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Southern Forest Experiment Station Research Note

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Control of Dogfennel (*Eupatorium Capillifolium* (Lam.) Small) Does Not Increase Loblolly Pine Yields[1]

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SUMMARY

Control of dogfennel alone did not increase height or cubic-foot volume of newly planted loblolly pines. Of five treatments – check, removal of dogfennel in the 1st year only, removal of all dogfennel yearly, removal of all competing vegetation biannually, and yearly spraying of all competing vegetation with chemicals—only biannual removal of all competing vegetation produced significantly better pine height and cubic-foot yields.

Additional keywords: Weed control

INTRODUCTION

Mechanical site preparation on upland sites in the West Gulf Region is often followed by a rapid proliferation of both annual and perennial plants that compete with newly planted pines. Controlling all competing plants can increase the cubic-foot yields of pines, but such measures may be impractical and prohibitively expensive. So we must find out if controlling only certain plant populations will significantly increase pine yields.

This study determined whether controlling one major competitor—dogfennel (*Eupatorium capillifolium* (Lam.) Small)—in a newly planted loblolly pine (*Pinus taeda* L.) plantation would increase pine survival, height, and volume.

Dogfennel is a short-lived perennial commonly found on pine sites in Louisiana. It grows in colonies from thick woody roots, averages 4–5 ft tall when mature, and may have thousands of stem clusters per acre.

METHODS

The study area is located in central Louisiana on a moderately well drained Beauregard silt loam soil that originally supported a scattered

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stand of loblolly pine. The site was chosen for its large dogfennel population.

Harvesting of the pine in 1974–75 left a dense mixture of hardwoods that were mainly understory trees before the cutting. The predominant species included oaks, sweetgum, blackgum, and flowering dogwood (see table 4 for scientific names). These hardwoods numbered several thousand per acre, ranged up to 17 inches in diameter, and averaged about 7 inches in d.b.h. (diameter at 4.5 ft aboveground). In the summer of 1975 the residual stand was sheared, windrowed, and left unburned. In February 1976 the area was machine-planted with 1-0, bare-root loblolly pine seedlings at a 6 × 12 ft spacing.

In July 1976 the most numerous plant species on the site, excluding grasses, were inventoried. Dogfennel averaged 21,000 plants (clusters from common rootstock) per acre. The major vine and brush species were smilax (6,500 stems per acre), American beautyberry (6,000 stems per acre), and shining sumac (2,800 stems per acre). Many forb species and a mixture of scattered oak, hickory, sweetgum, blackgum, flowering dogwood, tree sparkleberry, and muscadine grape also grew on the area.

Plots were established in a completely randomized block design with four replications. Each plot contained one row of 10 loblolly pines. All plots were at least 12 ft from a windrow, and no plot touched another.

Five different degrees of competition control were maintained over three growing seasons starting in July 1976:

(1) Check—no post-planting control of competing vegetation;
(2) Removal of dogfennel by digging up roots in the 1st year only;
(3) Removal of dogfennel yearly;
(4) Removal of all competing vegetation by hoeing twice a year;
(5) Control of all competing vegetation by annual spraying with a mixture of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) and MSMA (monosodium acid of methanearsonate) in water solution.

For treatment 5, pines were shielded in 1976 and 1977 so they would not suffer chemical injury. Trees were not shielded in 1978. During July 1976, each chemical was applied at 8-lb acid equivalent (ae) per acre in 3 gal water. The rates were halved for the May 1977 and May 1978 treatments. Even the 4 lb ae rates, however, were excessive for treatment among young loblolly pines because the chemicals pruned the lower branches. Chemicals probably also caused less evident injuries that might have decreased pine survival, height, and volume. So damage from chemicals compromised treatment-5 results, and they were excluded from further analysis.

No treatment could be devised for controlling all competing vegetation except dogfennel.

Tip moths (*Rhyacionia frustrana* Comstock) infested the plantation during March 1977. Pines were treated in March 1977 and 1978 with pellets that were 10 percent carbofuran. This treatment prevented confusion of insect damage with damage caused by dogfennel. Pellets were broadcast by hand around individual pines at a rate of 10 g per tree in 1977 and 20 g per tree in 1978. Pines suffered little evident tip moth damage.

As a measure of treatment response, total heights to the nearest 0.1 ft and diameters at one-half of total height to the nearest 0.1 inch were taken each fall on all surviving pines. Diameters at the groundline were also taken in 1978 to the nearest 0.1 inch. Total cubic-foot volume per tree was calculated with the equation from Perry and Roberts (1964):[2]

$$V = 10.62\, D^2 \cdot H$$

where V = volume per tree in cubic inches
H = height per tree in feet
D = diameter per tree at one-half of total height in inches.

For each plot, single-tree volumes were averaged.

On May 1 and 2, 1978, all competing vegetation within a 1-milacre circle around tree number 5 was cut to a 1-inch stub and bagged for drying on the treatment-3 and -4 plots. For each check plot, a 1-milacre sample was taken from an adjacent row so that check plots would not be disturbed. This inventory was taken before cultural treat-

[2]Perry, T. O. and A. Y. Roberts. 1964. Volume formulas for loblolly pine seedlings in the vicinity of Raleigh, North Carolina. J. For. 62:182–187.

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ments were applied. Samples were ovendried at 70° C to a constant weight.

During the first four growing seasons after planting, an inventory of the dogfennel was conducted before cultural treatments were applied. This inventory was done on 3 milacres per plot, with pine seedling numbers 2, 5, and 8 as center points.

In October 1979 I inventoried competing plants again to determine the most numerous species on the study area at stand age 4 (table 4).

Average pine survival, diameters at groundline, total heights, and cubic-foot volumes were tested by analyses of variance. Differences among means were determined by Duncan's Multiple Range Test (0.05). Survival percentages were transformed into arcsin $\sqrt{\text{proportions}}$ before analysis.

RESULTS AND DISCUSSION

Pine Survival, Growth, and Yield

Loblolly pine survival was high on all plots, and survival did not differ statistically among treatments (table 1).

By stand age 2, pines on treatment-4 plots were significantly taller than trees on check plots. This difference was maintained through the 3d year when loblolly pines on treatment-4 plots were 23 percent taller than pines on the check plots (table 1). Pines on treatment-2 and -3 plots where only dogfennel was controlled were not significantly taller than trees on check plots.

After 3 years, loblolly pine on treatment-4 plots had significantly larger diameters than did pines in the other three treatments (table 1).

Differences in the cubic-inch volume per pine developed during the second growing season. This difference increased during the third growing season; by stand age 3, trees on treatment-4 plots had over twice the average volume of trees on check plots (table 1). This large increase in yield occurred even though most competitors were herbaceous plants.

Competing Vegetation

The 21,600 dogfennel clusters per acre noted on the check plots at the beginning of the study had declined to 9,500 per acre by the fourth growing season after planting (table 2). And stem vigor and number per cluster had declined. By the fourth growing season, dogfennel numbered only 250 and 400 clusters per acre on treatment-2 and -3 plots where just dogfennel was controlled. No clusters were noted on treatment-4 plots.

Dogfennel seedlings were more common on treatment-2 and treatment-3 plots than on check and treatment-4 plots. Pines on treatment-4 plots had well developed crowns that shielded the plot surface, thus reducing encroachment, germination, and development of seedling dogfennel. Most dogfennel seedlings had disappeared by July on all plots. The few remaining seedlings were poorly developed and under severe moisture stress.

Evidently dogfennel can successfully pioneer an area, but then declines over the years under competitive pressure from strong perennials, like the grasses. As established dogfennels fade from the site, the other plants keep the seedling dogfennels from becoming established. The mechanism of suppression might be moisture stress or shading from overtopping plants. Removing dogfennel was ineffective because other herbaceous plants quickly replaced it, thus maintaining constant competitive pressure on the pines.

In May 1978, ovendry weights per acre of all competing plants were significantly less on treatment-4 plots than on check and treatment-3 plots (table 3). Treatment-2 plots were not sampled because these plots were intermediate to treatment-1 and treatment-3 plots.

Field evaluation in 1979 clarified May 1978 data. On check plots the woody competition was developing slowly, and herbaceous plants were still the major competitors of loblolly pine four growing seasons after planting. The major competitors on check plots were panicums, bluestems, common carpetgrass, purple lovegrass, composites, American beautyberry, blackberry, shining sumac, hypericums, and smilax (table 4).

In 1979 no difference was evident in level of competition on the check, treatment-2, and treatment-3 plots (except in number of dogfennel).

By the fourth growing season, pines dominated treatment-4 plots and were suppressing competition. In 1979, then, herbaceous plants were sparse, and despite the stopping of treatment in 1978, brush was limited to a few small shining sumac and a few small blackberry canes.

Table 1.—*Survival and growth of loblolly pine at stand age 3, by treatment*

Treatments	Survival	Total height	Diameter at groundline	Volume per tree
	Percent	*Feet*	*Inches*	*In*^{3}
Check	98 a*	5.2 a	1.5 a	32.0 a
Dogfennel removed 1st year only	98 a	4.8 a	1.3 a	23.2 a
Dogfennel removed yearly	100 a	5.3 a	1.3 a	28.4 a
All vegetation removed by hoeing	95 a	6.4 b	2.0 b	71.2 b

*Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, 0.05).

Table 2.—*Dogfennel inventories*

Treatments	July 1976 before treatments began	May 1979 after final treatment		
	Residual stem clusters	Residual stem clusters	New seedlings	1979 totals
	Number of stems per acre			
Check	21,600	9,500	16,500	26,000
Dogfennel removed 1st year only	16,700	250	61,250	61,500
Dogfennel removed yearly	23,900	400	52,100	52,500
All vegetation removed by hoeing	23,500	0	24,500	24,500

Table 3.—*Ovendry weight per acre of competing vegetation in May 1978*

Treatment	*Mean*
	Tons
Check	0.85 b*
Dogfennel removed yearly	0.88 b
All vegetation removed by hoeing	.07 a

*Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, 0.05).

Table 4.—*Abbreviated listing of the competitors of planted loblolly pine; field data were collected in October 1979, four growing seasons after planting*

Common name	Scientific name
Major competitors	
Grasses	
Panicums	*Panicum* spp.
Bluestems	*Andropogon* spp.
Common carpetgrass	*Axonopus affinis* Chase
Purple lovegrass	*Eragrostis spectabilis* (Pursh.) Steud.
Composites	
Maryland goldaster	*Heterotheca mariana* (L.) Shinners
Bushy aster	*Aster dumosus* L.
Skydrop aster	*Aster patens* Ait.
Dogfennel	*Eupatorium capillifolium* (Lam.) Small
Tall goldenrod	*Solidago altissima* L.
Brush	
Shining sumac	*Rhus copallina* L.
Smilax	*Smilax* spp.
Blackberry	*Rubus* Spp.
American beautyberry	*Callicarpa americana* L.
Hypericum	*Hypericum* spp.
Other competitors	
Grasses	
Fringeleaf paspalum[1]	*Paspalum ciliatifolium* Michx.
Arrowfeather threeawn	*Aristida purpurascens* Poir.
Composites	
Swamp sunflower	*Helianthus angustifolius* L.
Horseweed	*Erigeron canadensis* L.
Hyssopleaf eupatorium	*Eupatorium hyssopifolium* L.
Mistflower	*Eupatorium coelestinum* L.
Roundleaf eupatorium	*Eupatorium rotundifolium* L.
Purple cudweed	*Gnaphalium purpureum* L.
Fragrant cudweed	*Gnaphalium obtusifolium* L.
Hairy elephantfoot	*Elephantopus tomentosus* L.
Wrinkled goldenrod	*Solidago rugosa* Ait.
Fragrant goldenrod	*Solidago odora* Ait.
Forbs	
Woolly croton	*Croton capitatus* var. *lindheimeri* (Engelm. and Gray) Muell. Arg.
Maryland meadowbeauty	*Rhexia mariana* L.
Whiteleaf mountainmint	*Pycnanthemum albescens* T&G
Downy lobelia	*Lobelia puberula* Michx.
Southern bracken	*Pteridium aquilinum* (L.) Kuhn var. *pseudocaudatum* (Clute) Heller
Brush	
Muscadine grape	*Vitis rotundifolia* Michx.
Carolina jessamine	*Gelsemium sempervirens* (L.) Ait.
Eastern baccharis	*Baccharis halimifolia* L.
Southern bayberry	*Myrica cerifera* L.
Tree sparkleberry	*Vaccinium arboreum* Marsh.
Flowering dogwood	*Cornus florida* L.
Persimmon	*Diospyros virginiana* L.
Blackgum	*Nyssa sylvatica* Marsh. var. *sylvatica*
Sweetgum[2]	*Liquidambar styraciflua* L.
Water oak[2]	*Quercus nigra* L.
Southern red oak[2]	*Q. falcata* Michx.
Blackjack oak	*Q. marilandica* Muenchh.
Chinquapin	*Castanea alnifolia* Nutt.
Hickory	*Carya* spp.

[1]Fringeleaf paspalum was actually rare on the study site; no other paspalums were evident.
[2]These species will probably develop into the major understory trees beneath the pine canopy.

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