



Department of
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WEED MANAGEMENT FOR WILDFLOWERS

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The use of wildflowers in the landscape has increased since Lady Bird Johnson first promoted them in the late 1960's and early 1970's. Wildflowers were further popularized by the "Meadow in a Can" seed collections that were marketed in the early 1980's. A number of books have been written that describe methods for planning and planting wildflowers, however, few recommendations are available regarding maintenance and long-term weed management. In wildflower plantings, weed management is a complex system that requires knowledge of the specific wildflowers and weeds, environmental conditions, and control methods. Therefore, the objective of this leaflet is to discuss weed management strategies that can be applied to the planning, establishment, maintenance and renovation stages of a naturalized wildflower planting.

In North Carolina, extensive plantings on the highways have given wildflowers high visibility and further promoted the concept for use in other landscapes including golf courses, office parks and private residences. Naturalized wildflower plantings such as meadows are being recognized and appreciated as landscape designs. Wildflowers attract birds, butterflies and other wildlife as well as provide color when planted in lieu of large expanses of turf grass. When allowed to naturalize, they can reduce the maintenance required by a more formal landscape design.

The ultimate objective in planting a naturalized wildflower area is to develop an attractive, permanent planting that will provide flowers year after year with self-seeding annuals and perennials. However, wildflower plantings that are left unmanaged will eventually revert to the composition of plant species in the original plant community through a process called succession. Succession is a gradual change over time in the species composition of the plant community. The species that appear/disappear during this time change can generally be predicted based on historical knowledge of the planting site. For example, it is well documented that in North Carolina's Piedmont, the following sequence of successional species will occur in a cultivated area that is abandoned and not properly managed or maintained after the initial growing season:

Years After Abandonment	Major Plant Species Present
0-2	Crabgrass (<i>Digitaria</i> spp.)
	Horseweed (<i>Conyza canadensis</i>)
	Common ragweed (<i>Ambrosia artemisiifolia</i>)
	<i>Aster</i> spp.
3-5	Broomsedge (<i>Andropogon</i> spp.)
	Loblolly pine (<i>Pinus taeda</i>)
10-15	Loblolly pine
15-75	Loblolly pine with hardwood understory
75+	Mixed forest eventually changing to mature hardwoods

Wildflower plantings will essentially follow this successional process because they are given very little maintenance after the initial establishment period. In addition to successional changes, other weed problems can be anticipated, based on knowledge of the site selected. A primary source of weed contamination is from seed that have been deposited in the "soil seed bank" over a long period of time. These seeds often remain dormant for many years but will germinate when tillage lifts them to the soil surface where moisture, air, and light are favorable for germination. Research has found as many as 98 to 3,068 viable weed seeds per square foot in the top six inches of soil. This quantity of seed, if allowed to germinate, would present a formidable weed population in a new planting. Therefore, in selecting a site for a wildflower planting, knowledge of previous weeds and past use of the land will allow insight into potential weed problems in the future.

I. PLANNING

A. Analyze the site for potential weed problems. Assessing the wildflower site for potential weed infestations from the weeds present, the soil seed bank, the surrounding area and anticipated successional changes, is the first step toward developing a weed management strategy. The current weeds on the site should first be identified. If it is infested with difficult-to-control perennial weeds such as nutsedge (*Cyperus* spp.) or white clover (*Trifolium repens*), it may be best to select another site for the wildflower planting or weed pressure may be too great for wildflower establishment. If the site must be used, it may be advisable to spend several seasons dedicated to controlling and removing as many perennial and reseeding annual weeds as possible before planting wildflowers. Weed species and populations in surrounding areas should also be considered in the site selection process. Seed dispersal mechanisms that allow wind and water to bring in seeds from outside the planting area will add to the site's weed population. Germination times, such as fall or spring for annual weeds, will also affect wildflower growth if weeds are established and large enough to compete when the wildflowers germinate. After potential weed

species and their sources have been identified, their growth habits and characteristics should be studied. Knowledge of these weeds is essential in determining methods of control. (Weed identification references are included in the Reference Section.)

B. Select the desired wildflower species.

The second consideration in the planning phase is the selection of the wildflower species. The species planted will affect weed management at the site. The objective in selecting a variety of wildflowers is to develop a plant community that will be attractive and compatible in terms of growing requirements, that will flower over extended periods of time, that will reseed the site for generation of new plants, and that can be held and maintained at the flowering successional stage. In order to be successful in a particular location, the wildflower species must be compatible with and adaptable to growing conditions at the site. They must also be competitive with other species present, including weeds. Native species generally are most adaptable to local growing conditions and are usually the most competitive with native weeds that will be present.

In determining species that are to be included in a wildflower seed mix, consideration should be given to the germination times and growth characteristics of the species. Most wildflower mixes are a combination of annuals for flower color the first year and reseeding annuals or perennials for flowers in the second and succeeding years. The objective in using a mix is to develop a wildflower community of compatible species. Species that germinate and emerge rapidly after planting will become better established, provide ground cover and, consequently, will help reduce the number and growth of weeds. Early establishment allows the wildflowers to develop better root systems and to capture available resources such as water and nutrients so they can successfully compete with weeds that germinate at later times. A careful selection of wildflower species will help with weed management at the site. (The Reference Section includes resources for selecting wildflower species.)

II. SITE PREPARATION AND ESTABLISHMENT

The second stage of weed management in wildflowers is site preparation and establishment of the planting. In North Carolina, fall (October/November) is the recommended planting time for wildflowers. Generally, the soil is cool (40 to 60°F) and moist at this time of year which promotes seed germination and establishment. Winter annuals and some perennials will germinate and overwinter as small seedlings. In addition, the soil is cool enough to hold summer annual seed in a dormant state for early spring germination. The most effective weed management during site preparation is to kill as many weeds and viable weed seed as possible to prepare the site for wildflower planting. There are essentially two methods that are effective: 1) the use of a systemic herbicide and 2) fumigation.

A. Site Preparation with Herbicides.

Initial weed control with a systemic, non-residual herbicide such as glyphosate (RoundupTM and other trade names), is the approach most often used in establishing wildflowers. Glyphosate is often thought to kill all plants, however, it has selectivity for some plants depending on the time of year it is applied and the growth state of the plant. Proper timing of the application is, therefore, very important to achieve maximum weed control results. (N.C. Cooperative Extension Service Publication AG-427, "Weed Control Suggestions for Christmas Trees, Woody Ornamentals, and Flowers" and the glyphosate label contain details on application rates and timing for specific weeds.)

In order to plant wildflowers in October or November, site preparation must begin in late summer (August/September). Total preparation time is approximately four to six weeks using the following method:

1. Be sure the area has NOT been mowed so grass and weeds will be the proper size at the time of spraying as specified on the glyphosate label.
2. Spray only when the plants are dry. When the site meets these conditions,

uniformly spray the area for coverage but do not wet the plants to runoff.

3. Allow at least six hours of drying time for maximum plant kill with glyphosate. The timing of this first application should coincide with active weed growth because the optimum susceptibility to glyphosate for perennial weeds is when they are actively growing. In addition, they are most susceptible when they are not stressed.

4. Seven to ten days after the initial spray when the grass and weeds are dying, till the site and prepare it for final planting. This should be accomplished by mid-September for planting in early October.

5. If weeds emerge, re-treat with glyphosate two to four weeks after the final tilling and bed preparation. Tilling will bring new weed seed to the surface. The soil will be warm and if sufficient moisture is present, many annual weed seed may germinate. These seedlings will die within seven days after treatment and the site will be ready for planting.

B. Site Preparation with Fumigation. A second technique for site preparation and establishment of wildflowers is the use of fumigation. Fumigants kill most weeds and dormant weed seed except those with hard seed coats such as Carolina geranium (*Geranium carolinianum*), white clover, and nutsedge. Fumigation is a temporary weed control method and new weed seed will germinate as they are introduced into the planting area. The advantage of fumigation is that wildflowers become better established prior to weed emergence. Research has shown that fumigation can result in increased plant size over non-fumigated sites. Although increased size can benefit wildflower growth, the cost of fumigation is high and must be considered.

There are several fumigants available for use in wildflowers including methyl bromide, metham and dazomet. Methyl bromide is a gas and for large areas requires the use of

specialized equipment and a licensed applicator. Metham (Vapam and Sectagon) are water soluble liquids and are less active than methyl bromide, but they are easier to use. Dazomet (Basamid Granular) is a granular product that is most effective in cool soil temperatures. The metham and dazomet fumigants remain in the soil for longer periods of time than methyl bromide. To ensure the soil is safe for planting a soil bioassay should be conducted after any fumigation. However, because of the potential for prolonged soil activity with metham and dazomet, a bioassay is essential when these fumigants are used. If the soil still contains the fumigant, planting wildflower seed will result in the death of the seed. Extension publication AG-427 contains additional fumigation information and a complete procedure for conducting a soil bioassay.

If fumigation is chosen for preparation of a wildflower planting site, the site should be tilled and prepared for planting in late summer to early fall (August/September). Fumigation requires adequate soil moisture for movement in the soil and is generally very effective in September to early October when soil temperatures are still high. The site can be planted when the bioassay shows the soil is safe for planting (late October/November).

C. Planting. At planting time, loosen the soil surface slightly to enhance seed contact. At this time the soil surface should be disturbed as little as possible because most annual weed seed that germinate are within the top one-fourth inch of soil. If the soil is deeply disturbed, additional weed seed that are capable of germinating and competing with the wildflowers will be moved to the soil surface.

Distribute the wildflower seed evenly in the planting area to give each seed adequate space and resources for germination. Even seed distribution allows maximum coverage of the soil by new seedlings and provides the most benefit in weed suppression. After sowing, either tamp the soil or water the area to ensure good seed-soil contact. A light, seed-free mulch, such as wheat straw,

can also be used for seedling protection. The mulch should be lightly and evenly dispersed with no heavy clumps. A heavy, uneven mulch reduces wildflower growth and development and results in areas with no plants.

III. MAINTENANCE AND RENOVATION

The third and final stage in the development of a weed management strategy for wildflowers is to develop both short and long-term maintenance programs. The best approach for developing these programs is to: 1) anticipate weed problems, such as successional changes, before they occur; 2) identify seedlings quickly as they grow; and 3) take corrective weed control action as soon as possible. In general, weed seedlings are easier to control before they mature and establish good root systems. Optimum size for best control is usually four inches or less. Early control will reduce weed competition with young wildflower seedlings giving them maximum growth conditions.

After a wildflower planting is established, there is no single approach or "magic formula" to manage encroaching weeds. The problem is further compounded by the fact that most wildflower plantings are a mix of species, thereby reducing the number of herbicides that can be safely used for weed control. Similar plants, such as those in the same family, generally have similar tolerance to selective herbicides. For example, many popular wildflowers are in the Compositae family and so are many of the troublesome weeds in North Carolina. As a result, if an herbicide is safe for the wildflower, it will probably have no effect in controlling closely related weeds. With a mix of wildflowers from various families, it is unlikely that one herbicide will be completely effective for weed control without damaging some wildflowers. Therefore, weed management programs must be developed to use a combination of cultural, chemical and mechanical weed control techniques.

Most wildflower plantings are not static but change annually and seasonally due to the mix of species. A good mix will provide flushes of seasonal flowering from spring to

fall. Annual changes will occur based on the number of perennial plants and those species that have reseeding potential and the extent to which that potential is realized. Reseeding is essential for natural regeneration of plants in order to perpetuate and extend the life of the planting. Weed control techniques should be carefully selected in order to optimize wildflower reseeding potential at the site.

An integrated weed management approach that incorporates multiple weed control techniques and is site specific will be the most effective for wildflowers. Avoidance of the weed problem by preventing regeneration is often easier than trying to establish weed control at a weed infested site. In selecting the techniques to use, remember that small seedlings are the easiest to control. Also, control of weeds at the site will prevent weed seed dispersal and the development of other weed propagation structures such as rhizomes and tubers. Good control will minimize future weed pressure. A range of weed control techniques are discussed below. The manager must evaluate the site on a continuing basis and select those techniques that will be most effective on a long term basis for a given location.

A. Competition. One method of weed control that is often overlooked is competition. Seedlings that emerge first are often able to capture more space and resources and this gives them a competitive edge over later germinating seed. Young plants are the most susceptible to damage from weed competition. Therefore, if wildflowers are planted in a properly prepared, weed-free site, they will be quicker to germinate and establish than weeds. Early development of the wildflower canopy in the spring will also help suppress weed growth. An even distribution of seedlings at this stage will allow maximum growth of the wildflowers. If the wildflowers are heavily planted, they will compete with themselves. This will cause dieback and open areas within the site which promotes weed establishment. In North Carolina, horseweed can be expected to encroach in the first two years based on successional changes. It is difficult to control in wildflowers because it is a fall germinating

composite. Horseweed, however, can be suppressed with a good cover of fall wildflowers because it requires bare ground to germinate. Understanding weed and wildflower biology is essential in order to make maximum use of growth characteristics for weed suppression.

B. Mowing. Most wildflower plantings are maintained with an annual mowing. Mowing prevents development of pines and hardwood trees and arrests the successional development at the herbaceous plant stage. Mowing should be timed to meet three objectives: 1) to remove weeds before they flower and develop viable seed; 2) to disperse wildflower seed for reseeding within the site; and 3) to remove dead plant material and improve the appearance of the planting. Mowing is an important management tool and timing is essential to maximize weed control and wildflower reseeding.

C. Hand pulling. Hand pulling is a viable alternative for weed control in small wildflower planting sites. Any weeds that are pulled from the site before seed mature and disperse will contribute to future overall weed control. One weed can produce thousands of seeds. Therefore, even on the smallest scale, the contribution of hand pulling should not be overlooked.

D. Chemical control. Chemical weed control programs are based on herbicide selectivity and plant tolerance. The objective with chemical control is to find an herbicide that wildflowers can tolerate but which is detrimental to the weeds present. As discussed earlier, similar plant species have similar tolerance to herbicides. For this reason, herbicides are often classified as broadleaf and grass (graminicide) herbicides based on the weeds they control. Herbicide labels list the weeds that are controlled as well as tolerant, desirable species. At present, there are very few wildflowers included on broadleaf herbicide labels. Therefore, there are no broadleaf herbicides that are known to be safe for a wide range of wildflower species. On the other hand, most weedy grasses can be controlled in wildflowers with a graminicide such as sethoxydim (Vantage, Poast) or fluazifop (Ornamec,

Grass-B-Gon) without damaging the broadleaf wildflowers. However, use of a gramicide will also control any native or ornamental grasses that may be included in the wildflower planting.

In addition to the broadleaf and grass classification, herbicides are also categorized by their activity as either preemergence or postemergence herbicides. For the purposes of maintaining established wildflower plantings, preemergence herbicides would be applied to the soil prior to the emergence of the target weeds. Postemergence herbicides are applied after the emergence of the target weeds.

Preemergence products are applied uniformly to the soil to prevent germination and growth of the weeds controlled by the herbicide. This will require tolerance by all the wildflowers in the planting or it may damage susceptible species. In an established bed, these herbicides may be safe for existing plants. However, there is little known regarding the effects of preemergence herbicides on the reseeding potential of wildflowers. If the preemergence herbicide is detrimental to the wildflower seeds, regeneration of new wildflower plants would be reduced. In a planting with a good, established wildflower population and a growing weed population, the use of a preemergence may be warranted to reduce the weeds, even though reseeding will be reduced for a period of time. Managers should consider these possibilities when making the decision to use preemergence herbicides.

Postemergence herbicides are usually sprayed on actively growing weeds. One way to circumvent damage to the wildflower planting is to select a method for application that directs the herbicide to the targeted weeds and avoids the wildflowers. The following application methods can be used for this purpose:

1. Spot spray - A small sprayer is used that can be directed to individual or small groups of weeds so the spray will not contact desirable wildflowers.

2. Wipe-on application - An application device is used to wipe the herbicide on weeds that are taller than the wildflowers. Equipment may be either a rope wick or roller type applicator. This technique may be particularly useful for reducing tall weeds such as horseweed. Inexpensive hand wicks are available.

3. Clip-cut - Hand-held clippers that dispense a thin layer of herbicide onto the blade can be used to selectively cut weeds. This method applies the herbicide to the cut surface of the stem so it is translocated into the weed to kill the total plant.

When planning any chemical control program, the user has the responsibility to determine the most effective herbicide to use, timing of the application, and the proper rates. **Herbicide labels must always be carefully read and followed** for the best and most cost effective results.

E. Allelopathy. Some plants produce chemical compounds that inhibit the growth of other nearby plants (allelopathy). The toxic substances may be released from the roots or leaves and through plant residues on the surface that are leached into the soil with rainwater. Weeds are known to have allelopathic (detrimental) effects on some crops and vice versa. Some of the weeds that are known or suspected to be allelopathic are bermudagrass (*Cynodon dactylon*), johnsongrass (*Sorghum halepense*), yellow and purple nutsedge, pigweed (*Amaranthus* spp.) and sunflower (*Helianthus* spp.). Horseweed is known to be allelopathic to itself. This most likely is the reason it declines in the successional changes in North Carolina's Piedmont. However, even though it will decline over several years, if it is left in most wildflower plantings, it will severely reduce the wildflower population by out-competing more desirable plants.

Knowledge of allelopathic effects will never become a total weed control method for wildflowers. However, by observing differences in wildflower plantings and surrounding areas, managers may see differences in plant growth that can be effectively used in developing a weed management strategy.

F. Renovation. Wildflower plantings decline over time because many herbaceous perennial plants often have a limited life span. Decline may also be attributed to weed pressure, allelopathy, site, and environmental growing conditions. Renovation of an existing planting may be more cost effective than starting with a new bed if the weed pressure is first brought under control.

New seeds can be planted into existing wildflower plantings that are relatively weed free. The soil should be disturbed as little as possible to prevent additional weed seed germination. This can be accomplished either by raking or using a slot seeder. Since the seed cannot be tamped without damaging existing plants, water them in to provide adequate soil contact. Renovation should be completed following the same timeframes used for initial seeding.

Weed management in wildflowers is an ongoing challenge. As wildflowers become more popular, additional knowledge and experience will generate improved management techniques. The primary objective for wildflower plantings should be a naturalized planting with seasonal changes and interest rather than a weed-free groomed area. This can be achieved with properly applied weed management techniques.

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