Establishment of Native Grasses into Fescue Sod

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ABSTRACT

Cool-season perennial grass production declines rapidly during the hot summer months. This poor productivity is of special concern to forage producers who rely on a continuous supply of herbage. Establishment and obtaining a reasonable stand are problems associated with native grasses. A field experiment was initiated to evaluate the influence of disking, herbicide, and spring burn treatment combinations on stand population and vigor of four warm-season grasses. Treatments included a fall herbicide, spring herbicide, fall/spring herbicide, fall herbicide-spring disk, spring herbicide-spring disk, fall/spring herbicide-spring disk, fall herbicide-spring burn and an untreated control. The existing tall fescue (*Festuca arundinacea* Schreb.) vegetation was sprayed with glyphosate [*N*-(phosphonomethyl) glycine] at 1 qt a.i. acre^{-1}. The grass species were 'Kaw' big bluestem (*Andropogon gerardii* Vitman), 'Alamo' switchgrass (*Panicum virgatum* L.), 'Pete' eastern gamagrass [*Tripsacum dactyloides* (L.) L.], and 'Lometa' Indiangrass [*Sorghastrum nutans* (L.) Nash]. Visual assessments for plant density (%) were recorded in November of each year and for plant vigor and remaining tall fescue at the end of the third growing season. The data indicate that plant populations increased from Year 1 to Year 3 for combinations containing a disk treatment. Treatments without disk tillage did not produce a reliable stand of native grasses. The range of stand response for disk treatments (67-100%) was greater than the range for treatments without disking (0-25%). Stand populations for switchgrass and Indiangrass were higher than for other species (Year 3). Higher vigor ratings for grass species resulted from treatments in which a disk operation was conducted.

KEYWORDS

Native grasses, establishment, fescue eradication, herbicide, cultivation

INTRODUCTION

One of the major grasses used in forage programs in the mid-south is tall fescue. Tall fescue is characterized by early spring growth and is normally productive in the spring, early summer and again during the fall. A forage base that does not contain summer grazing can be detrimental to the performance of animal daily gain and performance. Perennial native warm-season grass species may offer an opportunity to provide much needed grazing during the hot, dry portion of the growing season (Rehm, 1984). Native grasses are also recommended for reseeding marginal cropland to improve available forage, conserve soil, and provide wildlife habitat (Beran *et al*., 2000).

Methods of establishment for native grasses into tall fescue sod may make this conversion of cool- to warm-season species more acceptable. Vassey *et al*. (1985) concluded that atrazine would facilitate good stand establishment under stress conditions or when inadequate equipment is used for seeding switchgrass. Burning or combining burning with atrazine to control prairie threeawn offered little advantage over atrazine alone applied in March (Engle *et al*., 1990). Samson and Moser (1982) used atrazine and glyphosate to suppress cool-season vegetation before seeding with reduced tillage techniques. Herbicides were used to control weeds and cool-season species allowing for the growth and expansion of warm-season species (Waller and Schmidt, 1983).

Because grass plantings require one or more growing seasons to become suitable for grazing, optimum densities of initial plants are needed to minimize the length of time for stand establishment. Two growing seasons were necessary for the establishment of switchgrass and flacidgrass (*Pennisetum flacci* L.) in North Carolina (Burns *et al*., 1984). Rapid ground cover is desirable in all new grass plantings. Sparse seedling stands frequently do not develop adequate ground coverage until tillering gives rise to additional plants. Poor initial stands may never become dominant because of weed and undesirable grass competition (Launchbaugh and Owensby, 1969). Concerns of forage producers about seed cost and difficult stand establishment (McKenna and Wolf, 1990) have limited the popularity and use of switchgrass. Possible reasons for stand failure or thin and uneven stands may be less

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favorable soil moisture and poor success in weed control. (Vassey *et al*., 1985).

The ability to influence the acceptance of native grasses would be increased with lower input establishment methods and a greater degree of success in obtaining a viable stand. This study was initiated to develop a reliable method to establish native warm-season grass species. The objectives of this study were to determine the effects of combinations of timing glyphosate applications, a spring burn, and dishing on stand response and plant vigor of four native warm-season grass species.

METHODS AND MATERIALS

The study was conducted at the Booneville Plant Materials Center, Booneville, AR, on sites previously established to tall fescue. The experimental design was a split-plot arrangement of a randomized complete block design with three replications. Main plots were preplant treatments and sub-plots were grass species. The main plot treatments were fall herbicide, spring herbicide, fall/spring herbicide, fall herbicide-spring disk, spring herbicide-spring disk, fall/spring herbicide-spring disk, fall herbicide-spring burn and an untreated control. Plot areas receiving a herbicide application were prepared by spraying existing vegetation with glyphosate [*N*-(phosphonomethyl) glycine] at 1 qt a.i. acre^{-1}.

The sub-plot grass species were ‘Kaw’ big bluestem, ‘Alamo’ switchgrass, ‘Pete’ eastern gamagrass, and ‘Lometa’ Indiangrass. Grass species were established using pure live seeding rates based on existing recommendations of 8, 8, 10, and 8, lbs acre^{-1} for big bluestem, switchgrass, eastern gamagrass, and Indiangrass, respectively. The north-south oriented rows were spaced 9 in. apart and drilled using a Kincade Plot Planter. The seeding date was 1 April. The plots were established on a Taft silt loam (fine-silty, siliceous, thermic Glossaquic Fragiudults) soil and were 12 ft by 20 ft. An initial soil test was obtained and soil pH was about 6.0. The plots were fertilized in the spring prior to planting with 80 and 150 lbs acre^{-1} P and K, respectively. No N was applied before or at seeding of the establishment year to limit weed growth and competition (Krueger and Curtis, 1980). In Year 1, after establishment of the study, N at 60 lbs acre^{-1} was surface-applied in the spring and each subsequent year. Once established, all plots were burned 1 March of each successive year. Visual assessments of plant density (0=no plants to 100%=solid stand) were made in November of each year. Plant vigor (1=poor to 10=best) and tall fescue (%) within each grass species sub-plot was assessed at the end of the third growing season.

RESULTS AND DISCUSSION

Relationships between tillage treatments and stand response for native grass species (Year 1, after establishment) are found in Table 1. The range of stand response for eastern gamagrass (25-33%) to tillage treatments with no spring disk was generally greater than for other grass species (0-25%). The fall herbicide-spring burn resulted in a higher percentage of plants for all species than for treatments that did not receive a spring disk. The spring disk regardless of the timing of a herbicide treatment produced a greater number of native grass plants than other treatment combinations. The range of stand response for grass species to disk treatments for switchgrass was lower (50-58%) compared to gamagrass (67-83%), big bluestem (67-75%), or Indiangrass (75-92%).

Means averaged across species for stand response indicated that the fall herbicide-spring disk (72.8%), spring herbicide-spring disk (73.0%) and fall/spring herbicide-spring disk (66.8%) were similar.

Stand response means, averaged across species, for Year 2 (Table 2) were similar to Year 1 for fall herbicide (6.3%), spring herbicide (12.3%), fall/

Table 1. Effect of herbicide application timing and spring tillage operation on stand response of native warm-season grasses in year 1.

Herbicide application	Spring operation	Gama grass	Big bluestem	Switch grass	Indian grass	Mean
		------------------------		%	------------------------	
Fall	----	25	0	0	0	6 b
Spring	----	25	8	8	8	12 b
Fall + spring	----	25	8	8	8	12 b
Fall	disk	83	75	58	75	73 a
Spring	disk	75	75	50	92	73 a
Fall + spring	disk	67	67	50	83	67 a
Fall	burn	33	25	17	25	25 b
Control		8	0	0	0	2 b
Mean		43 a	32 a	24 a	36 a	

Table 2. Effect of herbicide application timing and spring tillage operation on stand response of native warm-season grasses in year 2.

Herbicide application	Spring operation	Gama grass	Big bluestem	Switch grass	Indian grass	Mean
		------------------------	------------ %	------------	------------------------	
Fall	----	25	0	0	0	6 c
Spring	----	25	8	8	8	12 c
Fall + spring	----	33	8	8	25	19 c
Fall	disk	92	92	83	100	92 a
Spring	disk	75	83	50	100	77 ab
Fall + spring	disk	75	67	50	92	71 b
Fall	burn	33	25	17	25	25 c
Control		8	0	0	0	2 c
Mean		46 a	35 a	27 b	44 a	

spring herbicide (12.3%), fall herbicide-spring burn (25.0%), and control (2.0%). Stands of gamagrass and Indiangrass (Year 2) increased 8 and 17 percentage points, respectively, compared to the first year after establishment for the fall/spring herbicide treatment and values for big bluestem and switchgrass remained similar.

Greatest stand increases between Year 1 Year 2 occurred for the fall herbicide-spring disk tillage treatment. Means averaged across species for stand increases between Year 1 and 2 were greater for fall herbicide-spring disk (72.8 and 91.8%, respectively) compared to spring herbicide-spring disk (73.0 and 77.0%) and fall/spring herbicide-spring disk (66.8 and 71.0%). The fall herbicide-spring disk treatment produced a stand increase of 25 percentage points for switchgrass and Indiangrass compared to a 9-percentage point increase for eastern gamagrass.

At the end of Year 2 stand responses for Indiangrass were 100% for the fall herbicide-spring disk and spring herbicide-spring disk treatments. The fall herbicide-spring disk treatment produced an average cover of 92% for eastern gamagrass and big bluestem and was similar to Indiangrass with a fall/spring herbicide-spring disk. There were no big bluestem, switchgrass, or Indiangrass plants observed in the fall herbicide or control treatments at the end of Year 2.

Generally, in the fall of Year 3 (Table 3), there was no change in plant populations compared to Year 2 for eastern gamagrass, big bluestem, switchgrass, or Indiangrass with fall herbicide, spring herbicide, fall/spring herbicide or control treatments. Exceptions to this were for Indiangrass and gamagrass for the spring herbicide and fall/spring herbicide treatments, respectively. Small decreases in plant numbers were observed for all species with a fall herbicide-spring burn treatment. Stand response for Indiangrass, at the end of year 3 was 100% for all treatments that contained a disk treatment. The spring herbicide-spring disk treatment resulted in an increase in native plants for gamagrass, big bluestem, and switchgrass in Year 3. The spring herbicide-spring disk and fall/spring herbicide-spring disk produced the greatest increase in plant numbers for switchgrass (50

Table 3. Effect of herbicide application timing and spring tillage operation on stand response of native warm-season grasses in year 3.

Herbicide application	Spring operation	Gama grass	Big bluestem	Switch grass	Indian grass	Mean
		------------------------	------------ %	------------	------------------------	
Fall	----	25	0	0	0	6 cd
Spring	----	25	8	8	17	15 c
Fall + spring	----	25	8	8	25	17 c
Fall	disk	92	92	100	100	96 a
Spring	disk	67	67	92	100	82 a
Fall + spring	disk	75	67	75	100	79 ab
Fall	burn	17	20	15	20	18 b
Control		0	0	0	0	0 cd
Mean		41 a	33 a	37 a	45 a	d

Table 4. Effect of herbicide application timing and spring tillage operation on vigor of native warm-season grasses and % tall fescue in year 3.

Herbicide application	Spring operation	Gamagrass	Big bluestem	Switchgrass	Indiangrass	Tall Fescue
		-------------- Vigor rating -------------				-- % ---
Fall	----	1.7	0.0	0.0	0.0	50
Spring	----	2.7	1.0	1.0	1.3	50
Fall + spring	----	2.3	1.3	0.0	2.0	0
Fall	disk	6.7	7.0	7.7	6.7	0
Spring	disk	5.0	5.7	7.0	7.7	0
Fall + spring	disk	5.7	6.0	7.7	6.3	0
Fall	burn	1.7	1.3	0.0	2.3	10
Control		0.0	0.0	0.0	0.0	85

percentage points) from Year 2 to Year 3. Means averaged across species for stand response between Year 2 and 3 were similar for fall herbicide-spring disk (91.8 and 96.0%, respectively) and spring herbicide-spring disk (77.0 and 81.5%) and lower than the fall/spring herbicide-spring disk (71.0 and 79.3%) treatment.

Stand vigor ratings were assessed at the end of the third growing season after the year of establishment (Table 4). Higher vigor ratings for grass species resulted from treatments in which a disk operation was conducted. Vigor response of grass species to treatments without a disk ranged from 1.0 to 2.7 and these were lower than for species with a disk treatment that ranged from 5.0 to 7.7. Means averaged across species for vigor were higher for the fall herbicide-spring disk (7.0) compared to the spring herbicide-spring disk (6.4) and fall/spring herbicide-spring disk (6.4) treatments.

The percent tall fescue remaining at the end of the third growing season was greater for the control (85%) than for the fall herbicide or spring herbicide (50%). No tall fescue remained in the fall/spring herbicide or disk treatments.

CONCLUSIONS

These data provide evidence that a spring application glyphosate may reduce tall fescue and other plant competition to enhance stand establishment of native grasses. It also emphasizes the importance of providing limited soil disturbance to provide adequate seed soil contact. At the conclusion the third year, acceptable stands of eastern gamagrass, big bluestem, switchgrass and Indiangrass were achieved with a fall or spring or fall/spring herbicide application with a spring disk. The best stand in the third year after establishment was obtained with a fall herbicide-spring disk and this treatment was better than the spring herbicide-spring disk and the fall/spring herbicide-spring disk. A 100% stand of Indiangrass was obtained with a spring disk regardless of the timing of the herbicide application. The fall herbicide-spring disk produced a 100% stand of switchgrass by end of Year 3. The other five treatment combinations (without a disk treatment) resulted in stands equal to less than 25%.

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