Southern Forest Experiment Station

Research Note

SO-213

1976

Evaluation of Animal Hazard to Spot-Seeded White Ash In Central Tennessee

T. E. RUSSELL[1]

Screen protection of seedspots more than doubled white ash seedling establishment on forested sites of the Cumberland Plateau. For 3 years seeds were sown in fall and spring and given either no protection, or covered with l-inch mesh screen, or covered with ¼-inch mesh hardware cloth. Unprotected seeds and those covered with l-inch mesh screen suffered heavy depredations each year.

Although white ash can be protected from animals, successful seeding will require improved seed treatments and seedling techniques. Even where animals were excluded, poor germination caused unsatisfactory seedspot stocking in a number of trials.

Additional keywords: ***Fraxinus americana,*** artificial regeneration of hardwoods, direct seeding, animal damage.

White ash is an excellent species for a variety of sites throughout central Tennessee but usually occurs in small groups or as scattered trees. Because of the scattered seed source, artificial regeneration will be required if ash is to be established on many productive sites. Where steep slopes, rocky soils, or heavy logging slash make planting difficult, direct seeding could be a useful regeneration method.

Few attempts to direct seed white ash have been made, and the factors that influence success are largely unknown. Loss of seeds to birds or small mammals to some extent limits seedling establishment for most hardwoods. On the Cumberland Plateau, risks differ between species, and, for example, are high for oaks and black walnuts (Mignery 1975, Russell 1968), moderate for yellow-poplar (Russell 1973), and low for black cherry (Russell 1975). The study reported here was installed to evaluate animal hazards when spot-seeding white ash.

METHODS

Three levels of seedspot protection were tested at 10 widely dispersed locations near Sewanee. Sowing was done in both fall and spring for 3 years (1970-71, 1971-72, and 1972-73) on two sites—shallow U-shaped hollows on top of the Plateau and northerly slopes of the Plateau escarpment known locally as "coves." Soils in the hollows are mainly fine sandy loams of the Hartsells-Ramsey association that support fair-quality stands of oak and hickory with an occasional yellow-poplar or other miscellaneous species. Cove soils are dark, friable loams of the Allen or Bouldin series. Timber types vary here from oak-hickory on dry, south and west facing

[1] Principal Silviculturist at the Sewanee Silviculture Laboratory, maintained at Sewanee, Tennessee, by the Southern Forest Experiment Station, Forest Service—USDA, in cooperation with the University of the South.

slopes to mixed-mesophytic hardwoods on northerly aspects.

The areas had all been logged within the past 15 years. Since my main purpose was to define the potential for animal damage to white ash seedings, I did not deaden residual hardwoods. Deadening would have initiated a succession of herbaceous and woody vegetation that would have produced different cover types and densities for each yearly trial.

Treatments were replicated five times in a completely randomized, split-plot design; the five installations on each site were major plots. Each major plot was in a separate hollow or cove and at least 0.5 miles from other installations or from radically different cover types such as old fields. At all locations, protection and season of sowing treatments were tested on six subplots, each containing 16 seedspots spaced about 6 feet apart. Hardwood litter was removed, and 20 white ash seeds per spot were pressed into the surface of the mineral soil.

Unstratified seeds were sown in November and stratified seeds in March for 3 consecutive years. The same subplots were resown for all annual trials after seeds or seedlings from a previous year were removed by raking.

On randomly selected subplots, seeds received one of three levels of protection from animals: (1) no protection, (2) covered with l-inch mesh screens that allowed passage of small rodents such as mice but barred squirrels and larger animals, and (3) covered with ¼-inch mesh hardware cloth that prevented animal access. A preliminary trial in spring 1970 had determined that the screens would provide the degree of protection desired and that seed damage could be reliably detected.

Results for each year were expressed as percent of seedspots disturbed, as the number of seedlings obtained per 100 seeds (tree percents), and as the proportion of spots producing at least one seedling (initial stocking). Differences were tested by analysis of variance after arcsine proportion transformation.

RESULTS

Depredations

Animal depredations fluctuated from year to year, but damage to exposed seedspots was severe each year in all trials (table 1). Losses under l-inch mesh screens were also heavy, indicating that mice or other small forest rodents may feed freely on white ash seeds. The ¼-inch mesh screens significantly (0.01 level) limited depredations in all years; seed was damaged only on a few plots where animals burrowed under the screens.

Table 1.—*Seedspot* depredation *seedspot stocking (data for fall and spring sowing and for cove and plateau sites combined)*

Type of seedspot screen	Year of test		
	1970-71	1971-72	1972-73
	Percent		
	Spots robbed		
None	94	68	81
l-inch mesh	90	75	87
I/l-inch mesh	0	0	3
	Stocking		
None	12	34	32
l-inch mesh	12	15	15
I/(-inch mesh	39	47	48

. More seedspots were robbed in the fall than in the spring in 1970-71; in 1971-72 depredations were heaviest in the spring. Animal activity did not vary significantly with season of sowing in 1972, nor between sites in any year.

The ability of seedlings to survive their first summer was observed each year. Survival averaged 84 percent with only a 2 percentage point difference between unprotected and the fully protected seedspots. Browsing animals are evidently not a serious threat to newly germinated white ash on the Cumberland Plateau.

Seedling establishment

Over the 3 years, tree percents averaged 1.8 on unprotected seedspots, 0.8 under l-inch mesh screens and 4.0 on spots protected with ¼-inch mesh screens. Differences between both levels of protection and exposed seed were significant in 1970-71; differences between the 1-inch and ¼-inch mesh screens were significant in all years. Spring was superior to fall seeding in two annual trials while results were unaffected by season of sowing in the third year. None of the differences between sites or their interactions with levels of protection and seasons were statistically significant.

Results expressed as tree percents generally paralleled those based on depredations. However, seedling establishment is influenced by seed quality and weather as well as by seed losses. Seedlots used in this study contained over 90 percent full seed and had a proven germinability of 24 percent for the seeedlot sown in 1970-71 and 37 percent for the lot used in the 1971-72 and 1972-73 trials. Even under ¼-inch mesh screens, field germination was invariably much poorer than the potential indicated by laboratory tests.

Stocking

Stocking averaged 26 percent on exposed spots, 14 percent under l-inch screens, and 44 percent under ¼-inch mesh screens and was significantly improved by the ¼-inch screen in all years (table 1). Stocking was higher on spring seeded than on fall seeded plots in 1970-71 and in 1971-72 but was not affected by season in 1972-73.

If each season of sowing at each location, including spring 1970, is considered a separate test, the study included 70 small-scale trials. The proportion of these trials yielding various specified thresholds of stocking with unprotected and fully protected seeds were:

Proportion of trials yielding initial seed-spot stocking of:	No protection	¼-inch mesh screens
	- - - *Percent* - - -	
65 percent or better	3	24
50 percent or better	17	47
35 percent or better	36	61

Excluding animals increased the odds for obtaining a stocking of 50 percent or better by almost threefold; stocking of 65 percent or better occurred eight times more often with protected than with unprotected seeds. Although the residual hardwoods were not deadened, the tolerant white ash seedlings survived well and stocking changed little during the first growing season after seeding.

DISCUSSION

On the Cumberland Plateau, foraging animals can limit spot seeding of white ash on two characteristic hardwood sites. Spring sowing produced better seedling establishment and stocking than fall sowing in 2 of 3 years; spring is probably the preferred season for sowing white ash in this region.

As a result of protection, tree percents were increased an average of three times, and the proportion of stocked spots was more than doubled. Mechanical devices as used in this study, while effective, are too costly for general use. A cheap and environmentally acceptable repellent is needed as a more practical way to minimize animal depredation.

White ash seeding was only marginally successful in many trials, even where seeds were fully protected. A major factor contributing to poor seedling establishment was the low rate of germination in the field. This may be compensated for to some extent by increasing the sowing rate. But consistent success in seeding white ash will require the development of bet-, ter seeding techniques and pre-sowing seed treatments to increase field germination.

LITERATURE CITED

Mignery, A. L.
1975. Direct-seeding oaks on the Cumberland Plateau in Tennessee. USDA For. Serv. Res. Pap. SO-107, 11 p. South. For. Exp. Stn., New Orleans, La.

Russell, T. E.
1968. Tests of repellents for direct-seeding black walnuts in Tennessee. USDA For. Serv. Res. Note SO-73, 4 p. South. For. Exp. Stn., New Orleans, La.

Russell, T. E.
1973. Animal depredations on spot-seeded yellow-poplar in central Tennessee. USDA For. Serv. Res. Note SO-148, 4 p. South. For. Exp. Stn., New Orleans, La.

Russell, T. E.
1975. Evaluation of animal hazards to spot-seeded black cherry in central Tennessee. USDA For. Serv. Res. Note SO-186, 4 p. South. For. Exp. Stn., New Orleans, La.