Responses of Planted Native Warm-season Grasses and Associated Vegetation to Seasonality of Fire in the Southeastern US

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Abstract - State and federal agencies have promoted native grass/forb plantings to increase and enhance habitat for *Colinus virginianus* (Northern Bobwhite). However, many plantings have resulted in dense stands of grass that do not provide suitable structure for Northern Bobwhite. Prescribed fire is an important tool for managing succession in southeastern grasslands, and previous research has suggested that the timing of prescribed burns can influence plant community composition and structure. We examined the response of planted, native warm-season grasses (NWSG) at three sites in Tennessee to the timing of annual burns conducted 2008–2011 during March, April, May, and September. The grasses included *Andropogon gerardii* (Big Bluestem), *Sorghastrum nutans* (Indiangrass), *Panicum virgatum* (Switchgrass), *Schizachyrium scoparium* (Little Bluestem), and *Bouteloua curtipendula* (Sideoats Grama). We monitored vegetation response once each summer during July or August). We used mixed-model ANOVAs to analyze the effect of treatment on bare ground (no plant cover), forbs desirable for Northern Bobwhite, and each NWSG species individually for each location. Although NWSG did not show strong responses to season of burn, Switchgrass cover appeared to be increased by spring burns when compared to the control plots. Forb cover was sparse (<10%) throughout the study, and four years of burning did not stimulate forbs. Therefore, in high-rainfall environments, soil disturbance may be necessary to reduce grass cover and stimulate forb cover in dense stands of planted NWSG.

Introduction

There is a long history of fire in the southeastern United States (Pyne 1982, Stewart 2009, Wright and Bailey 1982). This history includes natural fires started by lightning and human-induced fires ignited to manage game and increase forage production (Stewart 2009). Native warm-season grasses (NWSG) such as *Andropogon gerardii* Vitman (Big Bluestem), *Sorghastrum nutans* (L.) Nash (Indiangrass), *Panicum virgatum* L. (Switchgrass), *Schizachyrium scoparium* (Michx.) Nash (Little Bluestem), and *Bouteloua curtipendula* (Michx.) Torr. (Sideoats Grama) were once common in the Southeast, but coverage of these grasses has been greatly reduced as a result of fire suppression and moden agricultural practices (Nagahama and Norrmann 2012, Noss 2012). USDA Farm Bill programs, such as the Environmental Quality Incentives Program (EQIP) and Conservation Reserve Program (CRP), have promoted NWSG for soil and wildlife conservation, thereby increasing acreage of NWSG across the Southeast, particularly in Tennessee and Kentucky (Burger 2005, USDA 2009).

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Native grass plantings associated with Farm Bill programs must follow USDA Natural Resources Conservation Service (NRCS) recommendations and requirements. Although it is now common to include forbs when planting native grasses, many of the early plantings only included grass species (Burger et al. 1990, Dimmick et al. 2002). Furthermore, restoration efforts are often focused on former cropland (USDA 2012) with a long history of agricultural production; consequently seedbanks have become depleted of native perennial and/or pyrophytic forbs (Batary et al. 2012, Gulden et al. 2011). With no seedbank and a lack of forbs in the seed mix, these formerly cropped fields often lacked diversity and were comprised solely of the species planted. Additionally, USDA-recommended seeding rates were >8 kg PLS ha^{-1}; rates only recommended for forage establishment (Burger 2005, Harper et al. 2007, Keyser et al. 2011) and over 4 times higher than those currently recommended (<2 kg PLS ha^{-1}) for grassland restoration (Harper et al. 2007, Schramm 1992, Weber 1999). As a result, many of these established NWSG fields are dominated by dense stands of tall grass species that typically suppress other plant species, and consequently, these stands have limited value to grassland-associated wildlife (Doxon and Carroll 2010, Rodgers 1999).

The influence of fire on plant communities varies depending on various factors, such as fire frequency, intensity, and seasonality (Engle and Bidwell 2001). Often, fire intensity and seasonality are related; growing-season burns are usually less intense than dormant-season burns (Sapsis and Kauffman 1991, Weir 2009). However, growing-season burns generally have higher residency times, whereas dormant-season burns have faster rates of spread. Differences in plant response have been noted between dormant- and growing-season fires (Engle and Bidwell 2001, Harper and Gruchy 2009, Limb et al. 2011). Burning during the growing season has been used to decrease woody species and stimulate increased forb cover (Fuhlendorf and Smeins 1997, Gruchy et al. 2006, Winter et al. 2012). This is an important consideration when working in low diversity, grass-dominated stands where the goal is to increase forb cover to enhance habitat for pollinators and other wildlife species.

Phenology varies among NWSG species. Switchgrass is one of the earliest grasses to break dormancy, and its leaves usually begin to emerge in late March or early April; growth peaks in early June (Beatty et al. 1978). Big Bluestem and Indiangrass initiate growth later than Switchgrass, and peak production in these species occurs in late June and early July. Little Bluestem is one of the last warm-season grasses to initiate growth in the spring and its growth peaks in early July (Harper et al. 2007).

Our main objective was to examine the vegetation community response of planted NWSG stands to seasonality of fire. In Tennessee, active growth of NWSG typically begins in April, when average daily temperatures reach 16 °C, and continues until senescence in early fall (Harper et al. 2007, NOAA 2012). Therefore, we examined the vegetation response to fires conducted during the dormant season (March), early growing season (April), growing season (May), and late growing season (September). We hypothesized that forb cover would increase and that NWSG cover would decrease with growing-season fire (April, May, and September). Further, we hypothesized that the response of specific grasses would be dependent on how closely the active growth period overlapped with each burn. For example, a burn conducted during the growing season in May would more negatively impact Switchgrass cover than a similar burn conducted during the dormant season in March.

Field-site Descriptions

We conducted this research at three sites across Tennessee: Ames Plantation Research and Education Center (Ames), Grand Junction, TN (35.08°N, 89.08°W), West Tennessee Research and Education Center (West TN), Jackson, TN (35.62°N, 88.85°W), and Yuchi Wildlife Management Area (Yuchi), Dayton, TN (35.58°N, 84.84°W) (Fig. 1). Annual rainfall at these sites averaged more than 1270 mm (NOAA 2012). At each site, we established research plots on land with a history of >50 yr of agricultural production (i.e., *Zea mays* L. [Corn], *Glycine max* (L.) Merr. [Soybeans], and *Gossypium hirsutum* L. [Cotton]). Although plot sizes varied somewhat among sites based on space available to install the experiment, minimum plot size was 19.8 × 30.5 m. We disked to maintain 7.7-m wide firebreaks between plots. Grasses had been planted at the USDA NRCS-recommended rate of 9–11 kg PLS ha^{-1} (USDA 2002) at each site. Ames was planted with a mix of Big Bluestem, Indiangrass, and Switchgrass. West TN was planted with a mix of Big Bluestem, Indiangrass, Switchgrass, Little Bluestem, and Sideoats Grama. Yuchi was planted with a mix of Big Bluestem, Indiangrass, Little Bluestem, and Switchgrass. Establishment year varied among the sites but in all cases occurred between 2001–2006.

Methods

We installed four blocks of five treatments for a total of 20 plots at each location in a randomized block design with blocking based on soils and slope position. The treatments consisted of annual prescribed burns which were conducted at 20–50% relative humidity, 16–32 °C air temperature, and 3–19 kmh^{-1} wind speed. Treat-

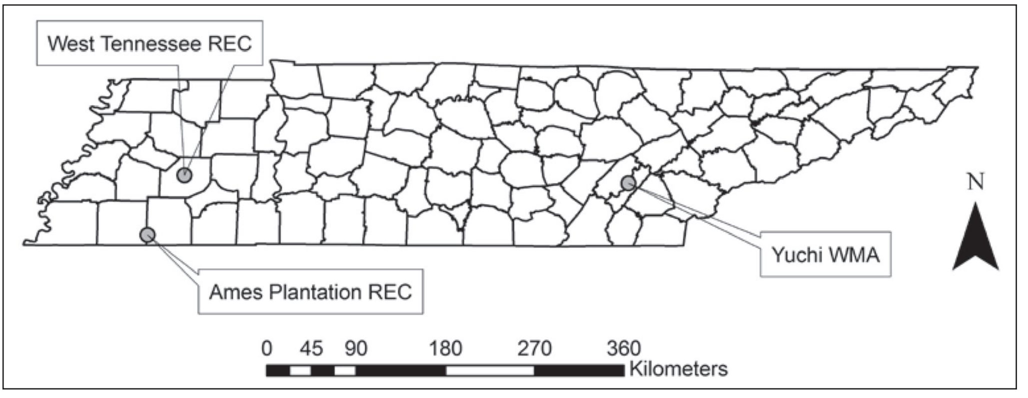

Figure 1. Location of three study sites used for fire seasonality experiments in Tennessee, 2008–2011.

ments were applied to examine fire responses to dormant, early growing season, growing season, and late growing season. These treatments corresponded to the following dates, respectively: 1 March, 15 April, 15 May, and 1 September or at the first opportunity thereafter with acceptable burning conditions; each block of treatments included an unburned control. We did not examine burns applied in June, July, or August because relative humidity levels and fuel moisture precluded any burning during this period. We initiated prescribed burns in 2008 and conducted burns annually until completion of the study in September 2011.

In July and August of each year, we monitored vegetation with two, 10-m line transects in each plot (Canfield 1941). We identified plants that intercepted the line to species and measured the horizontal distance covered by the plant.

We selected Big Bluestem, Indiangrass, Switchgrass, Little Bluestem, Sideoats Grama, bare ground, and forbs desirable for *Colinus virginianus L. (*Northern Bobwhite) to evaluate responses to timing of fire. We did not analyze litter because it was highly correlated with time since burn and date of sampling. We did not include trees, shrubs, or vines in our analyses because they occurred in <1% of the plots. We classified forbs as beneficial to Northern Bobwhite following Brennan and Hurst (1995) and Sudkamp et al. (2008). Beneficial forbs included *Ambrosia* spp. (ragweed), *Desmodium* spp. (ticktrefoil), *Chamaecrista fasciculata* Michx. (Partridge Pea), and *Solidago* spp. (goldenrod), which, collectively, comprised 95% of forbs documented. We calculated the linear cover (cm) per transect for each taxon and divided that value by the total transect length to determine percent cover for each species. We transformed the percentage data using arcsine square-root transformation (Dowdy et al. 2004) to meet the assumption of normality. Subsequently, we back-transformed data for graphical display. We analyzed the effect of treatment after averaging the subsamples ($n = 2$) to obtain a single annual observation for each plot. We analyzed cover (dependent variable) using the MIXED procedure (SAS Institute 2010) with repeated measures. Year was the repeated measure, and plot was the subject. Compound symmetry was selected as the covariance structure based on Akaike's information criteria comparisons. We tested effects of year, month of burn, and year × month of burn interaction on the seven vegetation variables. We analyzed year and treatment (month of burn) as fixed effects. We performed the analysis for each location separately because each one represented a separate experiment and had been established using different grass species. Where tests for fixed effects were significant ($P < 0.05$), we used the least square means procedure to examine relationships among individual means.

Results

Over all treatments and years, vegetation cover was dominated by one or two species at each location: Big Bluestem (>76%) at Ames, Switchgrass (41%) and Big Bluestem (27%) at Yuchi, and Indiangrass (28%) and Little Bluestem (25%) at West TN (Table 1). At Ames, there was not a year × month of burn interaction for Big Bluestem, Indiangrass, bare ground, or forbs ($P \geq 0.1$; Table 2), therefore, subsequent analyses were pooled among years for these variables. Big Bluestem cover was least with the May burns (65%) compared to March, April, and September burns (> 81%) (Fig. 2a). Indiangrass cover was <10% in all treatments and only differed between April and September burns (Fig. 2b). Bare ground was greater with May burns (7%) compared to control plots (2.5%) (Fig. 2c). Forb cover was

Table 1. Mean percent cover (± 1 SE) of dominant vegetation on three sites in Tennessee during fire seasonality experiment, 2008–2011.

	Ames		West TN		Yuchi	
Dominant cover	Mean	SE	Mean	SE	Mean	SE
Bare ground	6.2	1.3	17.7	2.9	0.6	0.4
Big Bluestem	75.4	4.2	1.3	0.5	27.2	4.7
Forb[A]	2.5	1.3	1.8	0.7	1.4	0.6
Indiangrass	3.1	1.1	28.5	4.3	1.0	1.0
Little Bluestem	0.1	0.9	25.7	4.1	0.0	0.5
Sideoats Grama	0.0	0.0	2.4	1.3	0.0	0.0
Switchgrass	0.0	0.1	2.3	0.9	45.1	7.4
Woody[B]	0.0	0.02	0.0	0.0	1.6	0.4
Sum of dominant vegetation[C]	87.3		79.8		77.0	

[A]Forbs desirable for wildlife were classified following Brennan and Hurst (1995) and Sudkamp et al. (2008). This included *Ambrosia* spp. (ragweed), *Desmodium* spp. (ticktrefoil), *Chamaecrista fasciculata* (Partridge Pea), and *Solidago* spp. (goldenrod).
[B]Woody cover consists of shrub and tree cover (e.g., *Rubus* spp. [blackberry], *Rhus* spp. [sumac].
[C]Other cover not listed in this table includes other forbs (e.g., *Lespedeza cuneata* (Dum. Cours.) G. Don. [= *Seicea lespedeza*]), cool-season grasses, litter, rushes, and vines.

Table 2. *F*- statistics and *P*-values for main effects in mixed ANOVA model examining vegetation-cover response to a fire seasonality experiment in Tennessee, 2008–2011. Treatment df = 4, 60; year df = 3, 60; treatment x year df = 12, 60.

Location	Dependent variable	Effect	*F*-value	*P*-value
Ames	Bare ground	Treatment	2.34	0.06
		Year	0.88	0.4
		Treatment x year	1.57	0.1
	Big Bluestem	Treatment	5.1	0.001
		Year	2.39	0.07
		Treatment x year	0.36	0.9
	Forbs	Treatment	11.44	<0.0001
		Year	1.05	0.3
		Treatment x year	0.68	0.7
	Indiangrass	Treatment	3.51	0.01
		Year	6.59	0.0006
		Treatment x year	1.41	0.1
	Little Bluestem	Treatment	1	0.4
		Year	1	0.3
		Treatment x year	1	0.4
	Sideoats Grama	Treatment	-	-
		Year	-	-
		Treatment x year	-	-
	Switchgrass	Treatment	-	-
		Year	-	-
		Treatment x year	-	-

greater in May burns ($P < 0.0001$), averaging 8.5% versus 1% in other treatments (Fig. 2d). At Ames, we did not detect differences in cover among treatments for Little Bluestem ($P = 0.4$). There was not enough cover (<1%) of Switchgrass or Sideoats Grama for analysis.

At West TN, we did not detect differences in cover among treatments for Big

Table 2, continued.

Location	Dependent variable	Effect	*F*-value	*P*-value
West TN	Bare ground	Treatment	12.76	<0.0001
		Year	12.86	<0.0001
		Treatment x year	3.6	0.0005
	Big Bluestem	Treatment	0.44	0.7
		Year	0.47	0.7
		Treatment x year	1.16	0.3
	Forbs	Treatment	0.83	0.5
		Year	3.25	0.02
		Treatment x year	0.52	0.8
	Indiangrass	Treatment	8.3	<0.0001
		Year	15.41	<0.0001
		Treatment x year	1.57	0.1
	Little Bluestem	Treatment	5.95	0.0004
		Year	14.54	<0.0001
		Treatment x year	4.43	<0.0001
	Sideoats Grama	Treatment	1.4	0.2
		Year	6.14	0.001
		Treatment x year	1.44	0.1
	Switchgrass	Treatment	1.64	0.1
		Year	1.07	0.3
		Treatment x year	0.82	0.6
Yuchi	Bare ground	Treatment	-	-
		Year	-	-
		Treatment x year	-	-
	Big Bluestem	Treatment	8.48	<0.0001
		Year	1.25	0.2
		Treatment x year	3.01	0.002
	Forbs	Treatment	2.61	0.04
		Year	6.96	0.0004
		Treatment x year	1.04	0.4
	Indiangrass	Treatment	1.44	0.2
		Year	3.09	0.03
		Treatment x year	1.42	0.1
	Little Bluestem	Treatment	-	-
		Year	-	-
		Treatment x year	-	-
	Sideoats Grama	Treatment	-	-
		Year	-	-
		Treatment x year	-	-
	Switchgrass	Treatment	20.32	<0.0001
		Year	8.18	0.0001
		Treatment x year	1.08	0.3

Bluestem, Switchgrass, Sideoats Grama, and Forbs ($P \geq 0.1$). There was not a year × month of burn interaction for Indiangrass ($P = 0.1$; Table 2), therefore, subsequent analyses were pooled among years for this species. Indiangrass cover was greatest with September burns (36%) and least in control plots (14%) (Fig. 3a). There was a year × month-of-burn interaction for Little Bluestem ($P < 0.0001$; Table 2), therefore, subsequent analyses were by year. Little Bluestem cover was greatest in 2008 in the control plots (60%), but declined for that treatment in subsequent years (40, 10, and 10%, respectively; Fig. 3b). In 2009 and 2010, Little Bluestem cover was least with May burns and greatest with March burns. There was a two-way interaction ($P < 0.0001$) for bare ground, and subsequent analyses were by year. Bare ground was least in control plots in 2008, 2009, and 2010 and remarkably high (44%) for the March 2010 burn plot (Fig. 3c). Indiangrass cover varied by year (Fig. 4) and cover was reduced in 2010 and 2011 vs. the first two years.

At Yuchi, there was a year × month of burn interaction in the analysis of Big Bluestem; therefore, subsequent analyses were by year for this species. In 2008, Big Bluestem cover was greatest in the control plots (23%) and lowest with the April burn plots (1%). However, in 2009, there was little cover of Big Bluestem in control

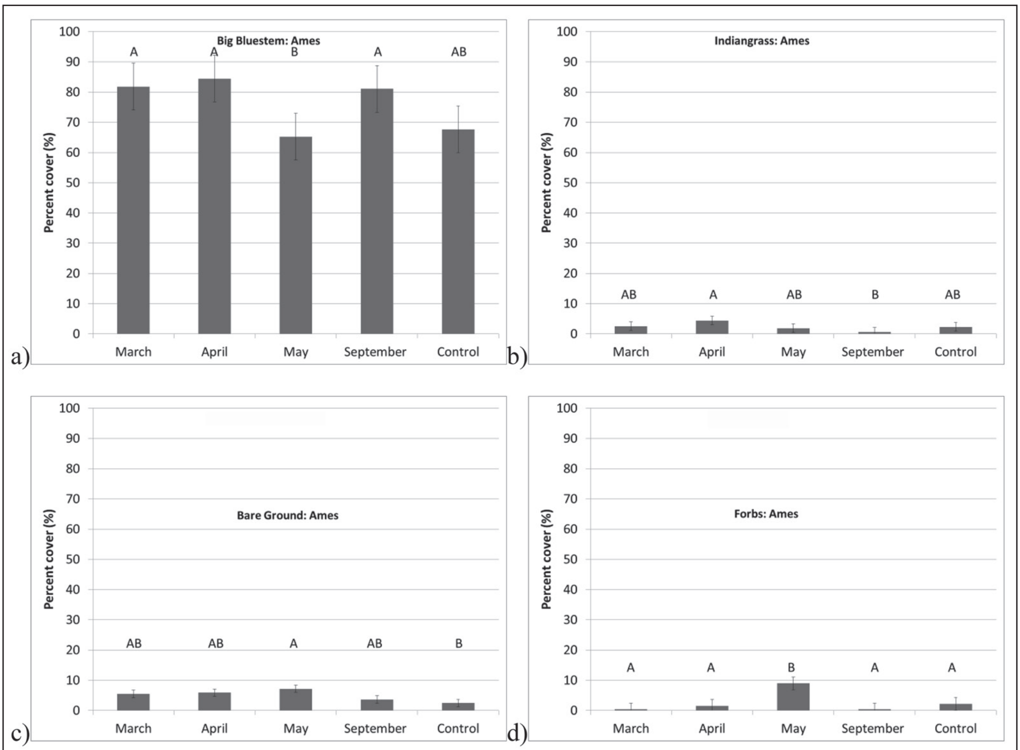

Figure 2. Least-square means (± 95% CI) for vegetation characteristics at Ames on seasonality of burn plots sampled in July–August, 2008–2011: a) Big Bluestem, b) Indiangrass, c) bare ground, and d) forbs. Means with different letters differ ($P < 0.05$) but where years are shown, only within years.

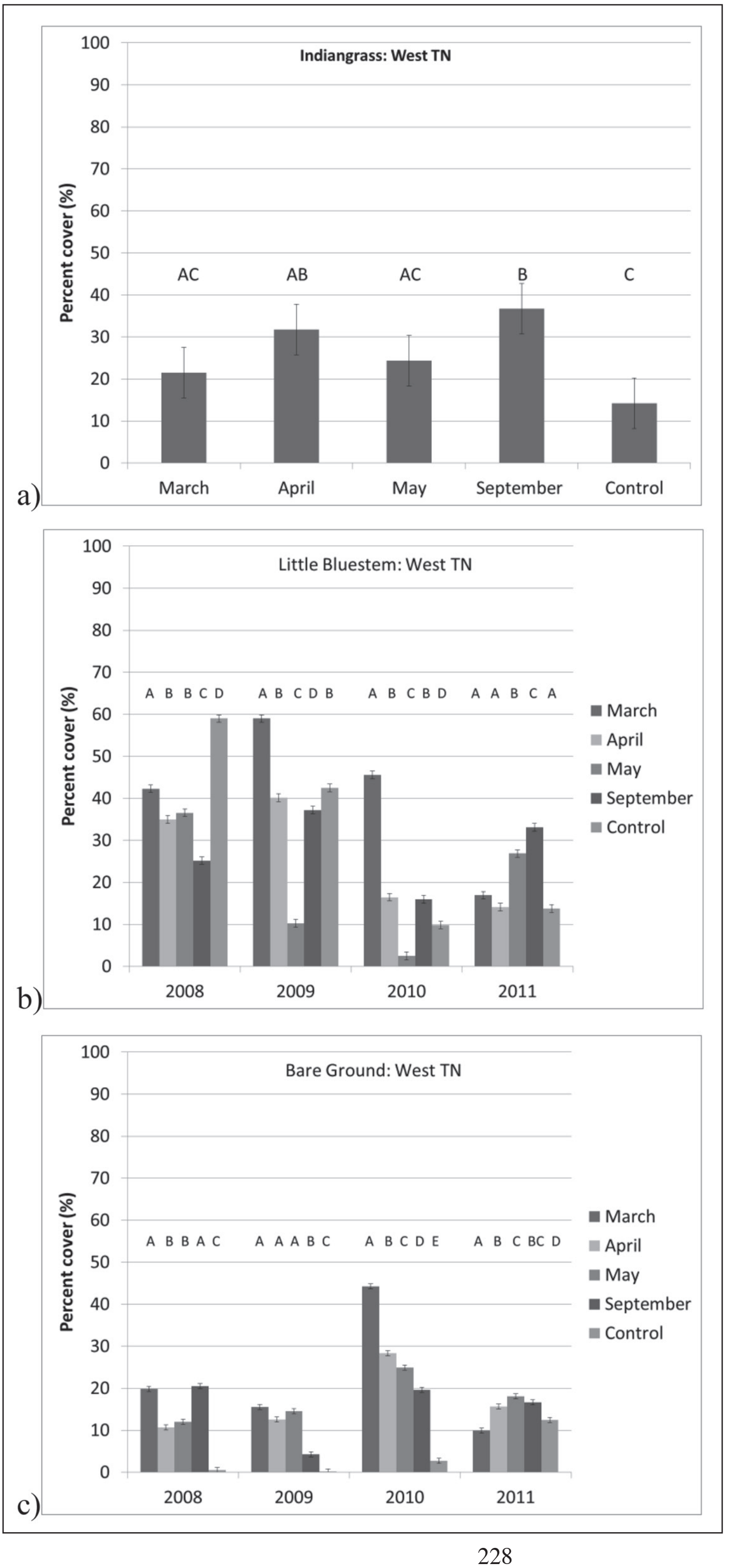

Figure 3. Least-square means (± 95% CI) for vegetation characteristics at West TN on seasonality of burn plots sampled in July–August, 2008–2011: a) Indiangrass, b) Little Bluestem, and c) bare ground. Means with different letters differ ($P < 0.05$) but where years are shown, only within years.

plots (3%) and April burn plots (1%). In 2010, March burn plots contained the greatest Big Bluestem cover (26%). In 2011, Big Bluestem cover was greatest (21%) with May burns, whereas April burn plots had the least (1%) (Fig. 5a). Cover in the April burn plots was lowest or equal to the lowest levels for any treatment over all four years of the study. We did not detect a year × month of burn interaction in the analysis of Switchgrass and forbs ($P \geq 0.3$; Table 2); therefore, we pooled years for all subsequent analyses. Switchgrass cover declined from March (73%) to April (51%) and reached a low for May burn plots (20%), none of which were different from control plots (23%) (Fig. 5b). Forb cover was minimal and differed only between March (2.5%) and April burn plots (0.5%) (Fig. 5c). We did not detect any differences in cover for Indiangrass by treatment. There was not enough cover of Little Bluestem, Sideoats Grama, or bare ground cover for analysis at Yuchi (cover <1% for all three species). With respect to year, we detected a trend in Switchgrass cover at Yuchi, where cover was lower in 2010 and 2011 than 2008 and 2009 (Fig. 6).

Discussion

Management recommendations for NWSG usually prescribe fire as the preferred management method (Engle and Bidwell 2001, Hall et al. 2012, Harper et al. 2007). Our results demonstrate that fire can help to maintain dense, planted fields of native grasses, but fire alone did not cause enough disturbance to substantially influence

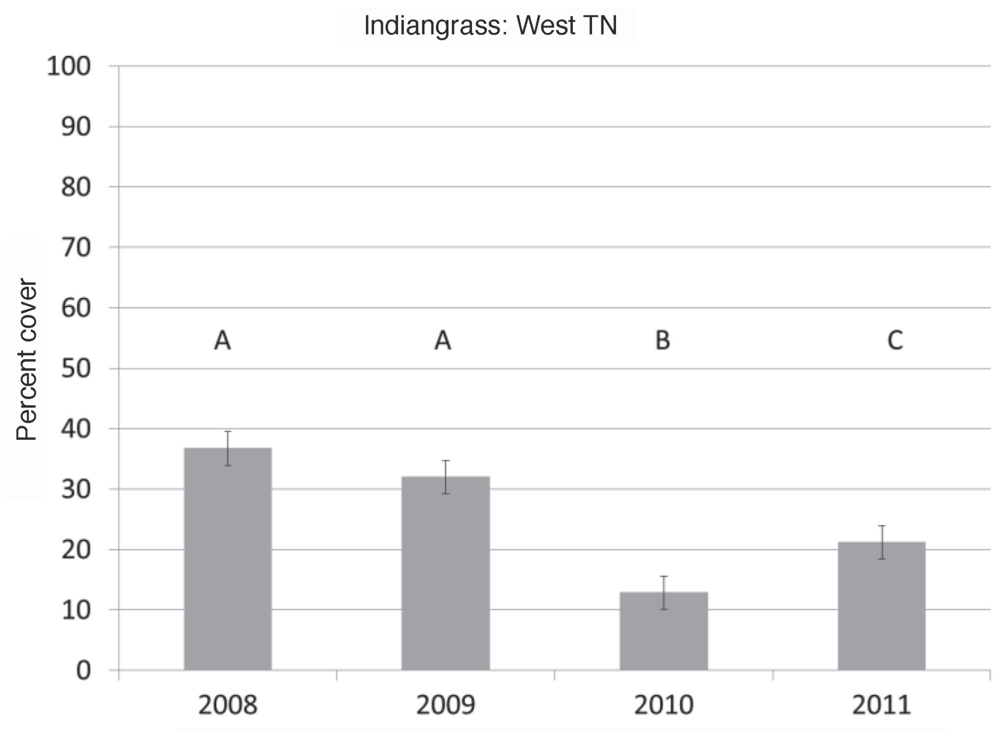

Figure 4. Least-square means (± 95% CI) for Indiangrass by year at West TN on seasonality of burn plots sampled in July–August, 2008–2011. Means with different letters differ ($P < 0.05$).

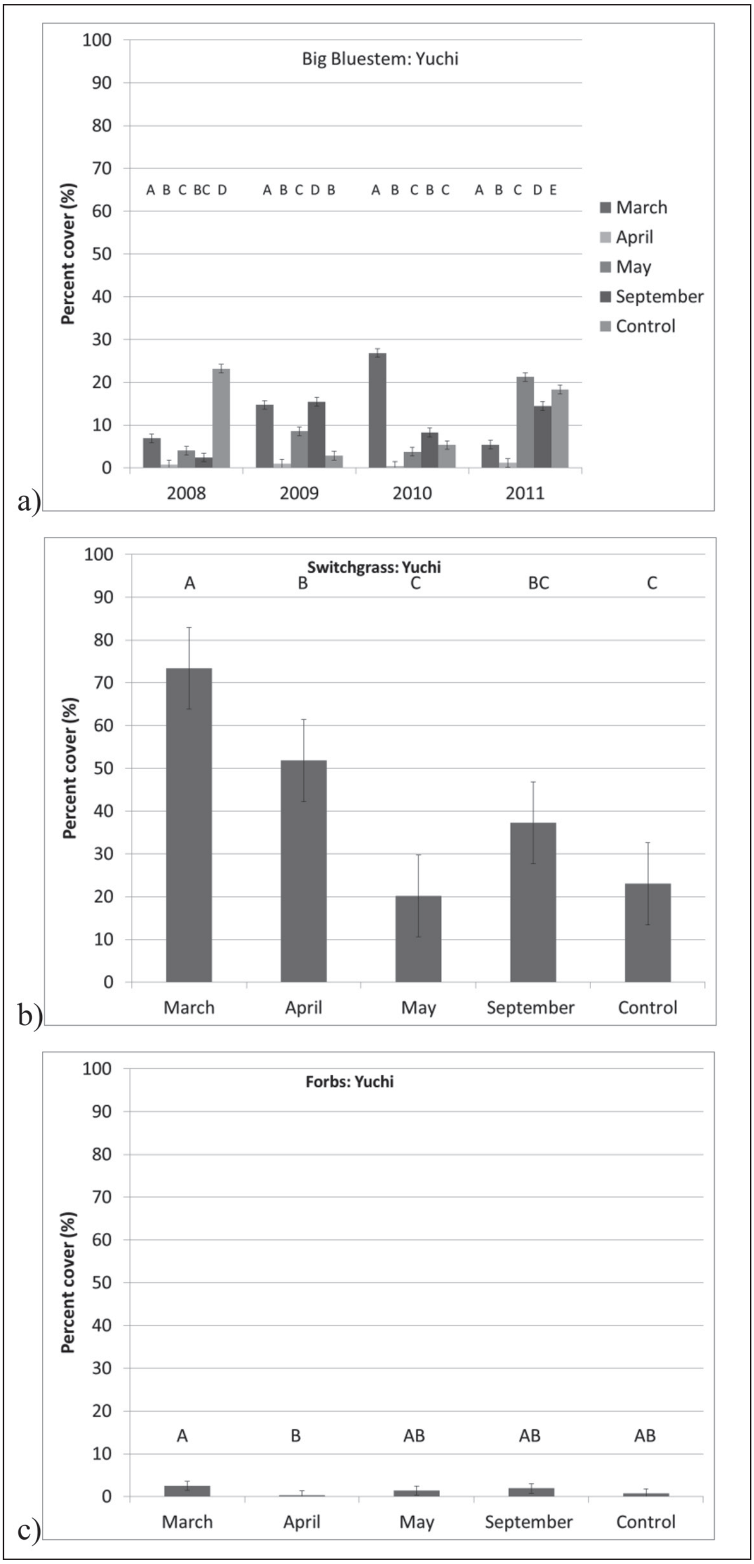

Figure 5. Least-square means (± 95% CI) for vegetation characteristics at Yuchi on seasonality of burn plots sampled in July–August, 2008–2011: a) Big Bluestem, b) Switchgrass, and c) forbs. Means with different letters differ ($P < 0.05$) but where years are shown, only within years.

the plant community (as defined by percent cover and species response) in our study areas. Across three study areas and four years of annual burning, we observed few differences in amount of bare ground, only limited increases in forb cover at two sites, and mixed results for the dominant grass species. These trends, though similar in pattern, were less consistent than those reported in other grassland burning studies conducted in semi-arid, native grassland communities that have shown changes in the grass community as a result of burn timing (Engle and Bidwell 2001, Limb et al. 2011).

Our results may seem somewhat contradictory to the numerous prairie studies of Great Plains grassland communities and their response to fire. However, there are several considerations regarding planted native grasslands in more humid environments that suggest fire alone does not stimulate large changes in the vegetation community. Our sites, like most stands of NWSG established in the southeastern US over the past several decades, had a long history of row-crop production prior to being planted in NWSG. Prescribed fire has generally been absent for decades from sites with this cropping history. Furthermore, when native grasses are planted at high density, space for forbs to occupy or colonize is limited (Kindscher and Fraser 2000, McCoy et al. 2001). These factors have led to reduced plant diversity, depleted native seedbanks, and reductions or elimination of pyrophytic vegetation (Gulden et al. 2011). Thus, fewer plant species that respond favorably to prescribed

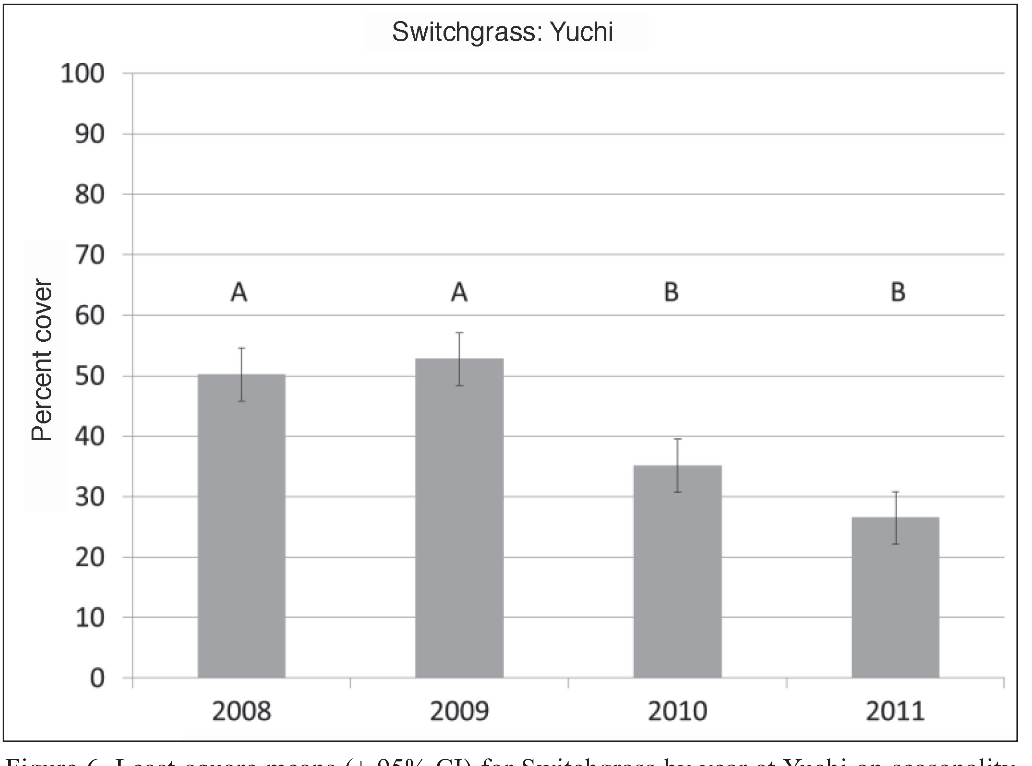

Figure 6. Least-square means (± 95% CI) for Switchgrass by year at Yuchi on seasonality of burn plots sampled in July–August, 2008–2011. Means with different letters differ ($P < 0.05$).

fire are present, and shifts in plant communities may be muted in the presence of dense, tall-growing grasses in high-rainfall environments like the ones we studied.

Even after four years of annual burning, unvegetated bare ground averaged <6% at Ames and Yuchi. Although we did not specifically measure openness at ground level, average NWSG cover measurements on all sites was >80%, verifying plant growth in these fields was quite dense. Other research suggests that additional disturbance, such as disking, may be necessary to increase openness at ground level and stimulate forb growth (Gruchy and Harper, in press; Harper and Gruchy 2009).

Unlike other studies that have found an increase in forb cover after summer burns (e.g., Howe 2011, Towne and Kemp 2008), we did not detect a season-of-burn response among forb species. Although treatment effect on forb cover was statistically significant at two of three sites, the effect was probably not biologically important. Seeding rates for all of our locations were high compared to those typically used for ecological restoration (Packard and Mutel 2005) and growth of forb species can be inhibited by high seeding densities of dominant grasses (Dickson and Busby 2009, Kindscher and Fraser 2000, Weber 1999). Furthermore, dense stands of grass can outcompete forbs that may be present and prevent the seedbank from responding to disturbance, including fire (Zimmerman et al. 2008). These established fields had very little unvegetated bare ground, which limited possible areas where forbs could have germinated and grown (Teague et al. 2008).

Response of dominant grasses was mixed. Little Bluestem at West TN (the only site where it was relatively common) showed some indication that March burns resulted in the greatest cover and May burns the least cover, but these patterns were only present in two of four years. Likewise, Indiangrass, which was only common at West TN, did not show a strong response pattern among burning treatments. Indiangrass cover was greater in September burn plots than in the control plots and appeared to decrease across all treatments over the course of the study. However, other than the comparison with the control plots, the magnitude of the effect was not large relative to other burning treatments (i.e., 37% vs. 21, 24, and 31%). At Ames, Big Bluestem, the only common grass species, showed a reduction in cover with May burns, but the magnitude of the response was not large relative to other burn treatments (i.e., 65% vs. 80, 81, and 84%) and was not different from the control plots. Interestingly, at Yuchi, Big Bluestem showed a marked decrease in all 4 years with the April burns. The reason for this apparent discrepancy between Ames and Yuchi (May vs. April) for this species is not clear, but it may have been that Switchgrass, which was abundant at Yuchi, and is a species with an earlier phenology than Big Bluestem, outcompeted this species during April. Switchgrass, which was only common at Yuchi, showed the strongest response to fire and its cover progressively increased from May to April to March burns. Furthermore, the magnitude of the response was impressive (73, 51, and 20%, respectively for March, April, and May). However, Switchgrass cover in May burn plot 3 was similar to Switchgrass cover in the control plots. This finding suggested that Switchgrass cover increased with March and April burns, likely the result of competitive release by removing litter and other cover. As was the case with Indiangrass at West TN, there appeared to be a modest overall decrease in Switchgrass cover at Yuchi over the course of the study.

Contrary to what we hypothesized, we did not document consistent responses to timing of fire for all of the grass species. Likely, fire timing and plant phenology interacted to some degree and led to the differential responses we observed. Of the species examined, Switchgrass was the most strongly influenced by fire. The nature of this response seems consistent with Switchgrass phenology in that when fires occurred before initiation of spring growth (March), Switchgrass cover was greater than what we measured in the control plots or for any other fire treatment. Later fires that occurred as spring growth progressed, resulted in reduced cover, presumably by impacting actively growing plants. The response of later-maturing Big Bluestem at Ames seems to be consistent with its phenology. However, the magnitude of the effect was not as dramatic because Big Bluestem dominated the site with >75% cover. Treatment effects on Big Bluestem at Yuchi were more obvious, presumably as a result of the interaction of fire and the greater abundance of the earlier-maturing species, Switchgrass. Indiangrass, the latest-maturing of the dominant species on our sites, appeared to be positively influenced by the late growing-season burn. This effect may have been a result of Indiangrass' later phenology, and it may have been able to grow actively for several weeks after the burn, before it entered fall dormancy, whereas other species were already senescing.

We did not observe substantial reductions in the competitive position of these grasses. However, because burning is effective in limiting woody encroachment and reducing thick thatch that can accumulate over time, we recommend prescribed fire when managing planted NWSG. We further recommend managers implement heavy disking or periodic heavy grazing to reduce grass density where needed and maintain an early seral stage. Soil disturbance not only may diversify plant species composition by stimulating the seedbank to germinate, but also creates more open structure at ground level that is desirable for many wildlife species, including Northern Bobwhite. Our results suggest that fire can be applied to dense, planted stands of NWSG at various times of the year, providing increased opportunities for landowners and managers with respect to burning season.

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