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Spring Sowing Of Longleaf Pine Reduces Risk Of Seedling Clipping

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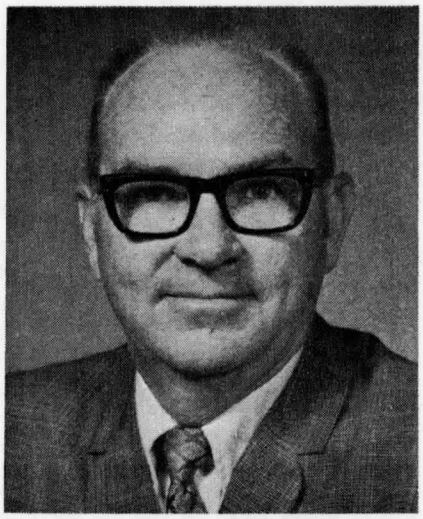

ABSTRACT—Longleaf pine can be established by direct-seeding burned, disked, or furrowed sites in February to circumvent midwinter seedling losses. Although the ability of spring-sown seedlings to survive severely dry summers has not been demonstrated, sowing season had no effect on first-year survival during a three-year period of moderate summer conditions.

A TROUBLESOME PROBLEM in direct-seeding longleaf pine (*Pinus palustris* Mill.), the only southern pine for which fall sowing is recommended, is midwinter clipping of fall-germinated seedlings (Fig. 1). From January to early March the succulent cotyledons are clipped by numerous species of small mammals and insects. Losses from 10 to 25 percent normally occur, but depredations up to 70 percent have been recorded (*3*). The results of the three studies reported in this paper indicate that clipping can be circumvented by direct-seeding in the spring, although the risk of mortality during summer droughts is increased. Losses after spring and fall sowing are reported for burned, disked, and furrowed seedbeds.

Methods

Three experiments were conducted in 1963-1964, 1964-1965, and 1966-1967 near Alexandria, Louisiana. Each was installed on level to gently rolling terrain. The soil used was a sandy loam of the Bowie-Beauregard series; surface and internal drainage were good; and sites were moderately droughty. All three sites were open, cutover areas with heavy stands of pinehill bluestem [*Andropogon divergens* (Hack.) Andres. ex Hitchc.], and other grasses.

Treatments were identical for all studies. Three types of seedbeds were prepared at the same time. Half of each was sown in the fall and half in the spring. One seedbed was a fresh burn. The second consisted of disked strips 7 feet wide and 7 feet apart, prepared with a tandem, offset farm harrow that pulverized the soil 4 to 6 inches deep. In the third, furrows 12 inches wide and about 6 inches deep were plowed with a fireline plow and spaced on 8-foot centers; a berm approximately 18 inches wide was upturned on each side of the furrow. Sowing dates were the third weeks of November and February. Fresh longleaf pine seeds coated with an Arasan-endrin repellent (1) were evenly distributed over the burned plots, but were confined to the prepared portion of the disked strips and the furrow of plowed plots. They were hand-sown at the rate of 15,000 sound seeds per acre. Each treatment was replicated four times.

Fig. 1.—In midwinter, succulent longleaf pine seedlings are particularly vulnerable to clipping by predators.

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Immediately after sowing, permanent sampling areas were established to observe the fate of seeds and seedlings. Sixteen circular milacres were located on each burned plot; 12 bed segments 6.6 feet long were located on mechanically prepared plots. Seeds on the sample areas were counted, and a pin was placed in the ground next to each. A total of 17,329 seeds were pinned on 960 sample plots.

During each study, initial inventories were made either in late May or early June. Data presented here represent means of all three studies. Tree percents are based on the proportion of sown seeds that became established seedlings. Seedlings per acre were computed by applying tree percents to the sowing rate. Only differences that were significant at the 0.05 level are reported.

Results and Discussion

Destroyed or missing seeds plus germination failures averaged 25.8 percent of the total sown. For fall sowing, the percentage of seeds that failed to establish a seedling was 12 points higher than for those sown in the spring. Seedbeds had no influence on effective germination, but there was a significant season by site interaction.

Effective germination achieved (74.2 percent) was within the normal range of 70-80 percent of fresh sound seeds (*2*). Of the 74 seedlings established from each 100 seeds, six were clipped by predators, 13 died during the hot summers, 13 were lost for unknown reasons, and 42 survived the first year.

Clipping losses were about 10 times greater on fall than spring-sown plots (Table 1). Average losses for the three studies were 30.9, 10.7, and 1.9 percent in the winter, and only 4.1, 0.0, and 0.2 percent in the spring.

Winter temperatures apparently influence clipping losses. The winter in 1963-1964 was much more severe than those for the other two studies. As a result, green grasses and forbs, which predators presumably prefer to seedlings, were more plentiful in the second and third studies.

Eighteen percent of the germinated seedlings were lost before the initial inventory to causes other than clipping (Table 1). Some of the seedlings disappeared completely; they were possibly pulled up and consumed by predators. High moisture stresses were probably the major cause of mortality of the dead seedlings that were found. Losses of this kind were twice as numerous after spring than after fall sowing. Depletions of seedlings in furrows were higher than those from burned plots. Losses from disked strips were intermediate and were not significantly different from those in burned plots or furrows. Seasonal differences for other losses on burned seedbeds averaged only 1.3 percent, while they were 14.1 and 20.2 percent for furrows and disked strips. These differences resulted in a season by seedbed interaction.

Spring sowing achieved 9.4 percent greater initial stocking than fall sowing, but not consistently. Best initial catches in all studies were on burned seedbeds, averaging 60 percent, compared to 55 and 50 percent for disked and furrowed seedbeds.

Summer survival of fall-germinated seedlings was only 6.4 percentage points better than that of seedlings germinated in the spring (Table 1). A severe drought, the usual cause of high summer mortality, did not occur. However, rainless periods of up to 37 days were recorded and longleaf seedlings established in both seasons demonstrated their ability to withstand at least moderately severe moisture stress. Survival was about 5 percentage points higher on mechanically prepared seedbeds than on fresh burns.

Stocking levels at the end of one year were not significantly affected by the season of sowing. Success was greater on burned and disked sites than in furrows—7,100 and 6,980 as opposed to 6,170 seedlings per acre. The overall average was 6,750 first-year seedlings per acre.

Plantation establishment is virtually assured if stocking at the end of the first growing season is at least 1,500 well-spaced seedlings per acre. Yields from all treatments averaged more than four times the minimum requirements for success, and at least twice the usual achievement in commercial operations with 15,000 seeds per acre. Some reduction in the sowing rate appears to be possible when care is taken to insure a favorable seedbed.

Since both seasons of sowing were equally effective, it appears that managers have a choice of February or November for direct-seeding longleaf pine. If seeds are sown in the spring, seedlings may not be as drought-hardy as those resulting from fall sowing. If sowing is done in the fall, the seedlings are subject to predation in midwinter. Fresh burns or disked strips appear to be satisfactory regardless of sowing season.

Table 1.—Seedling Loss, Seedling Yield, and Summer Survival Means for Three Direct Seeding Studies.

Treatments	Proportionate losses of germinated seedlings		Seedling to seed ratio in May	Summer survival
	Clipping losses	Other losses		
	— — — — — — Percent — — — — — —			
Fall burn	11.7	13.2	55.0	84.0
Spring burn	0.7	14.5	64.6	74.5
Fall disked	15.8	6.8	53.0	86.8
Spring disked	1.4	27.0	56.2	83.6
Fall furrowed	16.1	17.0	42.0	86.2
Spring furrowed	2.2	31.1	57.3	79.7
All burn	6.2	13.8	59.8	79.2
All disked	8.6	16.9	54.6	85.2
All furrowed	9.1	24.0	49.6	82.9
All fall	14.5	12.3	50.0	85.7
All spring	1.4	24.2	59.4	79.3
Overall means	8.0	18.2	54.7	82.5

Literature Cited

1. DERR, H. J. 1963. Better repellent for direct seeding. U.S. Forest Serv. Tree Planters' Note 61. p. 26-30.
2. ————, and W. F. MANN, JR. 1959. Guidelines for direct-seeding longleaf pine. USDA Forest Serv. South. Forest Exp. Sta. Occas. Pap. 171. 22 p.
3. MANN, W. F., JR. 1965. Progress in direct-seeding the southern pines. *In* Proc., Direct seeding in the Northeast—a symposium. Univ. Mass. Exp. Sta. p. 9-13.