



WEED MANAGEMENT IN ANNUAL COLOR BEDS

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Weeds compete with ornamental plants for water, light, and nutrients, reducing aesthetic quality and plant growth. To minimize these problems, a weed management program should be developed and implemented prior to planting. A successful weed management program involves four steps:

- Understanding weeds (identification and life cycle)
- Understanding the available weed management options.
- Site preparation – eliminate perennial broadleaf weeds and sedges before planting
- Implementing a combination of effective methods to prevent and control weeds

Understanding Weeds

The first step in developing a successful weed management program is identifying your weeds and their associated life cycle. Knowing the correct name helps to understand the herbicide labels and control recommendations. Several pictorial guides are available for identifying weeds (refer to suggested references).

Most weeds found in color beds have one of three life cycles: summer annuals, winter annuals, and perennials. The weed's life cycle provides information on timing of germination and method of reproduction. Summer annual weeds germinate in the spring (beginning with dogwood bloom) and

continue throughout the summer months. They flower and produce seed prior to the first frost. Common summer annual weeds include grasses such as barnyardgrass, crabgrass, and goosegrass; and broadleaves such as annual lespedeza, carpetweed, common purslane, morningglories, pigweed and prostrate spurge. Winter annual weeds germinate in late summer and early fall, overwinter as small dormant but green plants, and flower and produce seed in late winter and early spring. Winter annual weeds die with the onset of warm weather usually in late spring to early summer. Common winter annual weeds include annual bluegrass, annual sowthistle, common chickweed, hairy bittercress, henbit, horseweed and short buttercup. Perennial weeds are classified according to their method of reproduction as *creeping* or *simple*. *Creeping* perennials reproduce by above ground stems (stolons) or below ground stems (rhizomes). Of course, most perennial weeds can also reproduce by seed. Examples include nutsedge, bermudagrass, red sorrel, bindweed, groundivy, and quackgrass. *Simple* perennials spread by seed, they have no natural means of spreading vegetatively (stolons or rhizomes). Their roots are usually fleshy and can grow very large. Examples include common dandelion, curly dock, buckhorn and broadleaf plantain, and pokeweed. It is important to scout the weed population throughout the year to assess the success of the weed management program.

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Methods Available to Prevent and Control Weeds

The most important weed management tasks are done before planting. Good site preparation includes scouting for perennial weeds and controlling them before planting. Manual or mechanical control of perennial weeds is difficult and costly once the bed is established. There are three options for controlling perennial weeds: cultivation,

fumigation, or systemic postemergence herbicides (Roundup-Pro or Finale). Before planting, Roundup-Pro (sold under many other trade names in the consumer market) and Finale can be used to control annual and perennial weeds, but timing of the application is critical to obtain maximum perennial weed control. Rates and timing of Roundup application to control selected perennial weeds are shown in Table 1.

Table 1. Optimum application rates and timing of Roundup-Pro (glyphosate)

Amount of Roundup-Pro (glyphosate) to obtain 90% or better control of selected weeds one season later.

Plant(s)	Rate	Timing
Perennial grasses (johnsongrass, fescue, etc.)	1%	At time of first flowering
Bermudagrass	2%	At time of first flowering
Quackgrass	2%	Early spring, with 6 to 8 inches of new growth; or early fall
Blackberry	1 to 1.5%	Fall and early winter
Composites (asters, goldenrod, dogfennel, etc.)	1%	From first flowering to a few weeks before frost
Honeysuckle	1 to 1.5%	Full bloom and up to a month after (early summer)
Kudzu	1.5 to 2%	Full bloom and up to a month after (early summer)
Nutsedge	2%	Early summer, repeat treatments as new plants emerge
Poisonivy	2%	Two weeks on either side of full bloom (early summer)
Sericea lespedeza	2%	Full bloom (midsummer)
Trumpet creeper (cow-itch vine)	1.5%	Late summer to mid-fall before frost

Our data suggest that the following plants can be controlled with Roundup-Pro, although the manufacturer does not claim effectiveness on the produce label.

Clematis vine	1%	After bloom until frost
Englishivy	2 or 3%	3 to 5 fully expanded new leaves (early spring)
Greenbrier	3%	5 fully expanded leaves (early spring)
Japanese knotweed	2%	Late summer to early fall but before frost
Mugwort	1.5 to 2%	Full flower (late summer to early fall)
Passion flower (maypop)	1%	Early bloom to first fruit
Virginia creeper	1%	Late summer or first sign of fall color
Wisteria	1.5 to 2%	6 to 8 weeks after bloom (mid- to late summer)

In general, the application times given above have been more effective than applications made at other times of the year.

If the site is heavily infested with perennial broadleaf weeds or sedges, soil fumigation should be considered. Because fumigation kills by using toxic chemicals, it is important that care be given to each stage of the fumigation process to ensure the safety of the fumigator and the effectiveness of the treatment. Regardless of the fumigant used, soil preparation is the key to successful sterilization. Soil should be cultivated to a depth of 6 to 8 inches 7 to 10 days before and immediately before fumigation. Tillers are excellent for this purpose. At treatment time, the soil should be free of clods and fresh organic debris, moist enough for seed germination, and have a temperature greater than 55°F at the 6-inch depth. Fall is an excellent time to fumigate since soils are warm and proper moisture levels are easier to attain. Since most fumigants are inactivated by high levels of undecomposed organic material (such as leaves or grass), organic debris should be removed or allowed to decompose before fumigation. If the soil is not moist, properly prepared and free of fresh organic matter, there may be weeds that the fumigant will not kill. While the soil should be moist, wet soils are not sufficiently aerated to allow free movement of the fumigant within the soil and will result in poor control.

Three commonly used fumigants are metham, dazomet, and methyl bromide. Metham (Vapam) is a liquid while dazomet (Basamid) is in granular form; however, the active ingredient in both Vapam and Basamid is methylothiocyanate (commonly referred to as MIT) which is released as a gas after the material is applied to the soil. Since Vapam is a liquid, it may be easiest to use on small areas as a liquid drench. For best results, cultivate the soil thoroughly and irrigate before applying metham at a rate of 1 pint in enough water to uniformly cover 50 ft² of surface area. After application, irrigate the soil with sufficient water to saturate the surface. To increase effectiveness, cover the area with plastic sheeting. Cultivate the treated area 7 days after application to a depth of 2 inches. Do not plant until 14 to 20 days after treatment. If the soil is cold and wet you will have to wait longer. Always refer to product label for details and precautions.

Since dazomet (Basamid) is a granular material, it is easy to apply with a spreader. After application it should be rototilled into the soil then irrigated thoroughly. For maximum effectiveness, cover with a plastic sheet or tarp. However, plastic sheeting is not mandatory, irrigation or rolling to seal the surface can be used in place of plastic sheeting. If plastic sheeting is not used the soil surface

should be kept moist for several days to slow the loss of methylothiocyanate from the soil. Seven days after fumigation, cultivate the treated area to a depth of 2 inches. Do not till any deeper than 2 to 3 inches to prevent weed seeds and other pests from being moved into the previously treated soil. Do not plant until 14 to 20 days after treatment. If the soil is cold and wet you will have to wait longer. Refer to product label for details and precautions.

Methyl bromide is a pressurized liquid and becomes a gas when released. Since methyl bromide is highly volatile, the treated area must be covered with plastic and seal all edges with soil *before* treatment. Remove the plastic tarp 24 hours *after* fumigation. Cultivate the treated area to a depth of 2 inches (*no deeper*) to accelerate the aeration of the soil. Do not plant until 7 to 10 days after the tarp has been removed. If the soil is cold and wet you will have to wait longer. This product is *very toxic* and should be used only by professional applicators. Refer to product label for details and precautions. Methyl bromide will not be available after 2001.

Your County Cooperative Extension Agent is a good source of advice concerning which technique would be best for you. If you have never fumigated soil before, have an experienced pesticide applicator help the first time you fumigate. Fumigants are highly toxic chemicals that must be handled properly to be both safe and effective.

After fumigating the site, avoid reintroduction of weeds. Clean equipment such as tillers or tractors before using them in the area. Do not add top soil (unless it too has been fumigated). Use only "clean" composts. Control creeping perennial weeds in the surrounding beds and turf.

Mulch

An essential part of a weed management program is use of an organic or inorganic mulch. A 3- to 4-inch mulch will suppress weed seed germination and growth, and will provide adequate control of most annual weeds. Mulches control weeds by depriving them of light. Organic mulches e.g., pine needles, pine bark, hardwood bark, leaf mold (old leaves), etc. or inorganic mulches e.g., gravel, stones, etc., may be used. Organic mulches must be periodically replenished to maintain the 2- to 4-inch depth for suppression of weed seed germination. When mulches are too fine, too thick, or begin to decompose, they stay wet between rains, allowing weeds to germinate and grow

directly in the mulch. Therefore, for weed control, a mulch which is coarse-textured with a low water-holding capacity is preferred. In addition, escaped weeds in the bed and weeds in the surrounding areas should not be allowed to produce seeds which can be blown into the flower bed. Mulches are not effective in controlling perennial weeds such as quackgrass, bermudagrass, nutsedge, and mugwort. Mulches must allow free passage of water and air since both are essential for healthy, aesthetic plants. While black plastic will prevent weed seed germination, it also prohibits free passage of water and air and should not be used.

Cultural Control

Weeds occupy open spaces. Designing the color bed to utilize all the bed space will increase competition and reduce the sunlight reaching the soil surface which will decrease the weed population. Proper soil conditioning and amendments, in concert with quality plant selection and maintenance will minimize seedling weed emergence later in the season.

Mechanical Control

In many situations, herbicides cannot be used or are not effective in controlling all the weeds. In these situations, cultivation and hand pulling are often the only available options. Either should be done on young weeds, before they compete with bedding plants and before they set seed. Cultivation works well on small annual weeds; perennials will often regrow from the roots even if the top is removed. Also, remember cultivation can stimulate successive flushes of germinating weeds by bringing new weed seeds near the soil surface. You will need to check for emerging weeds on a 2- to 3-week cycle if you are routinely cultivating.

Hand pulling is also an essential part of any weed management program. No weed management program will control all weeds. Weeds which escape the management program need to be removed before they produce seeds.

If preemergence herbicides have been applied and activated, they should be left undisturbed to be effective. Cultivation disrupts the herbicide barrier and lessens the effectiveness of the herbicide. Therefore, cultivation should be shallow and used sparingly if a preemergence herbicide has been applied.

Preemergence Herbicides

Preemergence herbicides are applied before weeds emerge and provide residual control of weed seedlings. As with any other tool, each herbicide has unique characteristics which should be considered when planning a weed management program. The following characteristics are important in utilizing preemergence herbicides:

- Rate of application
- Residual activity (Length of time the herbicide will provide effective weed control)
- Activation [For maximum effectiveness, each herbicide needs to be watered ($\frac{1}{2}$ inch irrigation or rain) into the soil surface within a specified number of days.]
- Mechanism of action (How the herbicide kills weeds.)
- Weed control spectrum (Which weeds the herbicide will and will not control.)
- Potential losses (leaching, volatility).

Refer to Table 2 for information on preemergent herbicides labeled for use in bedding plants.

Since preemergence herbicides will not control emerged weeds, they should be applied before weeds germinate or all existing weeds must be killed prior to herbicide application. With annual flower beds, preemergence herbicides should be applied after transplanting to weed-free soil and irrigated. Frequency of herbicide application will depend upon the herbicide's residual. Residual weed control will increase with increasing herbicide application rate; and decrease with increasing amounts of rainfall or irrigation, soil temperature, and organic matter. The proper herbicide for each situation will be dictated by the plant species located in the bed, weed species, and future use.

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Table 2. Preemergence Herbicides Registered for Use in Color Beds

Table Legend:

R = Registered for this species. Can be applied over the top. **I** = Registered, but research indicates that injury can occur. **R*** = Registered for some species; check label for details. **No Entry** indicates the herbicide is not labeled for use on that species.

Common Name	Genus	Betasan	Devrinol	Factor	Pendulum	Pennant	PrePair	Ronstar G	Surflan	Treflan/Preen	XL
Ageratum	<i>Ageratum</i>		R		R*	R				R	
Balsam	<i>Impatiens</i>					R				R	
Begonia, fibrous	<i>Begonia</i>				R						
Cabbage, ornamental	<i>Brassica</i>				R*			R*			
Cockscomb	<i>Celosia</i>				R*						
Coleus	<i>Coleus</i>										
Cosmos	<i>Cosmos</i>									R	
Dusty miller	<i>Senecio</i>				R*	R*				R	
Geranium	<i>Pelargonium</i>		R		R*	R	R*		R*		R*
Gerbera daisy	<i>Gerbera</i>										
Impatiens	<i>Impatiens</i>					I			R*	R	R*
Kale, ornamental	<i>Brassica</i>				R			R*			
Lantana	<i>Lantana</i>		R		R		R*	R*			
Marigold	<i>Tagetes</i>	R			R*	I			R	R	R
Moss-rose	<i>Portulaca</i>				R				R*	R	R
Nasturtium	<i>Nasturtium</i>									R	
Nicotiana	<i>Nicotiana</i>									R	
Pansy	<i>Viola</i>	R			R	R			R*		R*
Pepper, ornamental	<i>Capsicum</i>										
Periwinkle	<i>Catharanthus</i>	R			R*					R	
Petunia	<i>Petunia</i>		R		R	R			R	R	R
Salvia	<i>Salvia</i>				R				R	R	R
Snapdragon	<i>Antirrhinum</i>				R	R			R	R	R
Strawflower	<i>Helichrysum</i>										
Sunflower	<i>Helianthus</i>									R	
Sweet alyssum	<i>Lobularia</i>	R								R	
Sweet William	<i>Dianthus</i>				R	R			R	R	R
Verbena	<i>Verbena</i>				R*					R	
Zinnia	<i>Zinnia</i>	R	R			I			R	R	R

Updated May 1998. Human errors can occur and labels change. Check the herbicide label before use.

Postemergence Herbicide Characteristics

Postemergence herbicides are applied to weeds after they have emerged. Characteristics of postemergence herbicides that should be considered before selection and use are:

- Systemic versus contact
- Selective versus non-selective
- Timing

Postemergence herbicides can be classified as systemic or contact, and selective or non-selective. Systemic herbicides such as Roundup-Pro and Finale are absorbed and move through the plant. These are useful for controlling perennial weeds. For best control, the weeds must be actively growing so the herbicides can move throughout the plant. Contact herbicides such as Reward and Scythe kill only the portion of the plant that is actually contacted by the herbicide. Contact-type herbicides control small annual weeds but only burn-back perennial or large annual weeds. Thus, good spray coverage is important.

Selective herbicides only kill specific plants. The only selective herbicides recommended for use in bedding plants are the postemergence, grass control herbicides, Vantage, Fusilade II, Acclaim and Envoy. These herbicides only kill grasses while broadleaves are unharmed. Check the labels for each herbicide for labeled bedding plants, susceptible weeds and special precautions. For example: Envoy controls annual bluegrass, whereas the other products do not. Acclaim will control crabgrass and other annual grasses but will not control most perennial grasses. For perennial grass control Fusilade II, Vantage or Envoy are preferred. Generally, these herbicides may be applied directly over the top of bedding plants, but some injury may occur to certain species or cultivars. Table 3 lists herbicides labeled for commonly grown bedding plants, but always check the label for precautions. Additionally, careful attention to application uniformity and dose are needed because over-dosing plants (or too high a concentration of spray adjuvant) can result in damage to bedding plants.

Non-selective postemergence herbicides such as Roundup-Pro, Finale, Reward and Scythe have the potential to kill or injure any plant that it contacts. However, they may be used as spot sprays avoiding contact with desirable vegetation. If tall weeds emerge in beds, and hand weeding is not feasible, it is also possible to wipe them with Roundup-Pro (about a 33% solution). Of course care must be taken to avoid Roundup-Pro contact with the bedding plants.

Following these 7 rules will help ensure that you get maximum effectiveness from postemergence herbicides.

1. Apply the correct dose
2. Multiple applications are may be required to control perennial weeds
3. Use the type and amount of surfactant specified on the label, if needed
4. Apply when air temperature and humidity are favorable
5. Treat weed at proper growth stage
6. Avoid mowing 3 or 4 days before and after herbicide application
7. Allow plenty of drying time (check the label for specified times)

It is important to develop a weed management strategy that encompasses all 12 months of the year and utilizes all available options. These include preventative measures such as organic and inorganic mulches, preemergence herbicides, and sanitary practices that prevent weed seeds and vegetative parts from spreading. Weed management in color beds can be accomplished with mulch, preemergence herbicides and/or hand weeding, if perennial weeds are controlled before planting.

NOTE: Always use pesticides according to directions on the label. Use of trade names does not imply endorsement by the N.C. Cooperative Extension Service or the N.C. Agricultural Research Service of the products named nor criticism of similar products not mentioned.

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Table 3. Postemergence herbicides registered for use on bedding plants.

Table Legend:

OT = Registered for over-the-top application. D = Registered for directed application only. I = Registered, but research indicates injury. P = Label *prohibits* use on this species. O*, D* = Registered for some species. Check the label.

Common Name	Genus	Acclaim Extra	Envoy	Fusilade II*	Vantage
Ageratum	<i>Ageratum</i>		OT	OT	
Balsam	<i>Impatiens</i>		OT		OT
Begonia, fibrous	<i>Begonia</i>	OT		O*,D*	O*
Cabbage, ornamental	<i>Brassica</i>				
Carnation	<i>Dianthus</i>			O*	
Cockscomb	<i>Celosia</i>				O*
Coleus	<i>Coleus</i>	OT	OT	O*	O*
Cosmos	<i>Cosmos</i>	OT			
Dusty miller	<i>Senecio</i>				O*
Fountain grass, red	<i>Pennisetum</i>			O*	OT
Geranium	<i>Pelargonium</i>	OT	O*	O*	O*
Gerbera daisy	<i>Gerbera</i>				O*
Impatiens	<i>Impatiens</i>				OT
Kale, ornamental	<i>Brassica</i>				
Lantana	<i>Lantana</i>		OT	O*,D*	O*
Lobelia	<i>Lobelia</i>	OT			O*
Marigold	<i>Tagetes</i>		OT	OT	OT
Morningglory	<i>Ipomoea</i>			O*	
Moss-rose	<i>Portulaca</i>		OT	O*	O*
Nasturtium	<i>Nasturtium</i>				
Nicotiana	<i>Nicotiana</i>		O*		OT
Pansy	<i>Viola</i>		OT		O*
Pepper, ornamental	<i>Capsicum</i>				OT
Periwinkle	<i>Catharanthus</i>		OT		O*
Petunia	<i>Petunia</i>	OT	OT	OT	OT
Salvia	<i>Salvia</i>	P	OT	O*	
Snapdragon	<i>Antirrhinum</i>	OT	OT	OT	OT
Strawflower	<i>Helichrysum</i>				
Sunflower	<i>Helianthus</i>				
Sweet William	<i>Dianthus</i>	OT	OT	OT	OT
Verbena	<i>Verbena</i>		O*		OT
Zinnia	<i>Zinnia</i>	OT	O*	OT	O*

Updated May 1998. Human errors can occur and labels change. Check the herbicide label before use.

Suggested References (Weed Identification Guides)

<p>Identifying Seedling and Mature Weeds (AG-208) Publications Office Box 7603 North Carolina State University Raleigh, NC 27695-7603 \$7.00</p>	<p>Weeds of the Northeast Cornell University Press P. O. Box 6525 Ithaca, NY 14851-6525 607-277-2211 \$29.95 plus \$3.50 shipping</p>
<p>Turfgrass Pest Management Manual North Carolina State University Department of Crop Science Box 7620 Raleigh, NC 27695-7620 \$5.00 (Check payable to Crop Science Extension)</p>	<p>Weeds of Southern Turfgrass Publication Distributions Center IFAS Building 664 P. O. Box 110011 University of Florida Gainesville, Florida 32611 (904-392-1764) \$8.00</p>
<p>Weeds of Arkansas (MP 169) University of Arkansas Cooperative Extension Service P.O. Box 391 Little Rock, Arkansas 72203 Attn: Cheryl Fraser (501-671-2038) \$5.00</p>	