

Direct Seeding of Oak In Missouri

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In seeking low-cost methods of forestation, the planting of seed instead of wild or nursery-grown seedlings offers possibilities. Direct seeding also may produce a stand of healthier and more vigorous trees because root injury, unavoidable in transplanting small trees, is eliminated. Root injury seems to be a critical factor in early survival and growth of transplanted trees, especially with tap-rooted species, such as the oaks and black walnut. If these advantages could be secured by direct seeding without serious disadvantages, this method would be preferable to planting seedlings. However, experience has demonstrated that rodents and unfavorable weather often

jeopardize the success of direct seeding. If these hazards can be overcome, seed planting may offer Missouri timberland owners an effective means of establishing valuable tree species on poorly stocked and bare lands.

Studies on direct seeding were initiated at the University of Missouri Forest in Butler County, approximately 15 miles north of Poplar Bluff, in 1948. Results of this work are reported here to show the difficulty of overcoming hazards and to indicate methods that show promise. This is a report of progress on a series of continuing studies.

EFFECT OF LITTER

The first experiment in direct seeding of white oak, black oak, and scarlet oak was designed to evaluate the effect of litter upon germination and survival. Three plots were established, each on a different site. The three sites included a ridge-top with substantially rock-free soil, a lower east slope with soil rich in organic matter and with good granular structure, and a south slope with heavy rock cover. The site index for oaks could be classified as excellent for the lower east slope, fair for the ridge-top, and fair to poor for the south slope. All three plots supported open hardwood stands, with crown canopies under 50-percent density. None of the areas had burned for at least 10 years. The litter was heavier and more evenly distributed and the surface vegetation was more dense on the lower east slope than on the other sites. Mouse activity was noted on all plots, their tunnels being most numerous on the lower east slope.

Each plot embraced an area 120 feet square and contained 400 seed spots in a 6- by 6-foot spacing. The litter was removed from one-half of each plot before the seeding was done. One acorn of each species was planted one inch deep at each seed spot in early November, 1948. Many white oak acorns had started to germinate at the time of planting. Some white oak acorns showed signs of insect infestation, but all acorns of scarlet oak and black oak appeared sound.

Periodic examinations of the seed spots were made following planting, until freezing weather occurred. Mouse pilferage, detected by examination of tooth marks on damaged acorns, was noted during this period, particularly on the east slope plot. Radicles from white oak acorns grew as much as four inches before freezing weather occurred. Weekly examination of the seed spots was resumed in the spring and continued until germination was complete. Then, monthly examinations were made to check survival, the final observation being made during the second growing season in June, 1950.

Rainfall was normal during the growing period and no drought conditions developed.

The results showed that removal of the litter had some effect on the percentage of acorns germinating, and that this effect varied on different sites. The east slope, where mouse activity was highest, had only 40- to 50-percent germination, compared to 60 to 70 percent on the other two sites. On the east slope, removal of the litter evidently reduced mouse damage; the percentage of germination was increased from 36 to 48 percent. On the other plots, there was considerable frost heaving of black and scarlet oak acorns (they did not germinate until spring) on the bare portions, resulting in somewhat better germination on the litter-covered areas.

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White oak had the highest percentage of germination (73 percent) probably because of its early germination. Scarlet oak germination was 53 percent; black oak, 45 percent.

The percentage of survival in June, 1950, of all acorns planted is shown in the table below.

Seedling survival was better on the bare areas because of the reduced mouse damage compared to the litter-covered areas. In addition to destroying acorns before germination, mice destroyed parent acorns while seedlings were still subsisting on food stored in them. The effect of litter removal was most pronounced on the east slope, where the mouse population was highest. Where the litter cover was present, the seeding was almost a complete failure.

On the two sites where the mouse population was not heavy, survival was only slightly better on

the bare areas. The difference probably is not great enough to justify litter removal before seeding, as an economic forest management measure.

Assuming that a stocking of approximately 1,000 seedlings per acre is desirable, it would be necessary to plant 3,700 acorns per acre to get this stocking on the bare site with the heavy mouse population. This would require a spacing of approximately 3.5 ft. by 3.5 ft. for the seed spots. For sites with fewer mice, the spacing could be increased to about 4.5 ft. by 4.5 ft. because of the greater percentage of survival on these areas.

The seedling survival in percent by species was approximately 40 for white oak, 30 for black oak, and 35 for scarlet oak. With the exception of the area where the mouse damage was high, the smallest spacing necessary to insure a full stocking of any of the three species would be 3.5 ft. by 3.5 ft.

Species	East Slope		Ridge-top		South Slope		Average	
	Bare	Litter	Bare	Litter	Bare	Litter	Bare	Litter
White oak	36	5	75	58	48	28	53	30
Black oak	23	1	47	46	27	29	32	25
Scarlet oak	21	4	50	47	48	42	40	31
Average	27	3	57	50	41	33	42	29

RODENT CONTROL

Another experiment in direct seeding of oak was initiated in 1950 to explore some possibilities in rodent control. Two plots were established, one on a grassy ridge-top and the other on a lower east slope. The timber stand on each area was open, with crown canopies under 50-percent density. Both areas were heavily populated with mice, as evidenced by the numerous mouse tunnels.

Black oak and scarlet oak acorns were planted. Each plot included 495 seed spots on a 3- by 3-ft. spacing. In each plot one acorn of each species was planted one inch deep in each seed spot in November, 1950. The planting was repeated in the same manner in March, 1951, using acorns which had been stratified* during the winter.

Acorns subjected to different types of treatment were placed at random in each plot, with 45 seed spots in each treatment. The 11 treatments were:

1. No treatment of acorns.
2. Seed spots covered with hardware-cloth cones.
3. Litter removed from an area 18 inches in diameter.
4. Acorns dipped in dog-dung sludge.
5. Acorns dipped in hog-dung sludge.

6. Benzene hexachloride powder sprinkled liberally over acorn in seed spot.
7. Acorns dipped briefly in a solution of potassium permanganate (approximately 1 ounce per gallon of water).
8. Acorns dipped briefly in a solution of ferric chloride (approximately 1 ounce per gallon of water).
9. Acorns dipped briefly in an emulsion of equal parts of copper oleate and kerosene.
10. Acorns dipped in water and then coated with dehydroacetic acid powder.
11. Acorns dipped in linseed oil and then coated with red lead powder.

A seedling count was made after germination was complete in June, 1951. Each seed spot where no seedling was present was carefully examined to determine if the acorn had been defective or had been destroyed by rodents. If the acorn was missing or partially destroyed, the cause was attributed to mouse damage. Seedling death occurring prior to this examination and resulting from damage to the parent acorn also was included under mouse damage. Those seed spots which had been planted with defective acorns were discarded in analysis of the data on germination and survival. Approximately 10 percent of the acorns planted were defective; the percentage was 11.4 for scarlet oak and 8.5 for black oak.

*Stored outdoors in coarse sand from November to March, maintaining moist well-drained conditions, cool but not freezing.