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Forage and Tree Experiment (FATE)

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Abstract
Trees are becoming an increasingly important component of the Iowa landscape. For tree plantings to be more common in Iowa, two major problems related to establishment must be overcome: (1) intense weed competition and (2) lack of market or nonmarket values for several years for newly planted trees. To develop information that addresses these problems, a research project was initiated during the spring of 1998 at the Rhodes Research Farm.

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Introduction

Trees are becoming an increasingly important component of the Iowa landscape. For tree plantings to be more common in Iowa, two major problems related to establishment must be overcome: (1) intense weed competition and (2) lack of market or nonmarket values for several years for newly planted trees. To develop information that addresses these problems, a research project was initiated during the spring of 1998 at the Rhodes Research Farm.

The objectives of this research were to: (1) evaluate the influence of various weed control methods on the growth and survival of five tree species, (2) determine the cost effectiveness of planting trees with different weed control techniques, and (3) evaluate the influence of the trees on the productivity of small grain/forage crop combinations. Seven weed control treatments were used: (1) oats and red clover, (2) oats, red clover, and red fescue, (3) oats, red clover, and orchardgrass, (4) oats and hairy vetch, (5) herbicide, (6) mowing, and (7) control (no treatment). Five species of trees were planted in two groups; the first group (fast-growing trees) contained two poplar clones and silver maple. The second group (slow-growing trees) consisted of high-value hardwoods, red oak and black walnut, both planted from seedlings and seeds.

Materials and Methods

Moderately uniform upland and bottomland pasture sites on the northern end of the farm were selected for planting. Farm personnel disked both sites to prepare them for the study. Each site was divided into six blocks: three for the fast-growing hardwoods and three for the slow-growing hardwoods. Forages were seeded in the spring, and within a few days, tree seedlings and seed were planted. In all, 2,500 seedlings and 5,800 seed were planted.

Initial plans for the study called for harvesting the oats at grain maturity and subsampling forages to determine yield. However, inclement weather made forage maintenance impossible, creating very weedy conditions in the forage plots. As a consequence, we decided to not sample for forage production. Instead, steps were taken to promote growth of the forages by mowing the plots, because mowing is a practice used to help establish forages. Mowing was done three times during the growing season, which allowed the forages to increase to 80% or better coverage within most plots but prevented estimation of forage production. Mowing the forage plots twice a year was continued in the 2000 and 2001 growing seasons to help maintain the forage component of those plots. Yield samples were taken during the second year using a rising plate method, but because of weed problems, estimates were not reliable. That phase of the project was dropped.

The height of all surviving planted seedlings and seedlings from seed was measured each year during the fall. Forage crop coverage was estimated during the third and fourth growing seasons.

Results and Discussion

After four years, the treatments did not appear to influence seedling survival ($P \geq 0.28$). The treatments, however, had a definite impact on height growth (Table 1). Trees grown in herbicide plots were significantly taller (3.2 m) than those in the other treatments (2.5 m) ($P<0.02$). Surprisingly, except for the bottomland, slow-growing trees, tree heights increased in trees planted with forage crops compared to those in the mowing and control treatments (P≤0.05).

There was little difference in the average tree height among the forage treatments. Contrasts showed no significant difference in height (P≥0.14) on three of the four experimental groups. The bottomland slow-growing group was the only one to show a difference (P= 0.01), which was due to poor tree growth in the hairy vetch treatment.

After four years, black walnut seedlings from seed were taller (1.4 m) than planted seedlings (1.2 m) (P≤0.02), indicating that direct seeding is a viable alternative to planting seedlings.

A short-term economic analysis was conducted by estimating costs and returns with different weed control treatments for black walnut and Crandon. For black walnut, net present value increased by $464/acre when forage crops were used for weed control versus use of herbicides for weed control. Under the same scenario, Crandon net present value increased $517/acre.

Table 1. Differences in average total height (m) based on contrasts between various treatment groups for fast-growing and slow-growing species on upland and bottomland sites. Values in parentheses are P values for null hypothesis of no difference between groups of treatments.

Contrast	**Upland fast-growing (m)**	**Bottomland fast-growing (m)**	**Upland slow-growing (m)**	**Bottomland slow-growing (m)**
Mowing vs. Control	0.23 (0.25)	-0.30 (0.26)	0.10 (0.18)	0.11 (0.25)
Herbicide vs. Vegetative	0.38 (0.02)	1.04 (<0.01)	0.24 (<0.01)	0.53 (<0.01)
Vegetative vs. M&C*	0.41 (<0.01)	0.32 (0.05)	0.12 (<0.01)	0.0 (0.98)
Among vegetative	(P=0.28)	(P=0.43)	(P=0.35)	(P=0.01)

*M&C- Mowing and Control

Table 2. Short-term economic analysis of net present value (NPV) at a 7.5% alternative rate of return for Crandon and black walnut, both planted seedlings and from seeds, under various

Management option	Crandon	Black walnut seedlings	Black walnut from seed
	NPV ($/ac)	NPV ($/ac)	NPV ($/ac)
Herbicides	-573	-485	-358
Oats, red clover, & red fescue (harvested)	-56	42	106
Oats & red clover (harvested)	-112	13	77