Early Cone Collection and Postharvest Treatment Comparisons in a South Carolina Loblolly Pine Seed Orchard

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Placing loblolly pine cones in muslin sacks and air-drying in the shade of orchard trees yielded adequate quantities of high-quality seeds. Cones can be collected as early as August 29 with satisfactory seed yields if postharvest treatments are applied.

Demand for improved loblolly pine (*Pinus taeda* L.) seedlings is placing greater pressures on seed orchard managers to collect and process larger numbers of cones. Mature loblolly pine cones are normally handpicked within a 2-to 3-week period (7). A shortage of labor and equipment during this limited harvesting period may reduce the numbers of cones collected. If cone harvesting could begin several weeks earlier, followed by a satisfactory postharvest treatment, the number of seeds obtained could be greatly increased.

Several studies have indicated that an extended cone harvesting period for loblolly pine is possible if slightly immature cones are stored before kiln drying (2, 3, 4, 5, 8, 9). Effects of postharvest treatments and early cone collection on the degree of cone opening and germinative capacity for Coastal and Piedmont loblolly pine clones from South Carolina were investigated by Astriab and Schoenike (1). Cones stored in shade with moist burlap covers and cones stored in burlap bags and air-dried under the shade of orchard trees proved best of five treatments for Piedmont clones. Additional work was needed with Coastal loblolly pine because of the large variability among clones. The present study was initiated to further examine the effects of early collection and these treatments on seed yield and germinative capacity of Coastal loblolly pine. An analysis of cone specific gravity was made to assess its reliability as an index of cone maturity.

Materials and Methods

Seven clones of loblolly pine were selected from the Coastal seed orchard located at the Fulton B. Creech Seed Orchard Complex, South Carolina State Commission of Forestry, near Sumter, S.C. Twenty-two cones were handpicked from each clone at six weekly intervals beginning on August 22, 1980. At each weekly collection, two cones were randomly selected for specific gravity measurement using water displacement. The remaining 20 cones were divided into two groups of 10 cones each and placed in separate muslin sacks. The sacks were randomly assigned to one of two postharvest treatments, the "artificial shade" treatment and the "orchard" treatment. The artificial shade treatment consisted of placing the sacks on the ground beneath burlap-covered lath and sprinkling them with water about every 3 days. This procedure is very similar to the method currently used with Piedmont loblolly pine clones at the Fulton B. Creech Seed Orchard Complex. The orchard treatment consisted of placing the sacks on the ground at the base of orchard trees. Four weeks after the last cones were picked, postharvest treatments were terminated. All sacks were then placed in a forced-air dry kiln for a period of 5 days at 120° F for cone drying to facilitate seed removal.

After kiln drying, each cone was "bumped" to remove all available seeds. No seeds were forcibly extracted. The degree of each cone's openness was rated by assigning a value from 1 to 5, in which a value of 1 indicated fully closed cones and a value of 5 indicated fully open cones. Seeds were counted and weighed, and then a germination test was conducted. A 50-seed sample from each treatment-date-clone combination was stratified for 3 weeks at 40° F. Germination procedures followed the method described for loblolly pine in "Seeds of Woody Plants of the United States" (7).

A randomized, complete-block, split-plot design was employed with postharvest treatments and clones as whole-plot and collection dates as subplot factors. Analysis of variance was performed for degree of cone openness, average total seed weight per cone, seed number per cone, and germina-

tive capacity. In addition, a completely randomized design was employed to test differences in cone specific gravity among clones and dates. Differences among means for collection dates were tested at the 5-percent probability level using linear contrasts (6).

Table 1—*Results of artificial shade and orchard treatments for Coastal loblolly pine*

Cone collection date	Post-harvest treatment	Degree of cone openness	Number of seeds per cone	Total seed weight per cone	Germinative capacity
				g	%
August 22	Artificial shade	4.2	47.3	1.22	10.9
	Orchard	4.0	39.4	0.98	13.7
August 29	Artificial shade	4.6	59.9	1.64	48.6
	Orchard	4.3	65.0	1.68	47.1
September 5	Artificial shade	4.3	67.3	1.87	58.3
	Orchard	4.2	64.7	1.76	56.9
September 12	Artificial shade	4.8	66.9	2.01	72.6
	Orchard	4.3	59.6	1.86	79.1
September 19	Artificial shade	4.7	52.6	1.61	64.6
	Orchard	4.3	56.8	1.60	66.0
September 26	Artificial shade	4.6	52.6	2.14	55.1
	Orchard	4.9	73.0	2.24	60.9
Mean	Artificial shade	4.5	61.0	1.69	51.7[1]
	Orchard	4.4	59.8	1.74	54.0[1]

[1] Significant difference between treatments at the 0.05 probability level.

Results

No significant differences between artificial shade and orchard treatments were detected in degree of cone openness or total weight or number of seeds per cone (table 1). Seeds from cones given the orchard treatment had a small, but significantly higher, germinative capacity.

There was a linear increase in degree of cone openness and total seed weight and number per cone with cone collection date (fig. 1). The shade treatment produced better cone opening than the orchard treatment on all dates except the last, September 26 (fig. 1). terminative capacity increased with cone collection date until September 12, after which germinability decreased. The first cone collection date, August 22, yielded significantly lower seed germinative capacity and total seed weights and numbers per cone than other collection dates. Treatment-date and treatment-clone interactions were not significant for any of the variables examined.

Cone specific gravity was not a reliable index of cone maturity because of large variation among clones. Cone specific gravity was fairly uniform among clones on the first collection date, August 22; but afterwards variation among clones increased with time. There was a linear decrease in cone specific gravity with collection date from 1.05 on August 22 to 0.94 on September 26. Although average cone specific gravity on each collection date was greater than 0.89 (the traditional index of cone maturity), acceptable seed yields of more than 50 seeds per cone were obtained on all collection dates except the first, August 22.

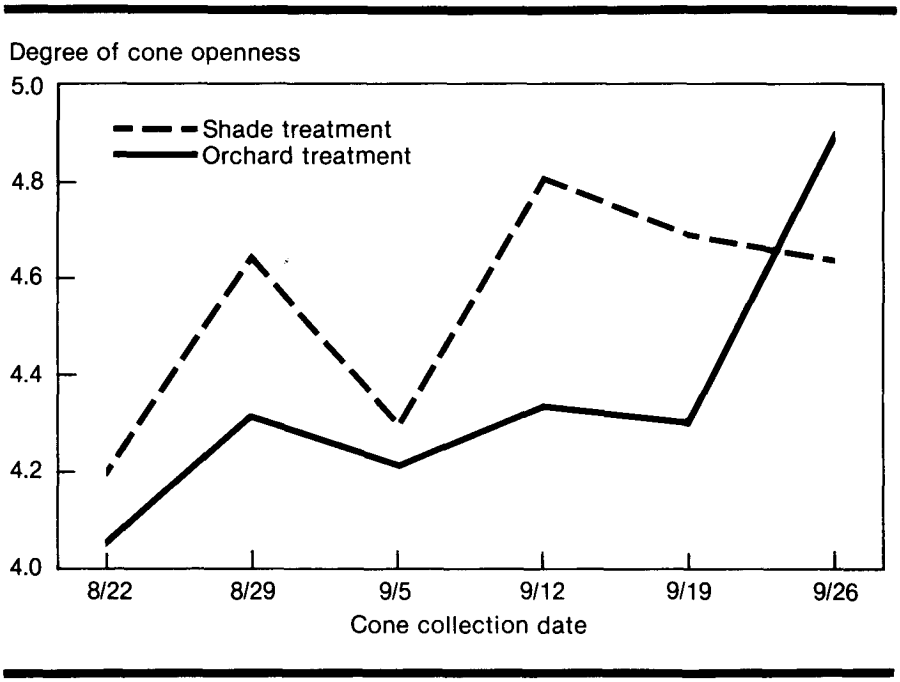

Figure 1—*The relationship between cone collection date and specific gravity.*

Conclusions

The orchard treatment used in this study is recommended for postharvest treatment to artificially ripen loblolly pine cones in South Carolina because: (a) there were no significant differences in degree of cone openness and average total seed weight and number per cone between the orchard and artificial shade treatments; (b) the orchard treatment yielded higher germinative capacities than the artificial shade treatment; and (c) the orchard treatment is a simpler, less expensive procedure. By applying this postharvest cone treatment, the harvesting period could be extended by 5 weeks, thus making commercial seed production cheaper and more efficient and allowing more seeds to be harvested.

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