the most advantageous for application.

Table 1. Mean germination values for 1979 Coastal orchard.

	DATE				
TREATMENT	9/6	9/12	9/20	9/26	MEAN
Cold	31.4	47.6	36.8	44.2	40.8
Orchard	62.3	75.6	62.5	73.8	68.8
Shade-no cover	60.3	71.2	55.1	53.7	60.9
Shade-with cover	64.6	63.1	66.8	63.1	64.3
Sun	50.1	77.4	65.0	72.8	66.8
MEAN	57.3	69.5	57.4	61.5	60.3

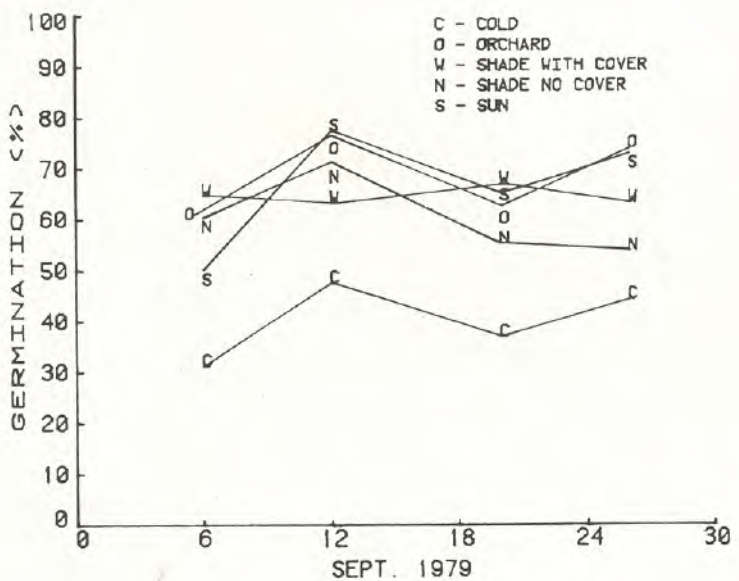

Figure 1. Germination by date for all treatments for 1979 Coastal orchard.

Table 2. Mean germination values for 1979 Piedmont orchard.

	DATE				
Treatment	9/6	9/12	9/20	9/26	MEAN
Cold	70.8	49.0	65.7	75.6	65.0
Orchard	85.3	90.0	72.7	89.0	84.3
Shade-no cover	70.6	84.0	83.3	85.3	80.5
Shade-with cover	81.3	86.0	85.3	93.6	83.5
Sun	71.0	96.0	83.3	93.7	86.0
MEAN	76.0	80.8	78.1	85.0	79.9

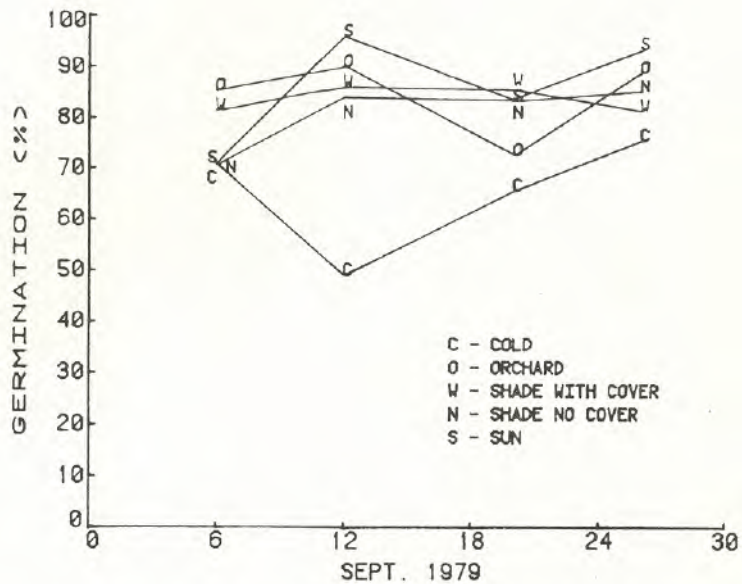

Figure 2. Germination by date for all treatments for 1979 Piedmont orchard.

Table 3. Mean degree of cone opening values for 1979 Coastal orchard.

	DATE				
TREATMENT	9/6	9/12	9/20	9/26	MEAN
Cold	1.49	1.85	2.76	3.78	2.47
Orchard	4.96	4.74	4.58	4.43	4.68
Shade-no cover	4.81	3.96	2.45	3.10	3.58
Shade-with cover	4.72	4.10	3.40	3.58	3.95
Sun	3.09	3.96	3.07	2.87	3.25
MEAN	3.81	3.72	3.25	3.55	3.58

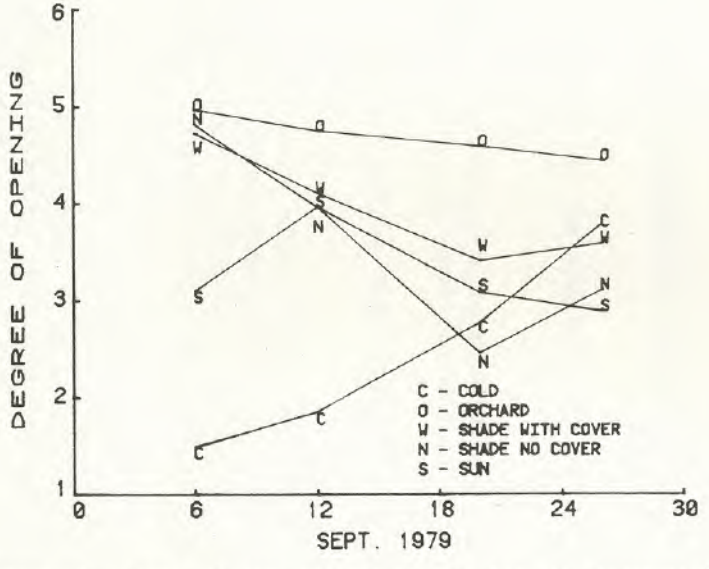

Figure 3. Degree of cone opening by date for all treatments for 1979 Coastal orchard.

Table 4. Mean degree of cone opening values for 1979 Piedmont orchard.

	DATE				
TREATMENT	9/6	9/12	9/20	9/26	MEAN
Cold	2.46	2.40	4.53	5.00	3.60
Orchard	5.00	5.00	5.00	5.00	5.00
Shade-no cover	5.00	4.33	4.80	4.86	4.74
Shade-with cover	5.00	4.93	5.00	5.00	4.98
Sun	4.66	4.80	4.73	4.86	4.76
MEAN	4.42	4.29	4.81	4.94	4.61

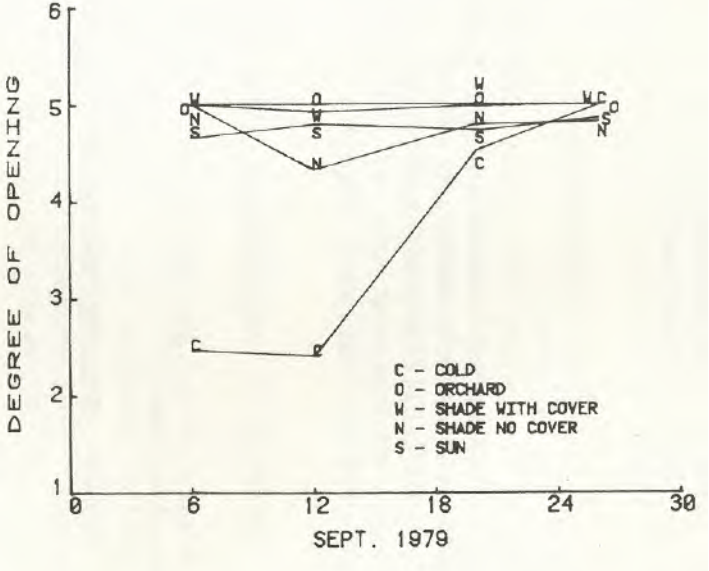

Figure 4. Degree of cone opening by date for all treatments for 1979 Piedmont orchard.

It appears that the shade and moisture treatments performed the best on the earliest collection dates. This is evidenced by the fact that no other treatment exceeded the performance of the orchard or shade-with cover treatments on the first collection day.

CONCLUSION

The results of this study definitely show that Piedmont loblolly pine cones may be collected up to 4 weeks earlier than normal with excellent seed yield and germination. Additional work investigating the Coastal clones is needed due to the variability among individual clones in this orchard. However, it appears appreciable progress toward earlier collection dates can be made with certain individual clones.

LITERATURE CITED

Seeds of Wood Plants of the United States. 1974. U.S.D.A. Forest Service Agr. Handbook No. 450.

Wakeley, P. C. 1954. Planting the southern pines. U.S.D.A. Forest Service Agr. Mono. 18.