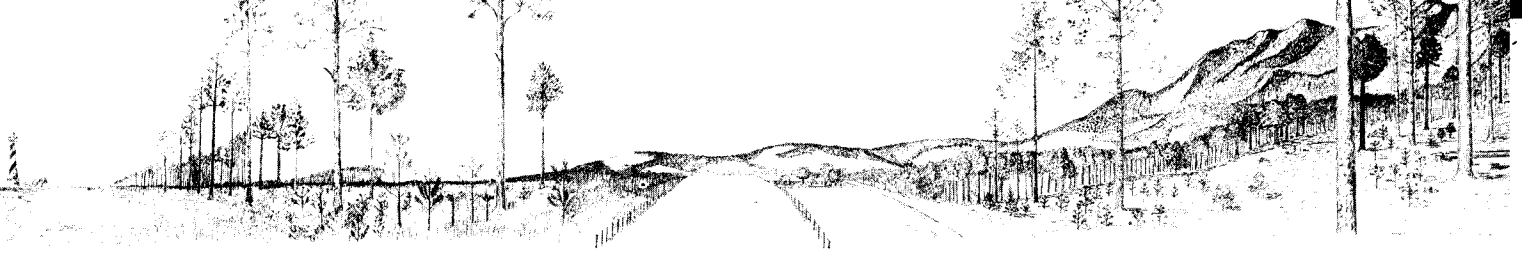

U. S. Forest Service Research Note SE- 39 February 1965

RODENT DEPREDATION--A DIRECT SEEDING PROBLEM

Foresters have known for a long time that seed-eating rodents, birds, and insects must be circumvented before direct seeding can be successful. Advances have been made in reducing losses in the direct seeding of pine by the use of chemical repellents, and in several areas of the South recommended[1] concentrations have been satisfactory. Direct seeding is now on an operational basis.

This note reports the results of a direct seeding study of loblolly pine at the Santee Experimental Forest, Berkeley County, South Carolina, using the recommended formulations. The objectives of this study were to obtain information on seed loss, and the effectiveness of two repellents.

The study was carried out in a small clearing on a Lynchburg loamy fine sand soil. Forty-nine seed spots were used in each treatment plot, with six seed per spot. There were 12 treatments, consisting of the combination of 3 sowings and 4 seed treatments in a randomized block design with 4 replications. Non-stratified seed were sown in November 1959, January 1960, and March 1960. Seed treatments included Arasan-75 and endrin 25W at 2.6 and 2.0 percent of dry seed weight and anthraquinone and endrin 25W at 15.0 and 2.0 percent, respectively. Untreated seed sown with and without screened protection were used as control treatments. The original stand on this site was predominantly longleaf pine with a few loblolly pine intermixed.

SEED LOSSES

Seed losses were high. As late as March 15, most of the treated and untreated seed were still in place; by the middle of April an average loss of 90 percent (excluding the screen-protected spots) was recorded (table 1). Differences in losses on a seed spot basis between the various treatments were not significant.

On nearly one-third of the spots, seed were eaten on the spot, as evidenced by the hulls. Teeth marks on the hulls indicated that nearly all depredation was from rodents--with the white-footed field mouse (Peromyscus maniculatus) the primary suspect. On the other seed spots where loss was sustained, seed was carried away. Although some of the seed hulls were found in nearby rodent runs, birds and other seed predators may have been responsible for part of this loss.

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[1] General recommendations for repellent formulations have been developed cooperatively by the Southern Forest Experiment Station and the U. S. Fish and Wildlife Service.

Southeastern Forest Experiment Station - Asheville, North Carolina

U.S. Department of Agriculture - Forest Service

Table 1.--Seed losses as of April 1960, by seed treatment and time of sowing

Repellent treatment	Seed loss by sowing date			Average
	November	January	March	
	Percent			
Arasan-endrin	90	95	97	94
Anthraquinone-endrin	90	96	86	91
None	84	80	96	87
Average	88	90	93	90

SEEDLING ESTABLISHMENT

Seedling establishment at the end of the first growing season was poor. An analysis of the tree percents[2] by study treatments showed significant effects of screen protection, of time of sowing, and of the interaction between these two variables.

The repellent concentrations tested were neither effective in reducing seed loss (table 1) nor in increasing the tree percents (table 2).

Table 2.--Seedling establishment one year after sowing

Repellent	Seed spot protection	Time of sowing[1]			Average[2]
		November	January	March	
		Tree percent			
Arasan-endrin	None	6.6	1.5	1.7	3.3
Anthraquinone-endrin	None	9.4	2.3	2.2	4.7
Untreated	None	12.2	8.7	2.2	7.7
Untreated	Screened	38.2	56.6	33.5	42.8
Average		16.6	17.3	9.9	14.6
Average (excluding screened)[2]		9.4	4.2	2.0	5.2

[1] Least significant difference by Tukey's Q test is 12.8 percent.
[2] Least significant difference by Tukey's Q test is 3.8 percent.

Untreated seed had the highest average establishment rate. This rate was significantly better than the Arasan-endrin treatment, but was not significantly different from the anthraquinone-endrin treatment. New studies have been installed to test the effectiveness of higher repellent concentrations. The evidence to date indicates that the repellents may be less effective in the Atlantic Coastal Plain than in the Gulf Coastal Plain.

[2] Tree percent is defined as the tree/seed ratio expressed as a percent.

DISCUSSION AND CONCLUSIONS

Two conclusions were drawn from the results of this study. First, the repellents did not deter the seed predators at the concentrations tested. This conclusion has led us into additional studies to test higher rodent repellent concentrations.

Second, the 5.2 average tree percent for the unprotected spots was low when compared with 42.8 percent average attained on the protected spots, or with the results obtained in other areas of the South.[3] Cassady, in describing the results from various direct seeding studies and trials in 9 states, reported tree percents ranging from 3 to 30 percent for loblolly pine. As a rough standard, he concluded that tree percents of 10 to 20 were needed to establish a stand adequately if 15,000 seed were sowed per acre. Cassady's standards appear to be valid for the Atlantic Coastal Plain. If higher establishment rates cannot be achieved with the repellents now being used, other means must be sought to increase them. In the meantime the logical course is to sow at higher rates, which in this case would mean doubling the sowing rate.

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[3] Cassady, John T. Seed requirements per acre for direct seeding. In Direct Seeding in the South; A symposium. Pp. 120-128. Duke Univ. School Forestry. 1959.

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