



CHAPTER 6

Weed Management

General Information and Guidelines

The primary goal of weed management is to optimize yield by minimizing weed competition. Weeds reduce yields by competing with the crop for water, light, and nutrients. Weeds intercept crop protectant sprays, preventing penetration to crop foliage. Weeds may promote development of disease by maintaining high humidity in the crop canopy, and some species are alternate hosts for pathogens and insect pests. Timely cultivations, wise use of herbicides and mulches, and prevention (never letting weeds go to seed) are integral parts of a good weed management system.

Among the factors that can influence weed control are the species present, their stage of growth when controls are applied, crop competition, soil characteristics, and rainfall or irrigation. Understanding how each of these aspects may affect weed control will enable the grower to develop an effective weed-management program. In addition, the weed-management program must be thought of as a continuous management effort and not as a seasonal duty. Make it a practice to record any changes in predominant weed species and to modify the control program in response.

Often, repeated use of one successful control technique can lead to shifts in composition of the weed community. This happens when weeds that are not controlled by the technique in use (these species are referred to as *escapes*) become the most prevalent species in time. When weed shifts occur, or preferably before they become serious, change the control tactic to one that will control *escapes* (Table 6-1). Obviously, the ability to correctly identify weeds is essential to selection and proper use of controls. Images of many of the most common weed problems in berry crops are found on page 188.

Weed Identification and Scouting

Identifying weeds is essential so that the right control tactic can be used. Several excellent guides to weed identification are available. One we have found particularly useful is *Weeds of the Northeast*, published by Comstock Press. On-line weed identification guides can be found on most university Internet sites. Patches of perennial weeds must be located and identified so that rhizomes, stolons, and rootstocks can be destroyed by herbicide spraying and cultivation well in advance of planting. Problem annuals may also be identified during the pre-planting year, and controls, such as summer fallow, can be used to reduce weed seed in the soil before planting. Scout for weeds every year.

In the establishment year, scouting should begin in spring even before planting so that prevalent annual weeds can be identified and controls planned. After planting, and in fruiting years, scout for weeds whenever fields are scouted for insects and diseases or at least weekly during May to early July and again in late August to late October. Pay careful attention to problem weeds in the field at harvest time as many controls can be implemented during renovation. Scout renovated fields carefully in late summer and early fall when many winter annuals germinate. Scouts should watch for occurrence of new and invasive weeds and perennials such as quackgrass and Canada thistle at all scouting opportunities. Record the distribution of each species as:

- GENERAL = found throughout the field
- LOCAL = found in a small portion of the field
- SPOTTY = found in just a few places.

Also record the density of each species as either:

- 1 = Scattered, just a few weeds
- 2 = Slight, 1 weed per 6 feet of row
- 3 = Moderate, 1 weed per 3 feet of row
- Severe = More than 1 weed per 3 feet of row.



Table 6-1. Weed Susceptibility Table for Small Fruit Herbicides.

Weeds	Cul-ti-va-tion	Caso-ron	Kar-mex	Fusi-lade	Round-up	Dev-rinol	Soli-cam	Sur-flan	Gram-ox-one	Kerb	Poast	Prin-cep	Sin-bar
Broad-Leaved													
Bed-straw	G	G	P	P	--	--	--	F	P	P	P	--	
Bittercress	G	G	G	P	G	G	--	P	G	P	P	F	G
Buckwheat, wild	G	G	G	P	G	--	--	--	G	--	P	GG	--
Chickweed	G	G	G	P	G	G	G	G	G	G	P	GG	--
Clovers	F	--	P	P	P	--	--	P	P	P	P	P	--
Corn Spurry	G	G	G	P	G	G	--	G	G	--	P	GG	--
Dandelion, common	F	G	P	P	G	G*	G*	P	P	P	PG*	F	--
Dandelion, False	P	G	P	P	G	P	G*	P	P	P	P	G*	P
Field Bindweed	P	F-	P	P	P	F	P	--	P	P	P	P	P
Field Horsetail	P	G	P	P	P	P	P	P	P	P	P	P	P
Field Violet/Pansy	G	-	-	P	G	P	-	-	G	-	P	F	F
Filaree, redstem	G	G	F	P	G	G	G	P	F	P	P	PG	--
Geranium	G	G	G	P	G	G	--	--	G	P	P	--	--
Groundsel, common	G	G	F	P	G	G	F	P	G	P	P	F	F
Henbit	G	G	G	P	G	P	G	F	G	F	P	G	F
Knotweed	F	G	F	P	G	F	G	G	P	F	P	GG	--
Ladysthumb	G	G	G	P	G	G	G	G	F	F	P	F	G
Lambsquarter	G	G	G	P	G	G	G	G	F	F	P	F	G
Mustard, wild	G	G	G	P	G	G	G	G	G	F	P	GG	--
Nightshade, black	G	G	G	P	G	P	G	P	G	F	P	GG	--
Pigweed, redroot	G	G	G	P	G	G	F	G	G	P	P	F	F
Pineappleweed	G	--	G	P	G	G	G	PG*	P	P	--	G	--
Plantain	G	G	P	P	G	--	P	G	P	P	G	G	--
Prickly lettuce	G	--	G	P	G	G	--	P	G	P	P	GG	--
Purslane	G	G	G	P	G	G	F	G	G	F	P	G	G
Shepherd's Purse	G	--	P	G	G	F	P	G	P	P	F	G	--
Sowthistle, annual	G	--	F	P	G	G	F	P	G	P	P	F	G
Tansy Ragwort	F	G	P	P	G	P	--	P	G*	P	P	--	P
Thistle, bull	G	G	P	G	--	--	F*	P	P	PG*	F	--	--
Thistle, Canada	P	G	P	P	G	P	--	P	P	P	P	--	P
Grasses													
Barnyardgrass	G	G	G	G	G	F	G	G	G	P	G	F	F
Bluegrass, annual	G	G	G	P	G	G	G	G	G	G	P	GG	--
Crabgrass	G	G	F	G	G	G	G	G	G	F			G*
Foxtail	G	G	G	G	G	G	G	G	G	F	G		G*
Johnsongrass	G*	-		F	G	G*			G*		G		G*
Quackgrass	P	G	P	F	G	P	P	P	F	G	P	P	F
Ryegrass, annual	G	--	G	F	GG*	G	G	G	G	G*	G	--	--

G = Good (85%-100%), F = Fair (70%-84%), P = Poor (0%-69%), -- = Response not known, * = Seedling stage only.



Pay special attention to low spots, wet areas, and field margins where new weed problems develop first. Many species will fall into the GENERAL category and will be the primary targets of the weed-control program.

LOCAL distribution may indicate that the species has been recently introduced to the field, and eradication by preventing seed production may be possible.

SPOTTY distribution of common weeds, such as lambsquarters, may indicate that herbicide resistant bio-types have developed, in which case herbicides with alternate modes of action should be adopted.

Take samples of weeds that cannot be identified in the field. Small weeds (less than 1-inch high) can usually be dug up with a small amount of soil attached to, and protecting, the roots. Samples should be placed in an inflated zip-lock bag and placed in a cooler for later identification. In some instances it may be necessary to plant unknown seedlings in the greenhouse and allow them to size up before identification can be made.

Action thresholds for weeds have not been established for berry crops. Berry crops do not compete well with most weeds, and maintenance of nearly weed-free conditions is important for optimum production. Therefore, it is best to prevent weed seed production within the berry field, thereby reducing future weed problems.

Combining cultivation, hand weeding, and herbicide use is essential to maintain good weed control. Cultivation, hoeing, and hand weeding are most effective when weeds are small (less than 1/2 inch in height). Herbicides should be selected and applied at the appropriate timing to control the most dominant species (see Table 6-2).

But, remember that species occurring in small numbers that are not controlled may quickly become the dominant species! Therefore, carefully remove weeds that tolerate herbicides before they go to seed, thereby, preventing buildup of resistant species.

Cultural Controls

Cultural controls are those good agricultural practices that minimize the growth of weeds, while optimizing crop growth. Many decisions

and practices influence the effectiveness of cultural controls. These include:

- **Site selection** — Well-drained, coarse-textured soils, that are free of perennial weeds. Repeated tillage and cultivation one or two years before planting reduces perennial and annual weeds (see the section on *Controlling Weeds Before Planting* on page 178). If a field has been in sod or pasture for several years, cultivation reduces grubs that feed on strawberry roots which can reduce plant vigor and cause the loss of plants. After cultivation, plant a crop that does not increase verticillium wilt disease, nematodes, or insects (see *Preplant Cover Crops* beginning on page 184). For strawberries, consider a grain crop such as wheat, which can be used for straw mulch for winter protection and disease control in the berry crop.
- **Crop rotation** — The seeds of annual weeds in the soil (the weed seed bank) can be reduced by planting a series of annual crops prior to planting berries. Field or sweet corn is an excellent rotational crop because cultivation and chemical weed control can reduce weeds. With sweet corn, the crop is harvested by early August, making the field available for winter cover crops or additional chemical weed control, cultivation, or fumigation in the fall before spring planting. Successive grain crops or rotating from legumes to grain and to strawberries are rotations that have been used successfully.
Be sure to use herbicides in the preceding crop that will not leave a high residual in the soil when berry crops are planted six to 12 months later. Inserting a period of summer fallow the year before planting berries can be very effective in reducing the number of annual weed seeds in the soil. Summer fallow consists of tillage and cultivation to prepare a good seed bed for germination of weed seed followed by harrowing or light disking whenever a flush of weeds occurs. To be effective, harrow when weed seedlings are in the cotyledon stage. Non-crop land can be mowed several times during the year to prevent annual weeds.
- **Soil fertility and water use** — Provide the optimum fertilization for the berry crop, based upon testing the soil before planting. Consider trickle irrigation that will place irrigation water



Table 6-2. Small Fruit Herbicides.			
Common Name (Trade Name)	Formulations	For Use On	Comments
PREEMERGENCE GRASSES			
Dacthal (DCPA)	W-75	Strawberries	Good on annual grasses, chickweed, and lambsquarter. Poor on perennial grasses and broadleaves.
Casoron, Norosac (Dichlobenil)	4 G	Blueberries Brambles	Good on annual and perennial grasses.
Devrinol (Napropamide)	50 DF	Blueberries Brambles Strawberries Grapes	Good on annual grasses, chickweed, knotweed, thistle, and sorrel. Requires water or cultivation to activate. May inhibit rooting of strawberry daughter plants.
Surflan (Oryzalin)	4 AS	Blueberries Brambles Grapes	Good on annual grasses, lambsquarters, pigweed, and purslane.
Sinbar (Terbacil)	80 WP	Blueberries Brambles Strawberries	Good on annual grasses and broadleaves such as chickweed, crabgrass, foxtail, henbit, mustards, nightshade, ragweed, prickly lettuce and smartweed. Partial control of quackgrass, nutsedge, and sorrel. DO NOT MIX OR USE IN CLOSE SEQUENCE WITH GRASS HERBICIDES SUCH AS FUSILADE, POAST, OR SELECT. SEVERE CROP INJURY MAY RESULT.
Solicam (Norflurazon)	80 DF	Blueberries Brambles Grapes	Good on annual grasses and broadleaves. Will suppress nutsedge and perennial grasses.
Kerb (Pronamide)	50 WP	Blueberries Grapes	Good on annual grasses and some broadleaves.
PREEMERGENCE BROADLEAFS			
Casoron, Norosac (Dichlobenil)	4 G	Blueberries Brambles Grapes	Good on annual and perennial grasses.
Princep, Caliper 90 (Simazine)	WP90 DF 4 L	Blueberries Brambles Grapes	Fair control on grasses but good control of broadleaves.
Sinbar (Terbacil)	80 WP	Blueberries Brambles Strawberries	Good on annual grasses and broadleaves such as chickweed, crabgrass, foxtail, henbit, mustards, nightshade, ragweed, prickly lettuce, and smartweed. Partial control of quackgrass, nutsedge, and sorrel. DO NOT MIX WITH GRASS HERBICIDES SUCH AS FUSILADE, POAST, OR SELECT. SEVERE CROP INJURY MAY RESULT.
Karmex (Diuron)	80 WP 80 DF	Blueberries Brambles Grapes	Good on annual grasses and broadleaves. Good on lambsquarter, mustard, nightshade, pigweed, and purslane.



Table 6-2 (Continued). Small Fruit Herbicides.			
Common Name (Trade Name)	Formulations	For Use On	Comments
POSTEMERGENCE GRASSES			
Fusilade DX (Fluazifop)	2 E	Blueberries Brambles Grapes Strawberries	Good systemic/selective grass herbicide and poor on broadleaves. Labeled only for non-bearing crops. Do not apply one year before harvest. Must be used with non-ionic surfactant or crop oil concentrate. DO NOT MIX WITH SINBAR, KARMEX, OR PRINCEP.
Poast (Sethoxydim)	1.5 EC	Blueberries Brambles Grapes	Action similar to Fusilade. Do not tank mix with 2,4-D. Preharvest interval varies on each crop. Must be used with crop oil concentrate. DO NOT MIX WITH SINBAR, KARMEX, OR PRINCEP.
Select (Clethodim)	2 EC	Strawberries	Action similar to Poast and Fusilade but generally more effective. Controls annual/perennial bluegrass and is also very effective on quackgrass. Must be used with crop oil concentrate. DO NOT MIX WITH SINBAR, KARMEX, OR PRINCEP.
Gramoxone Extra (Paraquat)	2.5 E	Blueberries Brambles Grapes Strawberries	Good on annual weeds but poor on perennials. Directed spray only kills vegetation.
Roundup (Glyphosate)	Various	Blueberries Brambles Grapes Strawberries	Good on perennial grasses and broadleaves. Directed spray only, or wiper only. Contact with foliage or green bark of crop plants may result in severe injury or death. For wick or wiper applications, mix 1 gallon of Roundup in 4 gallons of water to prepare a 20% solution.
POSTEMERGENCE BROADLEAFS			
Formula 40 (2,4-D amine)	4 E	Strawberries	Excellent control of morning glory, cocklebur, lambsquarter, pigweed, ragweed, smartweed. Good control on dandelion. Poor on grasses. Used at renovation. Allow 5 days before mowing.
Gramoxone Extra (Paraquat)	2.5 E	Blueberries Brambles Grapes Strawberries	Good on annual weeds but poor on perennials. Directed spray only kills vegetation.



and nutrients in the zone of crop roots while minimizing availability to weeds growing between the rows.

- **Cultivar selection** — Only plant adapted, vigorous transplants that will compete with weeds. Consider that some crop cultivars vary in sensitivity to certain herbicides.
- **Planting density** — Dense plantings compete best with weeds.
- **Mulches** — Black or opaque plastic can be used to prevent weed growth for one or more years. Straw and various other mulches can prevent or reduce weed growth, depending on the amount used.
- **Sanitation and prevention** — The old adage that says *One year's seeding, seven year's weeding* should be heeded by every berry grower. Preventing new weeds from invading the farm and minimizing or eliminating seed production in the field will prevent future weed problems. Prevention of weeds is best practiced by careful attention to cultural practices, such as cleaning equipment before moving it into the field, using clean straw mulch, and preventing annual weeds from producing seeds. Pay careful attention to any weed that is new on the farm; it may soon be your worst weed problem if it goes to seed. Ensure that straw used to mulch strawberries is weed free; for instance, grow your own straw and practice excellent weed control throughout its production.

Mechanical Controls and Hand Weeding

Hand hoeing and mechanical cultivation are important components of weed management in berry crops, particularly during the establishment year. Cultivate and hoe carefully to prevent damage to the root systems and above-ground portions of the berry plants. Blueberries in particular have shallow root systems that are easily damaged during cultivation. Remove all established weeds between the rows and within rows during establishment in order to obtain maximum sunlight for growth. Maintaining full sunlight throughout the establishment year is essential to obtain maximum flower bud formation in berry crops. In strawberries, mechanical cultivation between rows is necessary to train runners during the establishment year and to maintain a row width of

12 to 18 inches at renovation, with no more than 20 to 24 inches in early September. Cultivation is also important to incorporate fertilizer and herbicides.

Chemical Controls

Herbicides can be used to control weeds in most berry crops. Because they are selective, there will always be some *escapes*, and these, if not controlled, will in time become the dominant weeds in the field. To prevent this, do not depend exclusively on herbicides. Cultivate, hoe, and pull *escapes*. Rotate crops and be sure to use herbicides with differing modes of action in rotational crops.

Herbicides recommended in this guide are referred to by their brand name, and application rates are provided in the actual amount of product per acre. The guide provides enough information to assist you in selecting a herbicide for a particular crop and weed situation. For complete information, it will be necessary to consult the label. Too often growers neglect the label until something goes wrong. Wouldn't it be better to spend 20 minutes reading the label in advance and thereby preventing problems from ever developing? Labels contain explicit directions on using herbicides correctly and indicate all weeds that are controlled. Full text labels and Material Safety Data Sheets (MSDS) should be provided by your dealer. They can also be obtained for most herbicides over the Internet from company web sites or from compilers such as C & P Press, Inc., *GREENBOOK* at <http://www.greenbook.net> or from CDMS, Inc., at <http://www.cdms.net/manuf/manuf.asp>.

Herbicides used to control weeds in berry crop plantings are applied:

- **PREPLANT** — Preplant treatments applied before the crop is planted.
- **PRE** — Preemergence treatments, applied at the time of planting or some time before weed seedlings emerge.
- **POST** — Postemergence treatments, applied after planting and after weed seedlings have emerged.

Mixing two or more herbicides may improve control and the spectrum of weeds controlled, while minimizing required rates. However, do not mix herbicides unless the mixture is approved on at least one label of the products intended for use.



Berry crops can be injured by residues of herbicides used in preceding rotational crops, residues that still remain in the soil. Herbicides used to control weeds in corn and soybeans are most likely to carry-over and damage berry crops. A few herbicides will damage berry crops two or more years after they were last used. If you purchase or rent new land, be sure to ask the owner or manager about herbicides used in previous years — the farther back, the better! Labels contain information on permissible rotational crops and the required time interval between use and rotational crops.

A bioassay is the simplest and most cost-effective method to check for herbicide carry-over. To do this, collect, at random, soil from all areas of the field in question. Sample the root zone, typically 6 inches deep. Each test requires about 1 gallon of soil. Ends of fields, knolls, and low areas often have higher residues and may need to be tested separately. Collect a second sample from a nearby area of the same soil that was not treated with herbicide and use this for a control (for comparison) soil. If untreated soil is not available, add 1 teaspoon of activated charcoal per quart of dry soil and mix thoroughly. Activated charcoal can be purchased at most drug stores. Three or four pots of the test and control soils should be made and seeded out to oats, radish, and lentils. Place the pots in a warm, sunny location and monitor seedling growth for the symptoms described in the table. If any injury is noted, then contact your pesticide dealer or local Extension specialist for advice on the probable sensitivity of berry crops.

Herbicide Application

Berry crops can be easily injured if too much herbicide is applied. To prevent this, calibrate the sprayer frequently and adjust nozzle tips to the proper height above soil level. Herbicides should be applied with a boom sprayer. Backpack and airblast sprayers should not be used because they will not give uniform application. Calibration of boom sprayers and mixing of pesticides are described in Chapter 8 of this publication. An excellent fact sheet from Ohio State University Extension that provides detailed information on this subject is *AEX-520, Boom Sprayer Calibration*. This fact sheet can be downloaded from the Internet at <http://www.ohioline.osu.edu/aex-fact/0520.html> and Ohio residents can also obtain it from most county offices of OSU Extension.

Controlling Weeds Before Planting

Many of the worst weeds found in berry crops are perennials such as quackgrass, johnsongrass, yellow nutsedge, Canada thistle, and field bindweed. Perennials spread and reproduce mainly by underground root stocks or rhizomes and are very difficult to control once berry crops are planted. Therefore, eliminate all perennial weeds before establishing a new planting by using a planned program of tillage, rotational crops, and herbicides. Time and money spent before planting will eliminate the need for more costly and on-going weed control methods during the establishment and production years. In addition, without the presence of competing perennial weeds, there will be a greater potential for vigorous, healthy establishment of the small fruit crop.

Glyphosate, hereafter referred to as Roundup or Touchdown (many formulations and brands are available though most simply refer to this herbicide as Roundup), applied directly to the foliage of perennial weeds before plowing is the most effective means of control. Roundup application must be timed correctly and the right rate used for the perennial weeds you are trying to control. Most perennials are best controlled with fall-applied Roundup. Grasses should be at least 8 inches tall when treated. An extended period of drought just before spraying may adversely affect control. Spring applications are effective on grasses but do not provide as good control of broadleaf perennials as fall applications.

Descriptions of the perennial weeds presented here were extracted from the *Ohio Perennial and Biennial Weed Guide*, which is available on the Internet at www.oardc.ohio-state.edu/weedguide/. In the recommendations for controlling these weeds, application rates are provided for two of the most common formulations of glyphosate. The use of these brand names does not imply an endorsement of these over other glyphosate products, nor a criticism of those products that are not named.

Canada Thistle

Canada thistle can be treated in the flower bud to flowering stage in early summer or in late summer and fall during the rosette to flower bud stage. In fallow fields, stop tillage in late July and allow thistles

