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SEEDING BLACK CHERRY IN REGENERATION CUTTINGS

Abstract. Small seedbeds were established on three newly cutover areas on the Allegheny National Forest. Site preparation, protection from animals, and season of sowing were studied. It was not necessary to prepare the site or to provide protection to obtain good germination. Seedlings exposed to deer browsing were severely limited in height growth. Best height growth on the protected seedbeds was obtained on seedbeds that were burned with added fuel.

Much of the forest area on the Allegheny Plateau of New York and Pennsylvania contains black cherry *(Prunus serotina* Ehrh.), and this area is well-suited for growing the species. Many landowners would like to regenerate black cherry in their cutover stands because of its high commercial value. Although these cut areas will regenerate naturally for the most part, black cherry may be but a minor component of the new stands. Effective methods for increasing the stocking to cherry are desired. Direct seeding is one possible way to do this.

Our study was undertaken to compare the efficacy of different methods of seedbed preparation for direct seeding on recently cutover sites, and to determine the effects of birds, rodents, and deer on seeding success. The study was somewhat similar to an earlier one conducted on an open-field site.[1]

[1]Huntzinger, Harold J. GERMINATION, SURVIVAL, AND FIRST-YEAR GROWTH OF BLACK CHERRY UNDER VARIOUS SEEDBED AND SUPPLEMENTAL TREATMENTS. U.S. Forest Serv. Res. Note NE-26, 6 pp. NE. Forest Exp. Sta., Upper Darby, Pa. 1964.

The Study

The study was established on the Allegheny National Forest in northwestern Pennsylvania in the fall of 1962. Three newly clearcut patches representative of regeneration cuttings on the Forest were selected. These patch cuttings had just been made in conjunction with stand-improvement cuttings over much larger areas. This combination of patch cutting and stand improvement, which is a regular timber-management practice on the Forest, has been adopted partly because it tends to disperse deer browsing.

The three patches in the study were all on upland areas of well-drained, medium-textured, residual soils. The locations are known locally as Mill Creek, Hook Run, and Seldom Seen Corners. The sizes of the patches were respectively 5 acres, 19 acres, and 7 acres.

The patches had all contained scattered black cherry trees before the cutting. Numerous cherry seedlings had started around the larger cherry stumps, and occasionally seedlings were found elsewhere. These seedlings had started either before or soon after the cutting, but practically all of them were being severely browsed by deer.

The seedbed preparation treatments were applied to individual small plots just before seed ings were done both in the fall and in the spring. These treatments were:

- No treatment.
- Burned: litter supplemented by twigs and small branches to assure effective burns.
- Spaded: litter and humus turned under.
- Scarified: surface layers mixed.
- Treated with herbicide: 0.075 pounds of Dalapon per gallon applied at the rate of 100 gallons per acre 1 week before seeding.
- Blank: no preparation and no seed sown (included to provide an estimate of natural regeneration).

Seedbeds were protected from animals as follows:

- No protection.
- Protected from deer only.
- Protected from deer and rodents.
- Protected from deer, rodents, and birds.

The individual seedbeds or plots were 3 feet square. At each location eight lines of six plots each were laid out, providing four lines for fall seeding and four lines for spring seeding. The few remaining trees in and near the seedbed areas were felled, and all slash was removed to facilitate access to the areas and to lessen variation in ground conditions. All plots were placed out in the open at a distance from the edge of the clearing at least equal to the height of the bordering trees.

Six of the eight lines of plots were enclosed as a group with deer-proof fence; two lines (one for each season of sowing) were left outside the fence and were exposed both to deer and to other wildlife. Inside the fence, two lines of plots were left accessible to rodents and birds; two lines were surrounded by sheet metal barriers 30 inches high to exclude rodents; and two lines were enclosed—tops and sides—with ¼-inch mesh hardware cloth to exclude both rodents and birds. Sheet metal was used for the open-topped enclosures to discourage small rodents from climbing over. The tops subsequently were removed from the hardware cloth exposures to permit free growth of the seedlings.

Within the limits imposed by the deer fence arrangement, the protection treatments and the season of sowing were assigned to the lines of plots at random, and within lines of plots seedbed treatments were assigned at random. Thus the experiment was a split plot design with one replicate at each of three places.

Seed for the study was collected in September 1962. It was cleaned, dried of surface moisture, and stored temporarily in plastic bags. The fall sowing was done in mid-October. Seed for the spring sowing was stratified in peat out-of-doors on November 8, removed and placed in a plastic bag in a refrigerator on April 1, and sown April 15 to 23, 1963.

Fifty seeds were sown in each plot (except the blanks). The seeds were placed in five rows 6 inches apart at 3-inch spacing within rows. The individual seeds were pressed firmly into the soil or litter, but were not buried.

Observations of germination and survival were made weekly in May and June, once in July, and once in September 1963. Additional observations were made each spring and fall in 1964 and 1965. During each of the fall examinations, the height of the tallest seedlings in each bed was measured to the nearest 0.1 inch.

Analysis of variance was used to analyze differences in germination, survival, and height. Germination and survival percentages were transformed to the arcsin.

Results

The blank plots (no seed sown) demonstrated that volunteer black cherry seedlings were not numerous enough on the experimental areas to have any appreciable effect on the results on the seeded plots. Only nine seedlings appeared on the 24 blank plots; consequently, these plots will not be considered further. Because of the regular spacing of the seed on the sown plots, the occasional volunteer seedlings usually could be recognized easily and were omitted from tallies and measurements.

Also, except for an interaction with spring-applied herbicide, discussed later, the season of sowing had no significant effect on germination, survival, or growth. Therefore, except for a breakdown by seasons in the first-year results in table 1, data for the two seasons are combined in the following discussion.

Germination.—Of the 6,000 seeds sown, 57.2 percent germinated the first year, and an additional 12.4 percent germinated the second year. There were no significant differences in germination due to the degree of protection, but there were highly significant (1-percent level) differences due to the method of seedbed preparation. Germination was poorest on the beds treated with herbicide, and second poorest on the burned beds. The control treatment (no preparation) yielded as high a rate of germination as the best of the other treatments (table 1).

Both the herbicide-treated plots and the burned plots were relatively bare during the spring germination period and consequently would have dried rapidly at the surface during intervals of fair weather. This drying probably accounted for the failure of some seeds to germinate.

In addition, the low figure of 33.7 percent germination for the spring sowing on herbicide-treated plots probably reflects injury by residual herbicide. The herbicide, having been applied in both seasons about a

Table 1.—*Germination of black cherry seed and height growth of black cherry seedlings, the first year, by treatment groups*

Treatment	Fall sowing			Spring sowing		
	Germination	Height		Germination	Height	
	All plots	All plots	Protected plots	All plots	All plots	Protected plots
	Percent	*Inches*	*Inches*	*Percent*	*Inches*	*Inches*
Seedbed preparation:						
None	65.3	8.4	10.7	61.2	9.6	12.2
Burned	56.0	13.9	16.4	50.7	13.8	16.7
Spaded	63.8	9.2	10.6	61.5	11.0	13.2
Scarified	62.8	8.4	9.9	62.8	9.7	12.1
Herbicided	54.3	8.7	10.2	33.7	13.4	13.4
Protection:						
Unprotected	52.4	4.0	—	44.0	3.4	—
Protected from deer	59.9	16.1	—	52.8	15.2	—
Protected from deer and rodents	68.9	10.9	—	56.8	12.8	—
Protected from deer, rodents, and birds	60.7	7.7	—	62.3	12.6	—

week before the seeds were sown, would have undergone much less breakdown in the spring-sown plots at the time of germination. Moreover, 29 percent of the spring-sown seed had already sprouted when sown, and the seeds were even more vulnerable to any residual herbicide that they encountered.

Seedling establishment.—At the end of the first growing season (November 1963), the seedlings found and classified as alive represented 34.4 percent of the seed sown. This figure indicated a mortality of 39.8 percent of total germinaton. Differences in first-year survival due to levels of protection were significant at the 5-percent level; the significance is accounted for by the comparatively poor survival in the beds that were not protected against deer (table 2). Differences due to seedbed-preparation methods were significant at the 1-percent level; the significance here is accounted for mainly by the fewer survivors on the herbicide-treated beds. Lower germination was mainly responsible for these lower survival figures.

More living seedlings were present after the second and third growing seasons than were tallied after the first growing season. Some of this increase came from clipped seedlings that had been overlooked or classified as dead the first year but resprouted the second season, and some of the increase came from delayed germination. The number of seedlings living at the end of two growing seasons was 43.9 percent of the number of seeds sown (table 2). This figure had dropped to 36.8 percent by the end of the third growing season.

Table 2.—*Total seed germination, mortality, and seedling establishment, by protection levels*
(In percent of seed sown)

Item	Unprotected	Protected from—		
		Deer	Deer and rodents	Deer, rodents, and birds
First-year germination	48.2	56.3	62.9	61.5
Rodent mortality[1]	11.5	6.8	2.1	2.1
Mortality, miscellaneous, and unknown	16.0	13.7	20.0	19.0
First-year survival	20.7	35.8	40.8	40.4
Second-year germination	5.5	14.3	16.0	13.7
Second-year survival[2]	24.3	47.3	59.7	44.5

[1]Includes seeds consumed by rodents and seedlings clipped by rodents and cutworms.
[2]Includes some seedlings that were clipped or appeared dead at the end of the first season but resprouted the second season.

Height growth.—Differences in height growth among levels of protection were highly significant. Based on the tallest seedling in each seedbed, the mean first-year height of seedlings on protected plots was 12.6 inches, and the mean first-year height of seedlings on plots with no protection was 3.7 inches. In the second year, mean height of seedlings under protection increased to 25 inches, whereas those with no protection added less than 2 inches to their mean height, and considerable mortality was occurring (table 3).

Differences in mean heights of the tallest seedling per plot among seedbed-preparation methods were highly significant only for the protected seedbeds. This was true in all years from the first through the fourth growing seasons. The significance lay in the difference between the burned seedbeds and all other seedbeds collectively: In the first year (table 1), mean heights on the burned seedbeds were 16.4 inches and 16.7 inches for fall and spring sowings compared to a range of 9.9 inches to 13.4 inches on the other seedebeds; in the second year (table 3), the mean height on the burned seedbeds was 31.7 inches compared to a range of 21.3 to 25.0 inches on the other seedbeds. The superior growth on the burned beds presumably was due to nutrient elements released in the

Table 3.—*Two-year height growth by seedbed-preparation and locality for protected beds combined and for unprotected beds*

Treatment	Locality			
	Hook Run	Mill Creek	Seldom Seen Corners	All
	Inches	*Inches*	*Inches*	*Inches*
Protected:				
None	24.1	36.2	5.3	21.8
Burned	35.6	43.3	16.2	31.7
Spaded	25.8	36.4	12.2	24.1
Scarified	20.9	31.1	12.0	21.3
Herbicided	29.4	37.4	8.1	25.0
Average	27.2	36.9	10.8	25.0
Unprotected:				
None	4.0	5.5[1]	6.8	5.4
Burned	5.8	2.0	6.8	4.9
Spaded	7.8	3.2	7.8	6.3
Scarified	6.0[1]	2.0	7.5	5.0
Herbicided	4.0	[2]	9.0[1]	5.7
Average	5.4	2.8	7.4	5.4

[1]Only one bed had seedlings present.
[2]None living in fall or spring beds.

ashes; and this suggests that black cherry seedlings would respond to applications of artificial fertilizer.

Also, differences in height growth among the three plot locations were significant for the protected seedbeds. The significance of the differences held up through three growing seasons, but not through the fourth. As shown in table 3, growth was much poorer on the Seldom Seen Corners site than on the other two sites. A much denser ground cover of briars *(Rubus* spp.), climbing buckwheat *(Polygonum cilinode),* and grass on the Seldom Seen Corners site probably accounted for the slower growth.

Although measurements have been taken through four growing seasons, most of the effects of the experimental variables had been expressed after 2 years, and, consequently, no detailed later data are presented. In the beds protected from deer, growth has continued at a reasonably good rate. For the best seedbed-preparation method—burning—the average 4-year height, based on the tallest seedling in each plot, was 46.5 inches, and the best individual seedling measured 84 inches. However, one seedling in a bed that had received no preparation reached a height of 89 inches.

Discussion and Conclusions

A significant finding in this study was that germination was fully as good with no seedbed treatment as with any of the other seedbed treatments. Scarification and exposure of mineral soil, which consistently favor germination and initial establishment of conifers and such light-seeded hardwoods as the birches, apparently are of no benefit to black cherry.

Further, except for somewhat superior growth on the burned plots, none of the seedbed treatments resulted in better growth than on the controls. This is readily explainable because none of the treatments had any marked effect upon the development of the herbaceous and low woody vegetation that normally appears in forest openings. Even the herbicide treatment with Dowpon checked the grasses only temporarily (until about mid-June) and had no noticeable effect on ferns, briars, annual weeds, and pin cherry reproduction. The superior growth of the black cherry seedlings on the burned plots should perhaps be viewed with reservations because of the extra fuel that was carried onto these plots to assure a good burn. Burning on an area-wide basis probably would have less effect on subsequent seedling growth.

Consumption of seed by birds does not appear to be a problem with black cherry. Rodents take some seed, but, at least on these experimental

plots, their seed depredations were not very serious. In certain instances they took as high as 38 percent of the seed on a plot, but in general the seed losses to rodents were in the range of 5 to 15 percent.

Rodent damage is not restricted to seed consumption; considerable clipping of seedlings occurred on our plots in May of the first year and caused some mortality and a severe setback to other seedlings that then resprouted from the base. Some clipping appeared to have been done by cutworms, also. We have no measure of how much of the clipping damage is chargeable to each pest. However, although the damage attributable to rodents (and cutworms) may be considerable, it does not appear to be the determinant of success in regenerating black cherry from seed.

Deer are the really serious problem in regenerating black cherry on the Allegheny Plateau. On the unprotected experimental plots, few, if any, of the cherry seedlings appeared to stand much chance of ever getting tall enough to escape deer browsing. Because all slash had been removed, these seedlings were more exposed than is typical of regeneration cuttings. However, seedlings growing among normal accumulations of slash elsewhere on the cutover patches were not faring much better. At best, no more than an occasional seedling on these patches seemed very likely to grow above reach of the deer.

Although protected seedlings at the Seldom Seen Corners location made the poorest growth of any seedlings in the study, the unprotected seedlings grew somewhat better there than at the other locations. The denser ground cover, which apparently depressed the growth of the protected seedlings, tended to hide the unprotected seedlings and also provided more other browse. However, it is still doubtful that these unprotected seedlings will survive and make satisfactory height growth.

The results of this study support the conclusion that recently clearcut patches on the Allegheny Plateau like those used for our study can be regenerated to black cherry by seeding if present intensities of deer damage were substantially reduced. No specific seedbed-preparation treatments should be necessary to obtain adequate germination and initial seedling establishment. However, in some places, follow-up weeding treatments might be required to get the seedlings through the competition resulting from faster growing hardwood stems such as pin cherry seedlings and from sprouts at the stumps of the harvested hardwood trees.

—HAROLD J. HUNTZINGER
Research Forester
Northeastern Forest Experiment Station
Forest Service, U. S. Dep. Agriculture
Warren, Pennsylvania