MISSISSIPPI STATE UNIVERSITY EXTENSION

Wildflower Trails of Mississippi

Wildflower Trail

Pollinators and native plants are vital to production agriculture and healthy ecosystems. Pollinators make the reproduction and growth of more than 180,000 different plant species and more than 1,200 crops possible, ultimately adding nearly $217 billion to the global economy. To help support pollinators and create beneficial habitat, the partnership between the Mississippi State University Extension Service, the Keep Mississippi Beautiful Project, the Mississippi Soil and Water Conservation Service, the Natural Resource and Conservation Service, the Mississippi Department of Transportation, and the Mississippi Master Gardeners is helping bring wildflowers to public areas and rights-of-way across the Magnolia State.

This project has several goals: (1) to increase awareness and education of the importance of pollinators as well as native plants and their role in the environment; (2) to enhance aesthetics through the beauty of wildflowers; and (3) to generate tourism and economic development. The intent of this publication is to describe the establishment and maintenance of these wildflower areas for the benefit of city, county, and state right-of-way managers and public works employees who want to successfully manage wildflower plantings.

Site Preparation

Sites selected for the Wildflower Trail are publicly accessed parks, trails, and commercial landscapes. Other sites include road medians, intersections, and rights-of-way. For each of these areas, most are actively maintained (routine mowing) and dominated by sod-type grasses. These include seeded perennial grasses, such as bermudagrass (*Cynodon dactylon*), bahiagrass (*Paspalum notatum*), ryegrass (*Lolium* spp.), and tall fescue (*Schedonerous arundinaceus*); volunteered weedy species, such as Johnsongrass (*Sorghum halapense*), several species of crabgrass (*Digitaria* spp.), vaseygrass (*Paspalum urvelli*), knotroot foxtail (*Setaria parviflora*), bluestem (*Andropogon* spp), bromes (*Bromus* spp.), silver beardgrass (*Bothriochloa laguroides*), panicgrasses (*Dichanthelium* spp.), and lovegrasses (*Eragrostis* spp.); and broadleaf weeds.

Depending on the level of management at a specific location, herbicides may have been applied to control broadleaf weeds and summer annual grasses. Of the weeds listed the most troublesome for wildflower success are the perennial grass sods. Typically, it is recommended that there is a minimum 2-year process for herbicide control in sites with these weeds. This is due to timing for the greatest control and plant-back intervals associated with some of the wildflower species. To address site preparation for these weed species, here are some recommendations for warm-season and cool-season species.

Warm-Season Control

This section deals specifically with the control of bahiagrass, bermudagrass, and other warm-season perennial grasses. These two species are warm-season sod grasses, actively growing from April through October. After a killing frost, these species go dormant, remain inactive through the winter, and do not emerge again until air temperatures reach 50–55 degrees. For noncrop areas, such as rights-of-way or parks, only certain herbicide products can be used.

Also, for the purpose of the Wildflower Trail and for establishing sensitive species, managers must pay special attention to the plant-back interval for the herbicide to be used. For instance, when using an herbicide with the active ingredient imazapyr (4 pounds of active ingredient per gallon) at 40 ounces per acre (the highest label rate for bermudagrass control), it is best to plan for a 12-month waiting period, followed by a field bioassay. For most sites, we would not recommend this type of product.

Bahiagrass and bermudagrass may be controlled using several products in certain agricultural settings. For noncrop areas where managers work with small chemical purchase budgets and limited herbicide knowledge or expertise, the following steps are recommended for bahiagrass and bermudagrass control (**Table 1**). At least three applications are required before planting. The first application should include clethodim (26.4 percent active ingredient) at a rate of 8 ounces per acre. Mix crop oil at 1 quart per acre with this product for more effective uptake and burndown. Examples of trade names for this herbicide include Select 2 EC, Envoy Plus, Arrow, and Clethodim. This chemical is a graminicide, meaning it controls grasses only. It will not control broadleaf weeds.

The second application should be glyphosate (41 percent active ingredient) sprayed 4–6 weeks before the first killing frost in the fall before planting. Glyphosate should be mixed into a 2 percent solution rate (2 gallons of product plus 98 gallons of water). Most formulations of glyphosate already contain a surfactant. If the product does not contain a surfactant, add a nonionic surfactant at the rate of 1 quart per 100 gallons of spray mix solution.

Spraying in the fall helps herbicide solutions move into the roots of dying vegetation because it stores carbohydrates for the winter, and, thus, maximizes effectiveness. When using calibrated spray equipment, apply herbicides using a minimum pressure of 30 pounds per square inch and 15 gallons of water per acre to insure adequate coverage to all growing leaves and stolons. Do not apply herbicides when plants have been stressed by heat, compaction, recent mowing, drought, or excessive moisture. Otherwise, the herbicide will not be taken up effectively.

The third application of glyphosate should be made in the spring once cool-season weeds have germinated and are actively growing. These weeds include annual ryegrass (*Lolium multiflorum*), henbit (*Lamium aplexicaule*), buttercup (*Ranunculus* sp.), and mustard (*Brassica kaber*). This application rate should be at 1 quart per acre.

Table 1. Recommended herbicides for site preparation of designated wildflower areas.[1]

Active ingredient	Trade name	Rate	Adjuvant	Comments
Clethodim (26.4 percent active ingredient)	Select 2EC, Clethodim, Arrow	8 ounces per acre	Crop oil (1 quart per acre)	Controls grasses only. Applications should be made in the summer to actively growing plants, such as bahiagrass and bermudagrass.
Glyphosate (41 percent active ingredient)	Roundup, Buccaneer, Glystar, etc.	2 percent solution	None	Applications should be made in the fall 4–6 weeks before killing frost.

[1]Consult herbicide labels for safety protocols, recommended rates for species to control, and proper application methods.

Cool-Season Control

Tall fescue and annual ryegrass are the predominant cool-season grasses seen along rights-of-way in Mississippi. Annual ryegrass is a short-lived, bunch-type grass that establishes quickly in the fall during the onset of dormancy in warm-season species. Annual ryegrass is a valuable forage crop, and it is often overseeded as temporary cover in highly visible or high-traffic areas because of its rapid germination, aggressive growth, affordability, winter color, and ability to aid in erosion control. Because it cannot tolerate high temperatures, vegetative growth is limited from about October to May across most of Mississippi.

Tall fescue, a perennial, clump-forming grass that may propagate from both seed and rhizomes, is highly adaptable to variable environmental conditions. Kentucky-31 is the most notable cultivar, and its persistence is partially due to a mutually beneficial relationship with a fungal endophyte. Tall fescue primarily grows north of the Interstate 20 corridor, but it may be found as far south as I-10 in moist areas and in partial sun or shade. Plant growth and seed germination occur when average soil temperatures are between 50 and 65 degrees and day/night temperatures are between 59/50 degrees and 75/66 degrees. In north Mississippi, this period of increased plant growth usually occurs from October to November and from April to May.

Both tall fescue and ryegrass enter their reproductive phase in late spring when temperatures increase, producing highly viable seeds. Seedlings may quickly sprout and cover open gaps in vegetation, creating thick stands that are difficult to control once they are established.

Control of either species requires careful consideration months in advance. Both tall fescue and ryegrass are prolific seed producers, and despite above-ground biomass removal, new plants may emerge indefinitely from a viable soil seed bank. Therefore, herbicide control should happen before seed development. For complete eradication of tall fescue, it will be necessary to do repetitive control practices over multiple growing seasons; however, adequate postemergence control of aboveground biomass is feasible within a year without leaving residual herbicide that can compromise future plantings. A spray-smother-spray approach is effective for cool-season perennial-grass control in areas where an annual cool-season cover is allowed and planting equipment can operate.

With this method, managers treat vegetation with a nonselective herbicide such as glyphosate at 1.5 pounds (acid equivalent) per acre (1.33 quarts of Roundup Powermax®) in the fall once plants are actively growing. Many glyphosate-based products, specifically Roundup®, already contain a surfactant blend. A cool-season annual crop, such as wheat, is planted primarily to stabilize soil during the winter. In the spring, before tall fescue seed production, a second glyphosate application is made. This controls any emerged plants and terminates the cover crop before planting the wildflower mix.

Imazapic may also be tank mixed with this spring broadcast application or applied alone at planting at rates up to 0.0625 pound of active ingredient per acre (4 fluid ounces of Plateau®) to provide further annual weed and seedling tall-fescue control. When applying imazapic alone, add a nonionic surfactant with at least 80 percent in formulated product at a rate of 0.25 percent volume/volume (percent volume of herbicide in the total volume of spray solution). Keep in mind that a remnant thatch layer will need to be minimized or removed to ensure proper herbicide-soil contact. When removing thatch via burning or conventional tillage, apply imazapic afterwards at the time of planting.

Tillage

There are several factors to consider before using tillage. When existing vegetation has been controlled in small areas with minimal slope by using the methods previously described, tillage can be beneficial. By tilling, you fluff the upper 5 inches of soil, exposing moisture and creating an arable surface for germination and root development (**Figure 1**). However, tillage can also expose weed seed beneath the soil and create ideal conditions for its germination and emergence. Examples of tillable sites include elevated medians, landscaped areas next to buildings, and park trails. In areas where tillage can be used, it is highly recommended to cultipack soil after planting to ensure improved seed-to-soil contact (**Figure 2**).

For some sites in this project, roadsides and slopes are often chosen as areas to establish. These are excellent choices because they typically provide angles of vision for the wildflowers that make them more visible. These sites, however, should remain untilled to avoid erosion and loss of topsoil. Some of the wildflower species on this trail are quick to germinate and colonize, but they do not substitute for sod grasses that can completely cover the soil surface, protecting it from erosion.

Figure 1. This elevated median was tilled before sowing. Multiple passes over a site may be required to break down large clods. A smooth soil surface prevents broadcast seed from getting buried too deep between clods during weathering.

Figure 2. Cultipacking after seeding allows the seed to be pressed into the soil surface, allowing for greater seed-to-soil contact, which enables seed to imbibe water and nutrients for germination and development.

Table 2. Wildflower seed mix used for the Wildflower Trails of Mississippi project.	
Species	**Common name**
Grass	
Little bluestem	*Schizachyrium scoparium* (Michx.) Nash
Side oats grama	*Bouteloua curtipendula* (Michx.) Torr.
Splitbeard bluestem	*Andropogon ternatius* Michx.
Forbs	
Blackeyed Susan	*Rudbeckia hirta* L.
Purple coneflower	*Echinacea purpurea* (L.) Moench
Mexican hat	*Ratibida peduncularis* (Torr. & A. Gray) Barnhart
Plains coreopsis	*Coreopsis tinctoria* Nutt.
Lance-leaved coreopsis	*Coreopsis lanceolate* L.
Dwarf red plains coreopsis	*Coreopsis tinctoria* Nutt.
Cosmos	*Cosmos bipinnatus* Cav.
Sulphur cosmos	*Cosmos sulphureus* Cav.
Shasta daisy	*Leucanthemum* x *superbum* (Bergmans ex J. W. Ingram)
Wild blue lupine	*Lupinus perennis* L.
Corn poppy	*Papaver rhoeas* L.
Legumes	
Illinois bundle flower	*Desmanthus illinoensis* (Michx.) MacMill. ex B. L. Rob. & Fernald
Partridge pea	*Chamaescrista fasciculata* (Michx.) Greene
Purple prairie clover	*Dalea purpurea* Vent.
White prairie clover	*Dalea candida* Michx. Ex Willd.

Seeding Mix

For this project, we developed a seed mix that could be used throughout Mississippi (**Table 2**). All species used were native to North America. Ideally, managers would plant genetically distinct local varieties so sites could be established with plants adapted to specific regions and environments; however, commercial sources of seed for certain species of native plants are rare, and the seed may be prohibitively expensive. As a result, we purchased seed from an out-of-state vendor. It contained the most adapted species when available.

We developed the particular seed mix for this project to address several issues. First, several of the partners involved in the project had little or no experience in cultivating natural areas. This mix incorporated species known to germinate and develop rapidly, thus providing evidence of a successful planting and also yielding quick color. Second, species in this mix include annuals, perennials, grasses, forbs, and legumes, providing color from spring until fall, along with structure (grasses) during the winter if desired. Third, since many of the areas to be planted are rights-of-way or in park settings, all species included in the mix are considered short statured with mature heights of 3 feet or less. Weeds, such as Johnsongrass, present in the planted area may reach heights greater than 3 feet, thus justifying the use of weed control. However, all species included in the mix are tolerant to a post-emergent application of the herbicide imazapic. This specific chemical can control several problematic grass and broadleaf weeds during the establishment phase. See the "Weed Control and Stand Maintenance" section for more information.

Finally, we designed this mix to suit a majority of soils and climates across Mississippi. Soil pH, moisture, soil nutrition and texture, sunlight duration and intensity, and maintenance requirements change from site to site. This mix provides environmental diversity so that at least a few species will thrive in each environment. Just because these are native plants does not necessarily mean they will establish and colonize on poor sites. Better site selection and soil conditions will result in a more successful planting.

Planting Methods

There are several ways to plant the seed mix. The easiest method is simply broadcasting seed by hand, which can be very successful in small areas where tillage can be used (**Figure 3**). When broadcasting seed onto a tilled and prepared seedbed, use a cultipacker after seeding to press seed into the soil. In larger areas where hand broadcasting is not feasible, use a broadcast spreader specifically designed to handle fluffy seed (**Figure 4**).

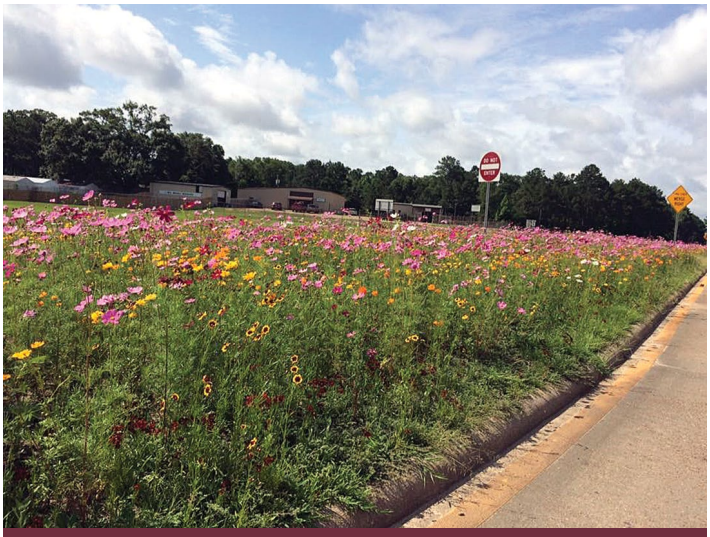

Figure 3. In this elevated median, the seed mix was broadcast by hand after tillage and cultipacking. Timely rains and excellent site preparation are key to getting successful stands.

Figure 4. Specialized broadcast spreaders with agitators and picker wheels help spread light, fluffy seed mixes.

The seed mix used in this project is very light and fluffy, and it will not flow through conventional broadcast seeders. Again, use a cultipacker after planting. The third method is to use a no-till drill (**Figure 5**), which is useful in larger areas where tillage is not feasible. A specialized seed drill with agitators and picker wheels must be used in order to distribute the seed evenly through the seed tubes and into the soil surface. There are several advantages to this method: (1) reduced soil disturbance; (2) the ability to see rows of seedlings and differentiate desired versus undesired vegetation; and (3) conserved soil moisture during germination.

Figure 5. A no-till drill is useful in larger areas where tillage is not an option. Using a drill allows for less seed to be used because it is metered out, as opposed to being broadcast to the soil surface. Specialized drills allow for light, fluffy seed mixes to be easily planted.

Weed Control and Stand Maintenance

The species mix used in this project tolerates imazapic herbicide (**Figure 6**), which is registered for sale in Mississippi under several trade names, including Imazapic, Impose, Panoramic, and Plateau. Postemergence applications of 4 ounces per acre with nonionic surfactant can be used to control annual grasses such as broadleaf signalgrass (*Brachiaria platyphylia*), foxtail (*Setaria* sp.) and crabgrass, as well as Johnsongrass. Broadleaf weeds that are controlled at this rate include morningglory (*Ipomoea* sp.), pigweed (*Amaranthus* sp.), sicklepod (*Senna obtusifolia*), and smartweed (*Polygonum* sp.). Rates greater than 4 ounces per acre applied postemergence can harm wildflowers. Equipment used in making applications must be properly calibrated, and there must be no overlapping when multiple passes are made at the planted site.

Figure 6. Post-emergent applications of imazapic can control annual grasses and broadleaf weeds. A treated area is on the left. Blooms of desirable wildflowers may seem burned after application, but they will recover after favorable conditions.

Note that wildflower foliage and blooms will appear burned and fall off when you use this product after the flowers have bloomed. This damage is mostly due to the effects of the surfactant and will be most pronounced when temperatures are above 95 degrees. With ample rainfall and good soil conditions, however, the flowers will rebloom.

Another option for weed control in wildflower plantings is the use of a graminicide (grass weed herbicide), which controls both annual and perennial grasses. The herbicide group contains several chemicals, including clethodim, fenoxaprop, fluazifop, quizalofop, and sethoxydim, which are sold in nearly 100 trade-name products. Graminicides may be used to control grassy weed competition during wildflower establishment.

However, our seed mixture contains three grass species. Applying a graminicide will kill emerging seedlings of these desired species. Therefore, only use a graminicide if grassy weed competition has exceeded 50 percent coverage of the planted area.

To maintain these wildflower areas, wait until after the first killing frost of fall to mow. This precaution will give the wildflowers and grasses time to produce mature seed. Mowing the seed heads will disperse these seeds onto the soil surface. Exposure to cool, wet conditions through the winter will help some of the annual species germinate the following spring. Reseeding potential of some of the species in the mix is not known and will vary from site to site.

Summary

The Mississippi Wildflower Trail project is a great way to bring beauty and awareness to public areas and rights-of-way across Mississippi. Interested municipalities, contractors, right-of-way managers, and public works employees are encouraged to contact their county Extension office for more information on this project and to ask any questions they may have in getting a wildflower area established.

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