EVALUATING PRE-EMERGENCE HERBICIDES FOR ESTABLISHING NATIVE GRASSES AND FORBS

Native grasslands were historically a common part of the landscape in the Blackland Prairie region across northern Mississippi and Alabama. Most of these grasslands have been replaced by croplands, improved pasture and urban land uses. As a result, northern bobwhite, grassland birds, native pollinators and other wildlife that depend on these habitats have declined.

Many conservation organizations in the Southeast are promoting native warm-season grass establishment in productive agricultural landscapes across the Southeast. Similarly, many conservation practices in federal conservation programs require establishment of mixed species stands of NWSG (for example, CP33 Habitat Buffers for Upland Birds in the continuous Conservation Reserve Program). Native grasses are superior to cool season and other non-native forage grasses because they are bunch grasses. Bunch grasses grow in a manner that produce more open stands of grass that provide cover while permitting northern bobwhite and other wildlife to move and forage. Additionally, spaces between clumps facilitate establishment by native legumes, forbs, and wildflowers adding to structural and floristic diversity.

However, many native warm-season grass plantings fail to reach their full potential as wildlife habitat because they do not include native wildflowers and other forbs in the planting mix. Wildflowers add beauty to any planting, but they also add important function. Historically, native prairie grasslands contained a diverse community of wildflowers and legumes. These forbs provide nectar sources for butterflies, native bees and other pollinating insects. Abundant insects, in turn, provide essential food for breeding birds and other wildlife. During the fall and winter, wildlife feast on forb seeds. Thus, native warm-season grass plantings that contain forbs are ecologically superior to stands where grasses are established.

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The most common cause of stand failure in native warm-season grass plantings is weed competition during the critical first growing season. Thus, best practices for establishing native warm-season grasses currently encourage the use of pre-emergence herbicides—such as Journey© (imazapic + glyphosphate)—at planting to control competition while native warm-season grasses are growing. Recommended application rates (10.7–21 ounces per acre) for the establishment of native warm-season grasses provide better weed control, which reduces competition and improves establishment compared to lower application rates. These higher rates, however, are above label recommendations (10.7 ounces per acre) for most forbs, and it is unknown if higher pre-emergence application rates inhibit the growth and establishment of prairie wildflowers. Thus, best practices for establishing native warm-season grasses may be at odds with best practices for establishing desirable forbs—a difficult conundrum for managers or landowners that want to maximize the ecological benefits that native warm-season grass plantings provide.

To provide information that could help solve this dilemma, we conducted a field experiment to test how weed species (potential competitors), native warm-season grasses, and native forbs responded to high and low pre-emergence application rates of Journey©.

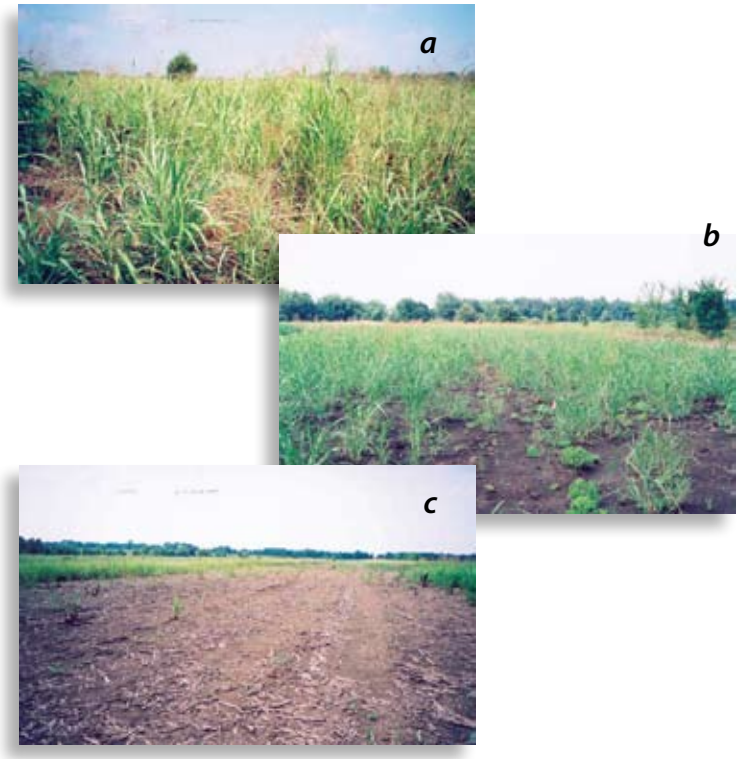

Photo 1. Weed cover two months after planting in native warm-season grass buffers that received (a) no pre-emergence herbicide (i.e. were not part of the study); (b) 10.7 ounces per acre Journey©; and (c) 21.4 ounces per acre Journey©.

THE EXPERIMENT

In April 2005, we planted approximately 194 acres of grass field buffers adjacent to corn and soybean fields at B. Bryan Farms located in Clay County, Mississippi, in the historical Blackland Prairie. These buffers were established under the continuous Conservation Reserve Program practice CP33-Habitat Buffers for Upland Birds. NWSG buffers were planted with a mixture of: 1.5 pounds per acre big bluestem (*Andropogon gerardii*), 1.0 pound per acre little bluestem (*Schizachyrium scoparium*), and 1.5 pounds per acre Indian grass (*Sorghastrum nutans*). We also included 3 forbs at 1.0 pound per acre each: partridge pea (*Chamaecrista fasciculata*), Maximilian sunflower (*Helianthus maximiliani*), and black-eyed Susan (*Rudbeckia hirta*).

We applied three (3) pre-emergence herbicide regimes at planting:

1. 10.7 ounces per acre Journey© as recommended for tolerant forbs;
2. 10.7 ounces per acre Journey© + glyphosphate follow-up application (using a wick applicator) 1-yr post-planting to suppress Johnsongrass and other competing weeds; and
3. 21.4 ounces per acre Journey© as recommended for establishment of native warm-season grasses.

We then measured native warm-season grass seedling density, weed cover, and forb density for three seasons along twelve 50-m transects in each treatment.

WHAT WE LEARNED ABOUT REDUCING COMPETITION AND IMPROVING NATIVE WARM-SEASON GRASS ESTABLISHMENT

Our experiment confirmed that higher application rates (21.4 ounces per acre) are better for establishing native warm-season grasses, and the benefits persisted for multiple growing seasons. Higher rates of pre-emergence Journey© dramatically decreased cover of weeds and competitive grasses like Johnsongrass (Photo 1). These differences lasted more than one year after planting into late summer 2006 (there were no differences in weed cover in 2007). Consequently, site preparation with 21.4 ounces per acre improved seedling survival of all three native warm-season grass species (Figure 1).

Better germination and less competition resulted in higher percent cover of little bluestem and indiangrass in buffers that received 21.4 ounces per acre Journey© pre-emergence, and these differences persisted for three growing season (Figure 2). Percent cover of big bluestem did not differ among pre-planting herbicide applications (Figure 2).

WHAT WE LEARNED ABOUT ESTABLISHING PRAIRIE FOODS

We found that some forbs could tolerate the higher herbicide rate that improves native warm-season grass establishment. Partridge pea tolerated 21.4 oz Journey® per acre because density did not differ significantly across herbicide treatments (Figure 3). Maximillian sunflower responded in a similar fashion. One year after planting, density of sunflowers was lower on buffers that received 10.7 ounces per acre + glyphosphate follow-up, indicating they could not tolerate the glyphosphate. By 2007, however, density of sunflowers was greatest on buffers that received 21.4 ounces per acre of Journey©. Thus, sunflowers not only tolerated higher application rates of Journey©, they also benefited from decreased competition over a 3-summer period.

Not all forbs could tolerate higher application rates. Density of black-eyed Susan was significantly higher in buffers that received only 10.7 ounces per acre compared to buffers that received either 10.7 ounces per acre + a glyphosphate follow-up or 21.4 ounces per acre Journey© (Figure 3). These differences persisted through the third summer. Thus, black-eyed Susan tolerated neither higher rates of Journey© nor glyphosphate applications that were necessary when we used lower application rates that did not adequately suppress Johnsongrass and other competing weeds.

RECOMMENDATIONS FOR ESTABLISHING MIXTURES OF FORBS AND NATIVE GRASSES

Current recommendations for higher pre-emergence application rates of Journey© (21.4 ounces per acre) pre-planting will increase seedling survival, decrease weed cover and competition, and accelerate establishment of native warm-season grasses in field buffers. Benefit effects may persist for at least three growing seasons.

Successful forb establishment, however, requires thoughtful consideration. Our research suggests that some forbs—especially partridge pea and Maximillian sunflower—can be successfully established with native warm-season grasses using pre-emergence Journey© application rates that maximize native warm-season grass establishment. However, many forbs—like black-eyed Susan—do not tolerate these higher rates of pre-emergence herbicide (although they do tolerate lower application rates). When higher pre-emergence herbicide rates are used, sensitive species like black-eyed Susan should either not be included in planting mixes, or they could be seeded into native warm-season grass stands after they are established and

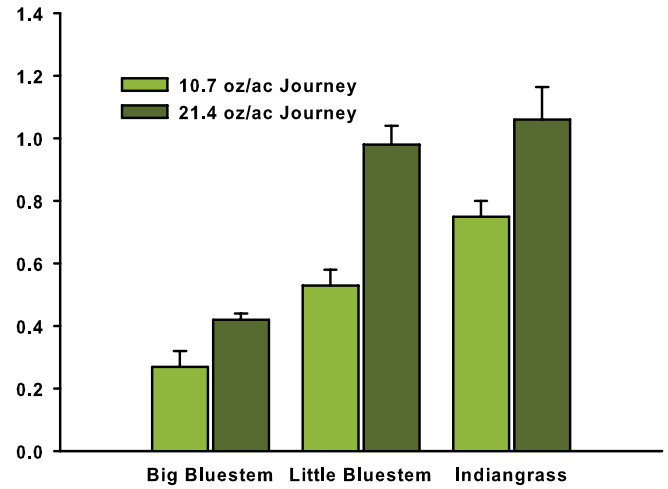

Figure 1. Seedling density (mean # tillers per meter measured along planting furrow [± 1SE]) of NWSGs 2 months post planting at Bryan Farms with pre-emergence applications of 10.7 oz/ac and 21.4 oz/ac Journey©.

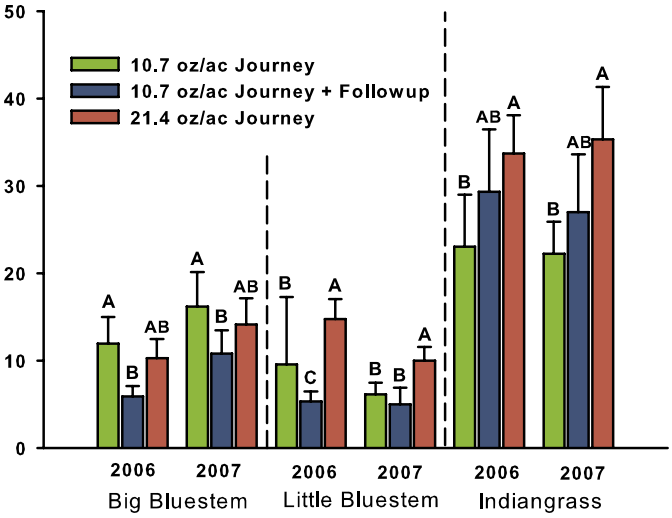

Figure 2. Mean percent cover (± 1SE) of NWSGs (1-m² plots) under three different herbicide treatments 1- and 2-years post-planting. Means with letters in common were not significantly different.

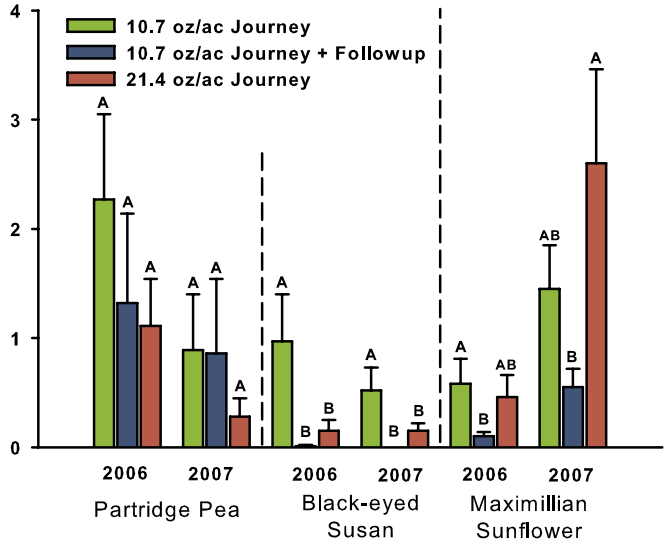

Figure 3. Mean density (± 1SE) of prairie forbs (# / m²) under three different herbicide treatments 1- and 2-years post planting. Means with letters in common were not significantly different.

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residual herbicide is no longer active. For example, a fall interseeding of forbs following a spring planting of native warm-season grasses may be effective. However, methods for seeding forbs after NWSG are established have not been extensively evaluated.

Unfortunately, little is known about how different forbs tolerate higher pre-emergence herbicide rates, so identifying appropriate species is difficult. Previous research on forb tolerance of imazapic herbicides have tested lower application rates, so it is unsafe to assume results will be the same at higher rates. For example, many native warm-season grass manuals list black-eyed Susan as tolerant at about 12 ounces per acre imazapic, but black-eyed Susan clearly did not tolerate 21.4 ounces per acre in our study. In other studies, legumes in general have been more tolerant of pre-emergence imazapic than other forbs (e.g., partridge pea, purple prairieclover), but still some legumes (roundhead lespedeza) are sensitive to rates even lower than we used in our study. Legumes currently offer the highest probability for successful establishment using pre-emergence Journey©, but success will be uncertain until more forb species of all types have been evaluated for sensitivity at 20+ ounces per acre.

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