ACCELERATING PLANTED GREEN ASH ESTABLISHMENT ON AN ABANDONED SOYBEAN FIELD

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Abstract–Planted green ash seedlings exhibit high survival rates on most bottomland sites that have recently come out of row crop production, making this species a popular choice for afforestation. Sub-optimal growth of planted hardwood tree species, including green ash, often delays the realization of many of the economic and environmental benefits that are used to justify the expense of tree planting and land use conversion. This study evaluates the impacts of silvicultural treatments, including pre-planting discing, and two herbicide treatments (sulfometuron and glyphosate) on early stand development in a green ash planting on a former soybean field in southern Illinois. After two growing seasons, both herbicide treatments increased green ash height growth while tillage produced no response. Sulfometuron increased total cover and percent grass cover relative to glyphosate and unherbicided treatments, largely by stimulating the growth of broomsedge (Andropogon virginicus). Glyphosate doubled broadleaf cover relative to the sulfometuron and no herbicide treatments.

INTRODUCTION

Formerly-forested bottomland sites offer excellent opportunities for afforestation in the lower Midwest and Mid-south. Typicaly, these sites were cleared of forest cover during the soybean boom of the 1960's and 70's but are now considered marginal for row crop agriculture. More recently, private and government programs are resulting in restoration of native hardwood cover to many of these sites (Stanturf and others 2000).

While survival and growth of planted trees is usually adequate to satisfy afforestation guidelines, the combination of planted trees and volunteer vegetation have failed to produce forest cover in some areas. Establishment failures in similar settings have been attributed to poor matching of species and site (Hodges 1997). Sometimes, these conditions are an unintended consequence of long-term row crop agriculture and may ultimately limit the number of desirable species that are suitable for the site. Green ash (Fraxinus pennsylvanica Marsh.) is one species with demonstrated utility in formerly farmed bottomland sites and was therefore selected for use in this study (Groninger and others 2000).

Competition from herbaceous vegetation also appears to hamper the establishment of canopy cover on similar sites. Funds are generally available through cost share programs for vegetation control treatments, including tillage and herbicides. However, their use is limited because several local land managers question the value of these treatments. The objectives of this study were to evaluate the efficacy of tillage and herbicide treatments, alone and in combination on the establishment of planted green ash. Further, volunteer herbaceous vegetation response to these treatments were evaluated.

METHODS

This study was conducted on a poorly drained site in Saline County, Illinois. Soils were classified as a Bonnie silt-loam (Fine-silty, mixed, acid, mesic, Typic Fluvaquents). The site had been cleared of forest cover ca. 1967 and cropped periodically thereafter in soybeans. Corn was planted in 1997 and the site left fallow in 1998. In Fall 1998, the site was mowed and enrolled in the Wetlands Reserve Program.

The tilled treatments consisted of a) three passes with a tandem disk drawn by a 40 hp farm tractor and b) an untilled control. Tillage was carried out on May 8, 1999, the earliest date soil moisture conditions permitted use of this equipment. Herbicide treatments consisted of a) sulfometuron methyl, b) glyphosate, and c) an untreated control.

Green ash seedlings (1-0) of unknown origin were obtained from the Illinois State Tree Nursery. Seedlings were machine planted on May 4 with follow-up hand planting to replace mis-planted individuals on May 28. Immediately following replacement planting, herbicide treatments were initiated. Sulfometuron was applied over the top using an ATV mounted with a 10 foot boom as 2 oz Oust/ac. in a water carrier. At that time, budbreak had occurred in some seedlings. The glyphosate treatment was applied on July 8 as 1.5 percent RoundupPro solution using a water carrier. The glyphosate treatment was applied to a 4.5 foot diameter circle around each seedling. During the glyphosate application, seedlings were shielded with a 4" diameter stovepipe to prevent herbicide contact with foliage.

Seedling survival and height were measured during the winter following the first and second growing season. Deer

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Table 1—Mean end of growing season height for planted green ash in response to competition control treatments. Means within a column followed by the same letter are not significantly different (á < 0.05)

Treatment	Year 1	Year 2
	----------Height(inches) ---------	
No herbicide	14a	26a
Glyphosate	20b	39b
Sulfometuron	18b	40b

Table 2—Predominant volunteer vegetation across competition control treatments during the second growing season

Species	Cover (percent)
Crabgrass (Digitaria sanguinalis)	22
Broomsedge(Andropogon virginicus)	13
Barnyard grass(Echinochloa crusgalli)	7
Goldenrod (Solidago spp.)	4
Horseweed(Conyza canadensis)	3
Trumpet creeper(Campsis radicans)	2
Yellow nutsedge(Cyperus esculentus)	2

Table 3—Second-year volunteer vegetation response to competition control treatments. Means within a column followed by the same letter are not significantly different (< 0.05)

	Broadleaves	Grasses	Total cover
	----------percent----------		
No herbicide	11 a	31 a	42 a
Glyphosate	24 b	33 a	57 a
Sulfometuron	11 a	66 b	77 b

and rodent damage were assessed immediately prior to bud break preceding the second growing season. Identity and percent cover of each herbaceous species were determined during early August within a 0.5 m^2 area surrounding each planted seedling.

The study employed a randomized split plot design where main plots consisted of tillage treatments and split plots consisted of the herbicide treatments. Each experimental unit consisted of 20 green ash seedlings. The study was replicated four times with blocks intended to account for soil moisture conditions. Significant differences between treatments were identified using Duncan's New Multiple Range Test (< 0.05). Tree height and cover data were

Table 4—Second-year broomsedge and horseweed cover response to competition control treatments. Means within herbicide and tillage within a column followed by the same letter are not significantly different (< 0.05)

Treatment		Broomsedge	Horseweed
		----Cover (percent)----	
Herbicide	No herbicide	8 a	3 a
	Glyphosate	5 a	11 a
	Sulfometuron	27 b	7 a
Tillage	No tillage	22 b	3 b
	Tillage	5 a	11 a

transformed using logarithmic and arc sine transformations, respectively.

RESULTS AND DISCUSSION

Green ash survival at the end of two growing seasons exceeded 95 percent in all treatments and was not considered in further analyses.

Tree growth

Green ash height was greater in response to herbicide treatments following both the first and second growing seasons (table 1). Herbicide treatments did not differ from one another in terms of growth response despite the fact that the pre-emergence sulfometuron application resulted in a longer period of nearly total weed control than the post-emergence glyphosate treatment.

Seedlings showed evidence of foliar damage, including chlorosis and small leaf size, in response to sulfometuron application (Babassana 2000). Ezell and Catchot (1997) and Horsley and others (1992) reported similar damage in response to post-foliation application of sulfometuron at similar rates. Although herbicide damage did not impact survival rate, resources that might have otherwise increased height growth were needed to overcome herbicide-induced injury. An unusually dry late spring may have also played a role in eliminating competition control gains associated with the earlier weed control treatment.

The tillage treatment did not effect seedling growth, consistent with the findings of Kennedy (1985). Successful tillage operations appear to require multiple treatments at least through the first growing season (Devine and others 2000).

Deer browsing between the first and second growing seasons was minimal (< 3 percent across treatments) which may reflect a particularly mild winter or the relative unpalatability of green ash seedlings (Rayburn and Barkalow 1973). Deer browse will be assessed immeidately prior to the third growing season, following a particularly long and cold winter.

Volunteer Vegetation

Volunteer community composition during the second growing season was typical of an abandoned bottomland field in this region (Bazzaz 1968) dominated by native and exotic grass and forb species (table 2). Volunteer community composition differed in response to herbicide treatments (table 3). Glyphosate more than doubled percent cover of broadleaf weeds over the other herbicide treatments. Sulfometuron resulted in 100 percent greater grass cover relative to glyphosate and the control. Overall, sulfometuron resulted in the highest average percent vegetation cover, driven largely by increased broomsedge cover (table 4). Tillage generally did not impact cover of dominant weed species. Exceptions were broomsedge which was decreased by tillage and horseweed which was increased by tillage.

Increased broomsedge dominance in response to weed control has been widely observed (Miller and others 1995). The antagonistic effects of broomsedge on first-year growth of trees is well-documented (Morris and others 1989; Zutter and others 1999). In the present study, broomsedge is becoming dominant somewhat later in stand development and may therefore impact tree growth differently. In the present study, the two herbicide treatments resulted in differing community composition but result in virtually identical tree growth. In this setting, the apparently increasing importance of broomsedge should provide some information regarding the role of post-establishment community composition on green ash growth in the coming years.

CONCLUSIONS

After two growing seasons, herbicides, but not tillage, improve green ash height growth. The amount and composition of volunteer vegetation differed among herbicide treatments providing land managers with the flexibility to establish a range of herbaceous community types while simultaneously accelerating tree canopy closure. Further monitoring will be required to determine the effects of these treatments on long-term vegetation development.

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