

LD  
5655  
A761  
P4  
no.13  
1981  
c.2

REVISED JANUARY 1981

PEST MANAGEMENT GUIDE 13

V.P.I. & S.U. LIBRARY

MAR 12 1981

BLACKSBURG, VIRGINIA

# **Chemical Control of Diseases, Insects, and Weeds of Turfgrass**

VIRGINIA COOPERATIVE EXTENSION SERVICE

EXTENSION DIVISION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Trade and brand names are used only for the purpose of information and the Virginia Cooperative Extension Service does not guarantee nor warrant the standard of the product, nor does it imply approval of the product to the exclusion of others which may also be suitable.

#### KEYS TO PROPER USE OF PESTICIDES

1. Read the label on each pesticide container before each use. Follow instructions to the letter; heed all cautions and warnings, and note precautions about residues.
2. Keep pesticides in the containers in which you bought them. Put them where children or animals cannot get to them, preferably under lock and away from food, feed, seed, or other material that may become harmful if contaminated.
3. Dispose of empty containers in the manner specified on the label.

SEE YOUR DOCTOR IF SYMPTOMS OF ILLNESS OCCUR DURING OR AFTER USE OF PESTICIDES.

Virginia Cooperative Extension Service programs, activities, and employment opportunities are available to all people regardless of race, color, religion, sex, age, national origin, handicap, or political affiliation. An equal opportunity/affirmative action employer.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and September 30, 1977, in cooperation with the U.S. Department of Agriculture. W. R. Van Dresser, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; M. C. Harding, Sr., Administrator, 1890 Extension Program, Virginia State College, Petersburg, Virginia 23803.

# INSECTS - COMMERCIAL TURFGRASS

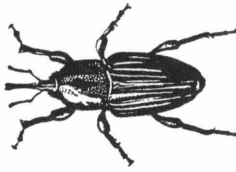
William H Robinson  
Extension Specialist, Entomology

Control of insects and mite pests of turfgrass is best achieved by considering the pests in above-ground and below-ground categories. For the latter, it is essential to get chemicals into the soil; for the former, the grass blades and ground surface should be treated so as to get a minimum of washoff and soil penetration by rain or watering. In general, emulsifiable concentrates provide the greatest residual on grass blades and the least immediate penetration into the soil. Wettable powders provide good residual, but dust and granular formulations move down into the thatch and soil. White grubs (masked chafer, May beetle, Japanese beetle, digger wasps, etc.) digger wasps, and ants are below-ground pests. Sod webworms, armyworms, and chinch bugs inhabit the thatch near the soil surface, but feed on grass blades. Leafhoppers, fruit flies, billbugs, and mites move and feed on grass blades.

**CAUTION:** Be sure to consider drainage, slope, type of soil, and general area use to avoid contamination of water sources. Avoid using treated areas immediately after applications.

**NOTE:** The following recommendations for dosage are given for 1,000 sq. ft. of area.

Insect Pests	Insecticide	Formulation	Amount to Use Per 1,000 sq. ft.	Remarks
ANTS	carbaryl* (Sevin)	50% WP	6.4 oz.	Use as localized treatments on ant mounds and nest areas. A general area application may be necessary for ants. Water-in immediately after application.
	dursban **	22% EC 45% EC	1 1/2 fl. oz. 3/4 fl. oz.	
	diazinon	(4E) 47.5% EC (50W) 50% WP (AG500) 48% EC	4 oz. 4 oz. 4 oz.	
CHINCH BUG	carbaryl* (Sevin)	50% WP 80% S	6 oz. 4 oz.	Water prior to treatment. Mix the suggested amount of insecticide formulation with 25-30 gal. of water for treating each 1,000 sq. ft. If granular formulations are used, water-in following application. Apply first treatment in late May to early June, repeat 2-3 weeks later. Only one application of aspon is necessary. Where infestations are discovered later in the season, treatments may be applied when insects are found. Grub-proofing treatments will not control chinch bugs. Keep children and animals off treated areas until product has been watered-in and area is dry. Do not water for at least two days after application.
	diazinon	(50W) 50% WP (AG500) 48% EC 14 G	2-3 oz. 3-6 oz. 1/2-1 lb.	
	dursban**	22% EC 4 M	1 1/2 oz. 3/4 oz.	
	aspon	13% EC 3.2% G	10 2/3 oz. in 15 gal. water	
	ethion	81% EC 5% G	4 oz. 5 lb.	
	trithion	79% EC	2.6 oz.	
CUTWORMS	carbaryl* (Sevin)	50% WP 80% S	6 oz. 4 oz.	Applications in the evening are preferred and should not be watered-in following treatment. Sprays are preferred; apply by mixing with 20-40 gal. of water. Do not cut grass for 1-3 days after application.
	dursban**	22% EC 41% EC	1 1/2 oz. 3/4 oz.	
	trichlorfon (Proxol)	80 SP	2 1/2-3 3/4oz.	
FRIT FLY	diazinon	(4E) 47.5% EC (50W) 50% WP (AG500) 48% EC	4 oz. 4 oz. 4 oz.	Mix the amounts in 3 gal. of water to treat 1,000 sq. ft. NOTE: Mow grass; water it thoroughly before treatment. Do not spray until grass dries. Do not water again until necessary.
LEAFHOPPERS	diazinon	(AG500) 48% EC (50W) 50% WP	1 1/4 oz. 1 1/4 oz.	Use spray formulations only, mixing the amounts in 10-15 gal. of water.
MITES (Clover)	dicofoi (Kelthane)	18.5% EC 35% WP	2 tsp. 3 3/4 tbsp.	Mix the amounts in 3 gal. of water to treat 1,000 sq. ft. A second application may be necessary 10-14 days later. Apply in spring and/or fall when mites appear.
	diazinon	(AG500) 48% EC (50W) 50% WP	4 oz. 4 oz.	
	dursban	41% EC	3/4 oz.	
SOD WEBWORMS	diazinon	(AG500) 48% EC (50W) 50% WP (4E) 47.5% EC	4 oz. 4 oz. 4 oz.	Applications in the evening are preferred and should not be watered-in following treatment. Sprays are preferred; apply by mixing with 10-20 gal. of water. Do not cut grass for 1-3 days after application. Trichlorfon: Mow lawn and rake dead grass from damaged areas; water lawn and allow grass to dry before spraying. Do not water again for least 3 days. Repeat as needed, but not more frequently than 3 to 4-week intervals. Up to 3 applications may be required for maximum control. First application should be made in May or June.
	carbaryl** (Sevin)	50% WP 80% S	6 oz. 4 oz.	
	dursban**	22% EC 41% EC	1 1/2 oz. 3/4 oz.	
	trichlorfon (Proxol)	80 SP	2 1/2-3 3/4 oz.	
	aspon (Sod webworm Control)	13% EC	10 2/3 oz. in 15 gal. water	

Insect Pests	Insecticide	Formulation	Amount to Use Per 1,000 sq. ft.	Remarks
WHITE GRUBS (European Chafar and Japanese Beetle)	diazinon	14 G (AG500) 48% EC	1 lb. 4 oz.	Chemicals penetrate slowly into the root zone area of the soil. Generally, the chemicals are slow acting against mature grubs, requiring At least 3 weeks or more to give effective kill. Applications are made to protect against reinfestation primarily or against young grubs in the fall.
	dursban	4 M	1 1/2-3 oz.	
	trichlorfon (Proxol)	80 SP	3 3/4 oz.	
BILLBUGS 	diazinon	14 G (4E) 47% EC (50W) 50% WP (AG500) 48% EC	1 lb. 4 oz. 4 oz.	For the wettable power and emulsifiable concentrate, mix the amount in 3 gal. of water and apply as a full-coverage spray per 1,000 sq. ft. For all treatments, water the grass thoroughly immediately after treatment. Adults emerge in May and a generation last 4-6 weeks. Treat in May and repeat at about 6-week intervals.
	DIGGER WASPS	diazinon	(AG500) 48% EC (50W) 50% WP (4E) 47.5% EC	
*outdoor use only				
BLACK ATAENIUS BEETLE	trichlorfon (Proxol)	80 SP	3 3/4 oz.	Apply either early in the morning or in the late afternoon, followed by thorough irrigation of the turf.

\* carbaryl (SP) - For best results, mow lawn, remove clippings and apply immediately after rain or watering. Apply full volume (40 gallons) to insure good penetration. Do not water for at least 2 days after application. Repeat in 2 or 3 weeks if needed.

carbaryl (G) - For best results, mow lawn remove clippings and apply immediately after rain or watering. Water following treatment. Keep children and pets off lawn until material is watered-in or grass is dry.

\*\* dursban - This product is highly toxic to bees exposed to direct treatment or residue on crops. Keep out of fishpools and other bodies of water. Do not apply where runoff is likely to occur. Keep children and pets off treated area until spray is dry.

CHEMICAL CONTROL  
OF DISEASES OF TURFGRASS

H. B. Couch  
Professor, Plant Pathology

January 1981

Disease	Turfgrass	Chemical <sup>(1)</sup>	Rate/1000 sq ft <sup>(2)</sup>	Season & Interval of Application
COPPER SPOT ( <u>Gloeocercospora sorghi</u> )	Bentgrasses	Cleary 3336 WP 50%	2.0 oz	May-June 7-10 days, 4 applications only
		OR Daconil 2787 WP 75%	4.0-8.0 oz	7-10 days
		OR Daconil 500 FL	6.0-11.0 oz	7-10 days
		OR Dyrene WP 50%	4.0-8.0 oz	7-10 days
FAIRY RINGS	All turfgrasses	Methyl bromide fumigation OR Prolonged water soaking of soil		Consult Extension Agent, Agriculture, for procedures
USARIUM BLIGHT <sup>(3)</sup> ( <u>Fusarium roseum</u> )	Bentgrasses Bluegrasses esp. Merion Kentucky Fescues Ryegrasses	Fungo 50 WP 50%	4.0-8.0 oz	Bentgrasses & Fescues April-September, 1 application only Bluegrasses July-August, 1 application only 2 applications only 1 application only
		OR Tersan 1991 WP 50%	5.0-8.0 oz	
		OR Bayleton WP 25%	2.0 oz 4.0-8.0 oz	
GRAY LEAF SPOT ( <u>Piricularia crisea</u> )	St. Augustine-grass	Acti-dione--thiram	2.0-4.0 oz	April-June 3-10 days
		OR Daconil 500 FL	3.0-11.0 oz	April-June 7-10 days
		OR Daconil 2787 WP 75%	2.0-8.0 oz	April-June 7-10 days

(1) Denotes either chemical, coined name of the material, or representative trade name.  
 (2) Except where indicated, all materials should be applied in 4.0-5.0 gal water per 1000 sq ft. Lower rates are to be used in preventive programs; higher rates are to be used in corrective programs.  
 (3) Apply fungicides for Fusarium blight control in 10 gal of water per 1000 sq ft.

Disease	Turfgrass	Chemical(1)	Rate/1000 sq ft(2)	Season & Interval of Application
<b>HELMINTHOSPORIUM DISEASES</b>				
(H. <u>vagans</u> )	Kentucky Bluegrass Ryegrasses Tall Fescue			April-June 7-14 days
(b) Zonate Eyespot (H. <u>giganteum</u> )	Bentgrasses Bluegrasses Bermudagrass Fescues Ryegrasses			July-August 7-14 days
(c) Helminthosporium Leaf Spot (H. <u>sorokinianum</u> )	Bentgrasses Bluegrasses Fescues Ryegrasses			July-August 5-7 days
(d) Red Leaf Spot (H. <u>erythrospilum</u> )	Bentgrasses			April-August 5-7 days
(e) Helminthosporium Blight (H. <u>dictyoides</u> )	Fescues Ryegrasses			April-June 5-7 days
(f) Brown Blight (H. <u>siccans</u> )	Ryegrasses Fescues			April-June 5-7 days
(g) Leaf Blotch (H. <u>cy nodontis</u> )	Bermudagrass			April-June 7-14 days

(The following list of fungicides is cleared for the control of one or more Helminthosporium diseases. Select for the control of Helminthosporium incited leafspot diseases one of the products from the following list that is labeled for your particular problem.)

		Acti-dione-- thiram	2.0-4.0 oz	
		OR		
		Chipco 26019 WP 50%	2.0 oz	
		OR		
		Daconil 500 FL	3.0-11.0 oz	
		OR		
		Daconil 2787 WP 75%	2.0-8.0 oz	
		OR		
		Duosan WP	4.0-6.0 oz	
		OR		
		Dyrene WP 50%	4.0-8.0 oz	
		OR		
		Fore WP 80%	4.0 oz	
		OR		
		Tersan LSR WP 80%	3.0-8.0 oz	
<hr/>				
POWDERY MILDEW ( <u>Erysiphe graminis</u> )	Bermudagrass Bluegrass Fescues	Acti-dione-- thiram	2.0-4.0 oz	July-September 3-10 days
		OR		
		Acti-dione TGF	2.0 oz	July-September 5-10 days
<hr/>				
PYTHIUM BLIGHT(3) ( <u>P. aphanidermatum</u> and <u>P. ultimum</u> )	Bentgrasses Bluegrasses Ryegrasses Bermudagrass Fescues Zoysia	Koban WP 30%	4.0-8.0 oz	July-September 5-10 days
		OR		
		Terrazole WP 35%	4.0-8.0 oz	
		OR		
		Tersan SP WP 65%	4.0 oz	

(1) Denotes either chemical, coined name of the material, or representative trade name.

(2) Except where indicated, all materials should be applied in 4.0-5.0 gal water per 1000 sq feet. Lower rates are to be used in preventive programs; higher rates are to be used in corrective programs.

(3) Apply fungicides for control of Pythium blight in 10 gal of water per 1000 sq feet.

Disease	Turfgrass	Chemical	Rate/1000 sq ft	Season & Interval of Application
RHIZOCTONIA BROWN PATCH ( <u>Rhizoctonia solani</u> )	Bentgrasses	Acti-dione-- thiram	2.0-4.0 oz	July-August 3-7 days
	Bluegrasses	OR		
	Bermudagrass	OR		
	Fescues	Bayleton WP 25%	1.0-2.0 oz	July-August 7-10 days
	Ryegrasses	OR		
	St. Augustinegrass	Chipco 26019 WP	1.5-2.0 oz	July-August 5-10 days
	Zoysia	50%		
		OR		
		Daconil 500 FL	3.0-11.0 oz	
		OR		
	Daconil 2787 WP	2.0-8.0 oz		
	75%			
	OR			
	Dyrene WP 50%	4.0-8.0 oz		
	OR			
	Fore WP 80%	4.0 oz		
RUST ( <u>Puccinia graminis</u> f. sp. <u>agrostis</u> ) ( <u>Puccinia coronata</u> ) ( <u>Puccinia zoysae</u> )	Bluegrasses	Acti-dione-- thiram	2.0-4.0 oz	July-August 3-10 days
	esp. Merion	OR		
	Kentucky	Acti-dione TGF	2.0 oz	July-August 5-10 days
	Ryegrasses	OR		
	esp. Manhattan and Pennfine	Bayleton WP 25%	1.0-2.0 oz	July-August 7-10 days
Zoysia	OR			
	Zineb WP 75%	2.0 oz	July-August 5-10 days	
RED THRIFAD ( <u>Corticium fuciforme</u> )	Bentgrasses	Cleary 3336 WP	2.0 oz	May-June and August-September
	Bluegrasses	50%		7-10 days
	Fescues	OR		
	Ryegrasses	Bayleton WP 25%	1.0-2.0 oz	
		OR		
		Daconil 500 FL	3.0-11.0 oz	7-10 days
	OR			
	Daconil 2787 WP	2.0-8.0 oz	5-14 days	
	75%			
	OR			
	Fungo 50 WP 50%	2.0 oz	5-14 days	
STRIPE SMUT <sup>(3)</sup> ( <u>Ustilago striiformis</u> )	Bentgrasses	Bayleton WP 25%	1.0-2.0 oz	1 application in October or early spring before grass growth begins
	Bluegrasses	OR		
	esp. Merion	Cleary 3336 WP	4.0-8.0 oz	
	Kentucky	50%		
	Meadow Fescue	OR		
Red Top	Fungo 50 WP 50%	4.0-8.0 oz		
Ryegrass	OR			
	Tersan 1991 WP	6.0 oz		
	50%			
SCLEROTINIA DOLLAR SPOT ( <u>S. homoeocarpa</u> )	Bentgrasses	Acti-dione-- thiram	2.0-4.0 oz	Late June-October 3-10 days
	Bluegrasses	OR		
	Bermudagrass	OR		
	Ryegrasses	Bayleton WP 25%	1.0-2.0 oz	3 applications only 7-10 days
	Fescues	OR		
	Zoysia	OR		
		Bromosan WP	3.0 oz	3 applications only 7-10 days
		66.7%		
		OR		
		Cleary 3336 WP	2.0 oz	3 applications only 7-10 days
		50%		
		OR		
		Daconil 500 FL	3.0-11.0 oz	7-14 days
	OR			
	Daconil 2787 WP	2.0-8.0 oz	7-10 days	
	75%			
	OR			
	Duosan WP	3.0 oz	5-14 days	
	OR			
	Dyrene WP 50%	4.0-8.0 oz	5-10 days	
	OR			
	Fungo 50 WP 50%	1.0-2.0 oz	3 applications only 10-14 days	
	OR			
	Tersan 1991 WP	1.0 oz	3 applications only 10-14 days	
	50%			

(3) Apply fungicides for control of stripe smut in 10 gal of water per 1000 sq feet.

Disease	Turfgrass	Chemical	Rate/1000 sq ft	Season & Interval of Application
SNOW MOLDS				
(Snow Molds include Fusarium Patch ( <u>F. nivale</u> ) and Typhula Blight ( <u>T. itoana</u> ). Fusarium Patch is the more commonly observed one in Virginia.)				
	Bentgrasses Bluegrasses Bermudagrass Ryegrasses Fescues Zoysia			
(Select for the control of snow mold from the following list of fungicides one of the products that is labeled for the control of your particular problem).				
Typhula Blight		Bayleton WP 25%	2.0-4.0 oz	2 applications Fall to Spring
		OR	5.0-8.0 oz	1 application Fall to Spring
		Dyrene WP 50%	4.0-8.0 oz	Fall to Spring
		OR	3.0-4.0 oz	Fall to Spring
		Calo-cure	3.0 oz	Fall to Spring
		OR	Follow label directions for spreader setting	Fall to Spring
		Calo-clor	6.0-9.0 oz	Fall to Spring
		OR		
		Calo-gran		
		OR		
		Tersan SP WP 65%		

NEMATODES

Apply Mocap (5.0 lbs of 10% granule) or Nematicur (3.0 lbs of 15% granule) uniformly on established turfgrass--immediately apply 1/2 inch water to the turf. Do not use in newly seeded areas. For use only by professional turfmen--do not apply on home lawns. Do not apply more than twice per year. Birds and other wildlife may be killed in treated areas. Mocap - approved for use on Bermuda, Zoysia, St. Augustine, and Centipede grass. Nematicur - approved for use on Bermuda, Centipede, bluegrass and bentgrass. CAREFULLY FOLLOW MANUFACTURER'S INSTRUCTIONS.

VOLUME MEASURE CONVERSION TABLE FOR USE IN PREPARING SMALL QUANTITIES OF FUNGICIDE SPRAY(1)

Fungicide	Weight	Tablespoons	Or	Cups
Acti-dione TGF	1.0 oz	3		1/4
Acti-dione--thiram	4.0 oz	22		1-1/3
Benomyl WP 50%	2.0 oz	11		3/4
Tersan 1991 WP 50%	4.0 oz	22		1-1/3
Daconil 2787	2.0 oz	11		3/4
	4.0 oz	22		1-1/3
Dyrene WP 50%	4.0 oz	19		1-1/4
	6.0 oz	28		1-3/4
Fore WP 80%	4.0 oz	14		1
	6.0 oz	21		1-1/3
Koban	4.0 oz	17		1-1/8
Zineb	2.0 oz	9		1/2
(Dithane Z-78)	4.0 oz	18		1-1/8

(1) The bulk density of fungicidal formulations varies somewhat. Obviously, the type of diluent used, whether or not the package is fluffed-up or allowed to settle, will influence the weight per volume. For this reason, volume measurements are not as accurate as weight measurements. They should be used for preparing small quantities of fungicide spray--and then only if a scale is not available.

WEED CONTROL IN LAWN AND TURF

S. W. Bingham, W. E. Chappell, and N. K. Rogers\*

BLUEGRASS, KY 31 FESCUE, PERENNIAL RYEGRASS, AND BERMUDAGRASS

A. WEEDY GRASSES:

There are several preemergence crabgrass killers available which will do an excellent job of controlling crabgrass and other annual grasses. Goosegrass is more difficult to control than most of the other annual grasses. Higher rates are suggested for goosegrass control and repeating herbicide application in May or June for best results with certain compounds.

Preemergence crabgrass killers kill grass seedlings as they germinate. Thus, it is necessary that they be applied in advance of crabgrass germination. Crabgrass usually germinates around April 1 in the mountains and by March 1 in the Piedmont areas.

As a rule, the life of preemergence crabgrass killers in the soil is about 2-3 months. There should be no problem with fall seeding of grass in an area that was treated in the spring.

Postemergent control of annual grasses is considered to be less desirable than preemergent control. The postemergent treatments will usually result in brown, and later bare areas in a lawn. However, postemergent treatments will provide excellent crabgrass control and allow turfgrass to begin to cover during the Summer and Fall. Goosegrass is very difficult to control with postemergent treatments. It is possible to control crabgrass and allow a more difficult problem with goosegrass to develop without competition for the space left by the dying crabgrass.

There is no selective control for most perennial grasses, and, if control is desired, it must be by physical removal or by non-selective chemicals.

Application	Weed Problems	Chemical Rate/1000 sq ft	Remarks
PREEMERGENT (New Seeding)	Annual grasses: Barnyardgrass, crabgrass, foxtails	Siduron 4.5 lb of 2.34% gran OR 0.2 lb of 50% WP	Apply at time of seeding. Kills annual weedy grasses, but not bluegrass, KY 31 fescue or perennial ryegrass. Do not use on bermudagrass.
PREEMERGENT (Established Turf)	Annual grasses: Barnyardgrass, crabgrass, foxtails	Benfen 3.0 lb of 2.5% gran  Bensulide 5.6-9.4 oz (4.0 lb/gal) OR 4.8-8.0 lb of 3.6% gran OR 1.9-2.4 lb of 12.5% gran OR 2.4 lb of 7% gran	Apply uniformly in late winter or early spring before crabgrass emergence. May be reapplied after 4 months for continued crabgrass control. Reseeding should not be attempted for 6 weeks after application.  Same. Do not reseed within 4 months of application. If for some reason turfgrass must be reseeded, charcoal will inactivate this herbicide. The lower rate may be used where crabgrass only is a problem. Application may be repeated after 3 to 4 months for continued annual grass control.
		DCPA 1/3 lb of 75% WP OR 5.0 lb of 5% gran	Apply in the early spring before crabgrass emergence. Flowering of forsythia can be used as a guide for proper timing of application. A second application, at 1/2 rate, 8 weeks later will improve control of late germinating crabgrass and goosegrass.
		Oxadiazon 3.4 lbs of 2% gran	Apply in the early spring before crabgrass emergence. Label includes bluegrass, bermudagrass and perennial ryegrass.
		Siduron 0.4 lb of 50% WP OR 9.0 lb of 2.34% gran	Use 1/2 rate in conjunction with seeding bluegrass (a preemergence treatment for bluegrass). Common bermudagrass is injured but not sufficiently to control it in a bluegrass or fescue lawn.

\*Professor of Plant Physiology, Extension Specialist - Plant Physiology, and Extension Specialist - Weed Scientist, respectively.

WEEDY GRASSES (Cont'd)

Application	Weed Problem	Chemical Rate/1000 sq ft	Remarks
PREEMERGENT (Cont'd)	Goosegrass	Oxadiazon 3.4 lb of 2% gran OR DCPA 0.4 lb of 75% WP OR 6.0 lb of 5% gran OR Benefin 3.0 lb of 2.5% gran	Apply uniformly in early spring before goosegrass germination. Goosegrass is more difficult to control than crabgrass and most preemergence herbicides are seldom 100% effective. Oxadiazon provides a high level of goosegrass control from one early spring application. A second application of DCPA or benefin, at 1/2 rate, 8 weeks after the first application will improve goosegrass control.
(Established Turf) (Cont'd)	Annual bluegrass	Benefin 3.0 lb of 2.5% gran OR Bensulide 0.6 pt (4.0 lb/gal) OR 2.25 lb of 12-1/2 gran OR 7.8 lb of 3.6% gran OR 4.1 lb of 7% gran OR oxadiazon 3.4 lbs of 2% gran	Apply in late August before annual bluegrass germinates. Do not overseed or reseed for 4 or more months. Application of activated charcoal will inactivate bensulide and allow reseeding of desirable grass. Spring treatments for crabgrass control do not provide sufficient residual activity for any appreciable annual bluegrass control in the Fall.
EARLY POSTEMERGENCE (Newly seeded turf)	Broadleaf weed seedlings	Bromoxynil 3.2 fl oz of .5 lb/gal product OR .55 fl oz of 2 lb/gal product	Can be applied after grasses emerge but before broadleaf weeds are past the 3-leaf stage of growth as rosettes are greater than 1 inch in diameter. If the broadleaf weeds exceed the indicated critical stage of growth, consult the section on standard postemergence recommendations for broadleaf weed control.

WEEDY GRASSES (Cont'd)

Application	Weed Problem	Chemical Rate/1000 sq ft	Remarks
POSTEMERGENT CROPS  (Established Turf)	Annual grasses: crabgrass, foxtails, goosegrass	DSMA OR CMA OR MSMA	Various formulations are available. Start in June when annual grass is in the 1-3 leaf stage and less than 1 inch tall. At least 3 applications at 7-day intervals are necessary for goosegrass control. Timing of application is critical. Apply when soil moisture is adequate for rapid growth of crabgrass and turf. Some discoloration of turfgrass is to be expected. Follow label instructions for use of individual formulations. Use lower rate when mid-day temperatures are 80°F or higher.
	Dallisgrass	DSMA 3.0 oz (70% formulatio)	Apply June through September when mid-day temperatures do not exceed 85°F. Two or three applications at 10-14 day intervals will be required for control.
	Nutsedge, yellow	Bentazon 1.0 oz (4.0 lb/gal formulation)	Apply when actively growing. At least 2 applications at 10-14 day intervals will be required for control. A third application may be made if needed (no more than 3 per year). Does not appear effective for purple nutgrass.
Renovation of Established Turf	Kentucky 31 fescue, quackgrass, bermudagrass, orchardgrass, nimblewill	Glyphosate 2-1/2 oz (3.0 lb/gal formulation)	Allow 2-4 weeks without mowing before chemical treatment. See label for desirable plant size to treat. Allow 7 days before clipping the dead sod and vertical mowing to 1/4 inch deep into soil. Seed the desired turfgrass and irrigate as needed. Early Fall applications coincide with seeding dates but application can also be made at other times when undesirable grass is actively growing.

B. BROADLEAF WEEDS

The herbicide response table below rates the susceptibility of common lawn weeds to weed killers. Annual weeds live only one year and should be treated in the seedling stage. Winter annuals germinate in the fall and should be controlled at that time. Spring germinating annuals, likewise, need to be treated in the spring. Biennial plants live 2 years and perennials live for 3 years or more. In general, broadleaf weeds respond best to weed killers when they are most actively growing and in the seedling stage. This is usually in the spring or fall. When equally effective, we prefer the fall applications because of less likelihood of damage to ornamental and garden plants. Application of high rates of weed killer during hot dry conditions may brown desirable grasses.

Most lawns that need treatment contain a variety of weeds which can best be controlled by a combination of ingredients. Many formulations are sold that contain more than one ingredient. It is necessary that label directions on the container be followed to get the proper application rate. When combinations are used, the results are additive and the individual rates are reduced.

A combination of 2,4-D and dicamba (1.0 lb + 0.25 lb) or 2,4-D and mecoprop (1.0 lb + 1.0 lb) is very effective on a wide range of broadleaf weeds. We would consider this to be the best treatment for an average lawn with a variety of weeds. Knotweed, dock, and red sorrel are susceptible to dicamba. Dicamba is soil-mobile and should not be used in the root area of shallow-rooted trees or shrubs.

Combinations of 2,4-D + MCPP + dicamba are on the market and offer a similar spectrum of weed control as two way mixtures of these compounds. Follow label directions on the containers for proper application rates and directions. The low rate of dicamba in these three-way mixtures reduces the possibility of dicamba injury.

Newly seeded turf areas should not be treated with broadleaf weed killers until enough growth has occurred to allow two mowings.

The broadleaf weed killers recommended for lawns are not particularly toxic to humans, pets, birds or wildlife. They would create a problem only if ingested in large quantities. They are biodegraded by soil micro-organisms and their persistence in the soil would range from 2-4 weeks for 2,4-D, and possibly 6-12 months for dicamba.

The chemicals noted below can be used safely at recommended rates on bluegrass, fescue, or common bermudagrass. The bentgrasses are susceptible to injury from 2,4-D; however, there are formulations containing low rates of 2,4-D in combination with other materials that may be safely used. Avoid application on bentgrasses when temperature exceeds 85°F.

The availability of many formulations of the various broadleaf herbicides which vary in amount of active ingredient makes it difficult to establish a general rate to apply to 1000 sq ft or to add to 1 gal of water. Directions on the container label should be used as a guide to determine the proper amount of formulation to use. With a 4.0 lbs/gal formulation, 1.0 qt contains 1.0 lb of active ingredient and a rate given in lb/A is equal to qt/A. To convert to small areas, 1.0 qt/A = 1-1/2 tbsps/1000 sq ft.

CONVERSION FOR SMALL AREA APPLICATION

Rate Desired	Formulation available			Formulation available		
	1 lb/gal	2 lb/gal	4 lb/gal	1 lb/gal	2 lb/gal	4 lb/gal
	QUARTS/ACRE			TABLESPOONS/1000 SQ FT		
1/3 lb/A	1-1/2	3/4	3/8	2-1/4	1-1/8	9/16
1/2 lb/A	2	1	1/2	3	1-1/2	3/4
1 lb/A	4	2	1*	6	3	1-1/2*
1-1/2 lb/A	6	3	1-1/2	9	4-1/2	2-1/4
2 lb/A	8	4	2	12	6	3

\*One quart per acre is equal to 1-1/2 tablespoons per 1000 sq ft.  
Two tablespoons is equal to 1.0 fluid ounce or 29.6 cc.

The relative effectiveness of commonly used herbicides for selected weeds is listed in the following table (on next page), using S = Weed susceptible; I = Intermediate, good control at times with high rates, sometimes poor, may require more than one treatment; R = Resistant weeds in most instances; A = Annual; SA = Summer Annual; WA = Winter Annual; B = Biennial; and P = Perennial. Weeds which are intermediate in response should be given repeat treatment rather than increasing the rate of a single application. It may sometimes be desirable to treat at times other than those listed. When this is necessary, make sure that good growing conditions prevail and contact with desirable plants is prevented. Combination products may be more effective than individual chemicals on a particular weed.

Broadleaf Weed Control in Bluegrass, Ky 31 Fescue, Perennial Ryegrass  
and Common Bermudagrass

Weed	Classification	Response to Herbicides (lb/A)				Preferred Time to Treat
		2,4-D (1.5-2.0)	Dicamba (0.33-0.5)	Mecoprop (1.5-2.0)	2,4-D + Dicamba (1.0-0.33)	
BEDSTRAW	A	I-R	S	I	S	April & May
BINDWEED	P	S	S	S-I	S	May & June
BITTERCRESS	WA or B	S	S	I	S	Oct. & Nov.
BLACK MEDIC	A, B, & P	S	S	I	S	April & May
BUTTERCUP	WA, B, & P	S-I	S	I	S	Oct. & Nov.
CARPETWEED	SA	S	S	I	S	May & June
CAT'S EAR (False Dandelion)	P	S-I	S	I	S	Oct. & Nov.
CHICKWEED Common Mouseear	WA P	R I-R	S S	S-I S-I	S S	Oct. & Nov. Oct. & Nov.
CHICORY	F	S	S	S	S	Oct. & Nov.
CINQUEFOIL Common	A	S	S	S	S	May & June
CLIMBER Crimson Hop White	SA SA F	S I I	S S S	S S S	S S S	May & June April & May Oct. & Nov.
CRANESBILL	WA or B	S	S	S-I	S	Oct. & Nov.
DAISY Oxeye	P	I	I	I	I	Oct. & Nov. or May
DANDELION	P	S	S	S	S	Oct. & Nov.
DOCK	P	I	S	I-R	S	Feb. - April
DOGFENNEL	P	I	S	I	S	Oct. & Nov. or April
GARLIC Wild	P	I	I	R	S-I	Oct. - Nov. & Feb. - March
GROUND IVY	P	I-R	S-I	I	S-I	April - May
HAWKWEED	P	S-I	S-I	R	S	Aug. & Sept.
HEALALL	P	S	S-I	R	S	Oct. & Nov.
HENBIT	WA	I	S	I	S	Oct. & Nov.
HONEYSUCKLE	P	S-I	S	I	S	May & June
HORSENETTLE	P	I-R	I	R	I	May & June
KNAPWEED Spotted	B	I	S	I	S	Oct. & Nov.
KNAWEL (German Moss)	WA	R	S	I	S	Oct. & Nov.
KNOTWEED	SA	R	S	I	S	March - April

Broadleaf Weed Control in Bluegrass, Ky 31 Fescue, Perennial Ryegrass  
and Common Bermudagrass

Weed	Classification	Response to Herbicides (lb/A)				Preferred Time to Treat
		2,4-D (1.5-2.0)	Dicamba (0.33-0.5)	Mecoprop (1.5-2.0)	2,4-D + Dicamba (1.0-0.33)	
LAMBSQUARTERS	SA	S	S	S	S	April & May
LESPEDEZA	SA	I-R	S	S	S	April & May
MUGWORT	P	I	S-I	I-R	S-I	March
MUSTARDS	WA & B	S	S	I	S	Oct. & Nov.
ONION, Wild	P	I	I	R	S-I	Oct. - Nov. & Feb. - March
ORNAMENTAL PLANTS	P	S-I	S	S-I	S	Most likely to injure from April to June
PENNYCRESS	A	S	S	I	S	Oct. & Nov.
PEPPERWEED	WA OR B	S	S	I	S	Oct. & Nov.
PIGWEEED	SA	S	S	S	S	April & May
PLANTAINS	P	S	I-R	I	S	Oct. & Nov.
POISON IVY	P	I	S-I	R	S-I	June
PONY FOOT	P	S	S-I	I	S	Oct. & Nov.
POORJOE (Diodia)	A	S-I	-	I	S	May & June
PROSTRATE SPURGE	SA	I	S	I	S	April - May
PURSLANE	SA	I	S	R	S	May & June
RED SORREL	P	R	S	S	S	Oct. & Nov.
SHEPHERDSPURSE	WA	S	S	S-I	S	Oct. & Nov.
SMARTWEED	SA	I-R	S	I-R	S	April & May
SOWTHISTLE	WA	S	S	I	S	Oct. & Nov.
SPEEDWELL	SA or WA	R	R	R	I-R	April
SPOTTED SPURGE	SA	I-R	S-I	S-I	S-I	May & June
THISTLE						
Bull	B	S-I	S	I	S	Oct. & Nov.
Canada	P	I	S	I	S	Oct. & Nov.
Curl	B or WA	S	S	I	S	April
Musk	B	S	S	I	S	April
VEGETABLES	A	S	S	S	S	Most likely to injure April to June
VIOLET	P	I-R	I	I-R	I	April

Broadleaf Weed Control in Bluegrass, Ky 31 Fescue, Perennial Ryegrass  
and Common Bermudagrass

Weed	Classification	Response to Herbicides (lb/A)				Preferred Time to Treat
		2,4-D (1.5-2.0)	Dicamba (0.33-0.5)	Mecoprop (1.5-2.0)	2,4-D + Dicamba (1.0-0.33)	
WILD CARROT	B	S	S	I	S	Oct. & Nov.
WILD STRAWBERRY	P	R	S-I	R	S-I	Oct. & Nov.
WOODSORREL, YELLOW	SA	R	R	R	I	April or May
YARROW	P	I	S	I-R	S	Oct. & Nov.
YELLOW ROCKET	B or P	S-I	S-I	I	S	Oct. & Nov.

ZOYSIA

V.P.I. and S.U. does not conduct an active research program on zoysia. The following materials have label clearance and specifically mention that they can be safely used on zoysia. These materials have been thoroughly tested at V.P.I. and S.U. on the more common grass varieties and we feel that they can be safely used on zoysia by following directions on the container label.

Preemergent Control of Annual Grasses

bensulide (Betasan)  
benefin (Balan)  
siduron (Tupersan)

Emergent Grass Control

DSMA (Chipco Crab Kleen)  
CMA (Weedone Crabgrass Killer)

Broadleaf Weed Control

2,4-D + MCPP (Scott's Bonus and Rhone Poulenc's Chipco Turf-Kleen)

NONSELECTIVE CONTROL OF PERENNIAL GRASSES  
(Bermudagrass, Fescue, Nimblewill, Orchardgrass, Quackgrass)

Undesirable patches or clumps of perennial grasses can be treated with dalapon (Dowpon) or glyphosate (Roundup). Lightly wet the foliage of the undesirable grass in the spring or summer when it is actively growing. Follow label directions for rates of application and proper timing. Dalapon is biodegraded in the soil and it is safe to reseed or resod the treated area about 30 days after the last application. Roundup has no soil residual and reseeding can occur as soon as the foliage has turned brown (7-10 days).

WEED CONTROL IN DRIVEWAYS, FENCE LINES AND PARKING AREAS

There are many good soil sterilants on the market that will give long-term control of weeds. These are discussed in the non-selective section of this guide. These materials are very powerful weed killer and not designed for homegrounds situation. Many trees and shrubs have been killed when application of soil sterilants was made within their root feeding area.

Dalapon mentioned above can be used to kill grassy weeds in a driveway, parking area or under a fence. Amizine (amitrole + simazine) is a very useful product in these areas. It does not move down in the soil sufficiently to kill trees. Amizine is sold by farm chemical suppliers but not readily available at many lawn and garden stores.

GOLF COURSE PUTTING GREENS  
Bentgrass or Bermudagrass

Weed Problem	Chemical Rate/1000 sq ft	Remarks
Preemergent Control of Annual Grasses	Bensulide 5.6-9.4 oz (4.0 lb/gal formulation) or 4.8-8.0 lb of 3.6% gran) or 1.9-2.4 lb of 12.5% gran or 2.4 to 4.1 lb of 7% gran	Apply uniformly in the late winter or early spring before crabgrass emergence. August or September application is used for annual bluegrass control. The higher rate is needed for annual bluegrass. For crabgrass, the lower rate is effective and may be repeated after 4 months for better continuous crabgrass control. Goosegrass control is generally poor with bensulide.
Postemergent Control of Annual Grasses	DSMA 1.0 oz of 70% formulation	Follow label directions. Discoloration of grass should be expected. Use only when mid-day temperatures are below 90°F. Goosegrass control will require 2-3 applications at 4- to 7-day intervals and seldom 100% effective. Goosegrass will also require the higher rates. Other label formulations may be equally effective. Follow label directions for rates.
Postemergence control of yellow nutsedge	Bentazon 1.0 oz (4.0 lb/gal formulation)	Allow nutgrass to grow 5 days before and after application. Repeat after 10-14 days. Do not irrigate for 2 days after treatment. Soil should be moist at the time of application.
Postemergent Control of Broadleaf Weeds	dicamba 1.0-2.0 tsp (4.0 lb/gal formulation)	Margin to tolerance is narrow. Excessive rates will kill grass. A teaspoon is 1/6 fluid ounce. Do not try to spot-treat on green or excessive rates will occur. Start spraying on apron and move across the green. Best to put on 1/2 rate in one direction and retreat with remaining 1/2 at right angles.
	mecoprop (MCP) 1.5-2.0 oz of 2.0 lb/gal formulation	Seaside, Arlington and Congressional bents may be injured.
	2,4-D + MCP + dicamba 1.0 oz of Trex-San Bent OR 1.0 oz of Trimec Broadleaf Herbicide (Bent Formula)	A commercial mixture with a reduced rate of dicamba which gives a good spectrum of weed control and increased margin of safety over dicamba alone. Do not over-apply. Slight yellowing may occur temporarily. Do not irrigate within 24 hours after application.

GOLF COURSE FAIRWAYS

Fairway weed control can be accomplished with the same weed killers listed in the first part of the turf section. The same rates and remarks will apply.

GOLF COURSE SAND TRAPS

Weeds in sand traps present considerable problems in golf course management. Stauffer Chemical Company now has label clearance for use of Eptam 5G in sand traps. All weed growth must be removed before application. Eptam must be raked into the sand to a 2 to 3 inch depth immediately after application. It will not injure greens when blasted or tracked on the turf by players.

Follow directions on the container label for correct rate and method of application.