

Diseases

Brandon J. Horvath, Extension Plant Pathologist, Hampton Roads AREC
David S. McCall, Research Specialist, Plant Pathology, Virginia Tech

Table 5.1 - Disease Control Use

Disease	Turfgrass	Chemical ¹	Rate/1000 sq ft ²	Season & Interval of Application
Fairy Rings	All turfgrasses	Prolonged water soaking of soil		
Fusarium Blight (<i>Fusarium culmorum</i> and <i>Fusarium poae</i>)	See summer patch and necrotic ring spot recommendations.			
Grey Leaf Spot (<i>Pyricularia grisea</i>)	Tall Fescue	Heritage 50 WG	0.2-0.4 oz	14-21 days
	Ryegrass St. Augustinegrass	Cleary 3336+	4.0-8.0 oz	14-21 days
Leaf Spot Diseases	Kentucky Bluegrass Ryegrasses Tall Fescue			April-June
(a) Melting-out (<i>Drechslera poae</i>)				
(b) Zonate Eyespot (<i>Drechslera gigantea</i>)	Bentgrasses Bluegrasses Bermudagrass Fescues Ryegrasses		(See below)	April-June
(c) Bipolaris Leaf Spot (<i>Bipolaris sorokiniana</i>)	Bentgrasses Bluegrasses Fescues Ryegrasses			July-August
(d) Red Leaf Spot (<i>Drechslera erythrospila</i>)	Bentgrasses			April-August
(e) Helminthosporium Blight (<i>Drechslera dictyoides</i>)	Fescues Ryegrasses		(See below)	April-June
(The following fungicides are cleared for use on lawns for the control of Helminthosporium diseases.)				
		Banner Maxx	1.0- 2.0 oz	14-28 days
		Heritage 50 WG	0.2-0.4 oz	14-21 days
Powdery Mildew (<i>Erysiphe graminis</i>)	Fescues	Reduce stress. Do not over fertilize.		

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

²Except where indicated, all materials should be applied in 1.0-2.0 gal water per 1000 sq ft. Lower rates are to be used in preventive programs; higher rates are to be used in corrective programs.

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Table 5.1 - Disease Control Use (cont.)

Disease	Turfgrass	Chemical ¹	Rate/1000 sq ft ²	Season & Interval of Application
Pythium Blight (<i>P. aphanidermatum</i> and <i>P. ultimum</i>)	(The following fungicides are cleared for use on lawns for the control of Pythium diseases.)			
	Bentgrasses Bluegrass	Banol	1.33-4.0 oz	7-21 days
	Ryegrasses Bermudagrass Fescues Zoysia	Heritage 50 WG	0.4 oz	10-14 days (Under heavy disease pressure, may not provide complete control)
		Insignia 20 WG	0.5-0.9 oz	14 days (Under heavy disease pressure, may not provide complete control)
		Segway	0.45-0.9 oz	14-21 days
		Subdue Maxx	0.5-2.0 oz	10-21 days
Rhizoctonia Blight (<i>Rhizoctonia solani</i>) ("Brown patch")	(Under heavy disease pressure, fungicides may not provide complete control)			
	Bentgrasses Bluegrasses Ryegrasses Fescues	Armada 50 WP	0.6- 1.2 oz.	14-28 days
		Heritage 50 WG	0.2- 0.4 oz.	14-28 days
		Disarm	0.09-0.36 oz	14-28 days
("Large patch")	Bermudagrass St. Augustinegrass Zoysia	Heritage 50 WG	0.4 oz	21-28 days approximately 30 days prior to dormancy
		Insignia 20 WG	0.5-0.9 oz	21-28 days
		Prostar 70 WP	1.5-3.0 oz	14-21 days approximately 30 days prior to dormancy
Rust	Adequate fertility to promote growth can help reduce severity.			
Leaf rust (<i>Puccinia graminis</i> f. <i>sp.agrostis</i>)	Bluegrasses esp. Merion Kentucky	Banner Maxx Bayleton 50 WSP	1.0-2.0 oz 0.5-1.0 oz	14-21 days 15-30 days
Crown rust (<i>Puccinia coronata</i>)	Ryegrasses esp. Manhattan and Pennfine	Eagle 20 EW	1.2 oz	14-28 days
(<i>Puccinia zoysae</i>)	Zoysia			
Red Thread (<i>Laetisaria fuciformis</i>) and Pink Patch (<i>Limonomyces roseipellis</i>)	Bentgrasses Bluegrasses Fescues Ryegrasses	Bayleton 50 WSP Banner Maxx Cleary 3336 WP Heritage 50 WG Prostar 70 WP	0.5-1.0 oz 2.0 oz 2.0 oz 0.2-0.4 oz 1.5 oz	15-30 days 28 days 14 days 21-28 days 21-28 days
	Fungicides rarely required. Fertilize to promote adequate growth.			
Stripe Smut (<i>Ustilago striformis</i>)	Bentgrasses Bluegrasses esp. Merion Kentucky Meadow Fescue Red Top Ryegrass	Banner Maxx Bayleton 50 WSP Cleary 3336 WP	1.0-2.0 oz 0.5-1.0 oz 4.0-8.0 oz	1 application in October or early spring before grass growth begins Plant stripe smut resistant varieties

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

²Except where indicated, all materials should be applied in 1.0-2.0 gal water per 1000 sq ft. Lower rates are to be used in preventive programs; higher rates are to be used in corrective programs.

Table 5.1 - Disease Control Use (cont.)

Disease	Turfgrass	Chemical ¹	Rate/1000 sq ft ²	Season & Interval of Application
Dollar Spot (<i>Sclerotinia homoeocarpa</i>)	Bentgrasses	Banner Maxx	0.5-2.0 oz	May-October
	Bluegrasses			14-21 days
	Bermudagrass	Bayleton 50 WSP	0.5-1.0 oz	21-28 days
Fungicides rarely required. Fertilize to promote adequate growth.				
	Ryegrasses	Eagle 20 EW	1.2 oz	14-28 days
	Fescues, Zoysia	Rubigan AS	0.75 oz	30 days
Fall and Winter Patch Diseases Fusarium patch (<i>Microdochium nivalis</i>)	Bentgrasses	Bayleton 50 WSP	1.0-2.0 oz	Fall to Spring
	Bluegrasses	Heritage 50 WG	0.4-0.7 oz	Fall to Spring
	Bermudagrasses Ryegrass Zoysia	Rubigan AS	8.0 oz	Fall to Spring
Summer Patch (<i>Magnaporthe poae</i>) Necrotic Ring Spot (<i>Ophiospharrella Korrae</i>)	Bluegrass	Banner Maxx	4.0 oz	First application when soil temperatures are 65°-75° F at 2-inch depth. Repeat 2-3 applications on a 30-day interval. Light, frequent irrigation and slow release N sources can also reduce disease severity.
		Bayleton 50 WSP	1.0-2.0 oz	

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

²Except where indicated, all materials should be applied in 1.0-2.0 gal water per 1000 sq ft. Lower rates are to be used in preventive programs; higher rates are to be used in corrective programs.

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Insects

Weather patterns influence both the growth and health of turfgrasses and the types of arthropod pests that are likely to cause damage during a given year. Warm, moist spring and summer weather stimulates turfgrasses to grow rapidly, whereas cool, dry conditions slow growth. The damage to turfgrass caused by insect pests is affected in two ways by weather conditions. First, the species of pests found in damaging numbers are dictated to some extent by weather; hot, dry summer conditions favor outbreaks of chinch bugs or sod webworm, while these same conditions during July may significantly reduce white grub populations. Second, the number of pests necessary to cause visible damage depends on the growth rate and general health of the turfgrass; a lawn in good health can tolerate higher numbers of insect pests than one that is water-stressed. Local weather conditions also influence the type of management practices that will be effective against turfgrass pests. For many biological control agents, exposure to hot temperatures or direct sunlight is detrimental, so special considerations must be met when using these methods.

Identification and monitoring of pest populations in lawns is the best way to avoid unnecessary or ineffective pest management practices. Keeping detailed records of materials and the level of satisfaction with their results can aid a homeowner in year-to-year choices of pest management tactics. When damage to a lawn is noticeable and pest management is warranted, a homeowner should follow this series of steps:

1. Make sure that the damage is caused by an arthropod pest and not drought, disease, poor soil fertility or another cultural problem.
2. Identify the pest and learn its life cycle.
3. Determine optimum timing of management practices. Make sure that a management tactic will suppress the pest population to an acceptable level, and that suppression is necessary to limit further damage.
4. Consider several management strategies, including biological and cultural methods. Match the management strategy to the pest species. If the pest feeds on grass leaves (black cutworm, for example), any material should be applied to the above-ground portion of the turf and not followed by watering. For white grubs that reside beneath the surface, any material used must be applied by injection or the application should be followed by irrigation.
5. Implement the management tactic as required by label instructions. For formulated insecticides, this is the law. When using biological control products, the user must be aware of the conditions under which the product will work properly.
6. Record pertinent information for future management decisions, including: date of application, material applied, pre-treatment pest population levels, weather conditions during and following application, pest population levels following treatment, level of satisfaction with results.

By following these steps, homeowners will be able to make decisions about pest management that will decrease pest populations and be safe, cost-effective, environmentally sound, and repeatable.

Key to Pesticide Formulations:

D - Dust

EC - Emulsifiable Concentrate

ES - Emulsifiable Suspension

F - Flowable

G - Granules

SC - Soluble Concentrate

WP - Wettable Powder

WSP - Water Soluble Powder

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Table 5.2 - Recommended Use			
Insect Pest	Insecticide	Formulation	Remarks
Ants	Carbaryl (Sevin) • Lawn and Garden Insect Control	22.5% L	Use as localized treatments to nesting area according to label directions. A general area application may not be necessary. Use of some other lawn insect controls will also control ants. Apply during daylight
	Gamma-cyhalothrin (Triazide)	0.25 L	
	Permethrin (Ant-Be-Gone)	0.25% D	
Chinch Bugs	Beauvaria bassiana (insect pathogenic fungus) • Botani Gard • Mycotrol O	ES WP	Chinch bugs can cause significant damage to turf when found in densities of 15 - 20 immature bugs/sq ft. Damage usually occurs to turf in sunny areas with a thick thatch layer. The bugs may be sampled by floatation. A cylinder with open ends is driven into the turf, and about 1 inch of water is maintained in the cylinder for 5 - 10 minutes. Chinch bugs will float to the top of the water. Two generations per year occur in Virginia. Insecticide treatment is often effective, but since the bugs are highly mobile, the area can be quickly recolonized. Therefore, an application in April - May, followed by 1-2 more applications at 2- to 3- week intervals is recommended for the first generation. Early treatment may provide season-long control. To spray, mix the suggested amount of insecticide in 15 - 30 gal water/1000 sq ft. Do not mow or water turf for 2 - 3 days after treatment. If the insect- pathogenic fungus <i>Beauvaria bassiana</i> is used as a control measure, do not apply fungicides immediately before or after application (see label on product). Cultural methods of management: plant endophyte enhanced fescue and ryegrass, reduce the use of fine (red) fescue in sunny areas, reduce thatch, avoid spring fertilization with high nitrogen.
	Carbaryl (Sevin)	22.5% L	
	Bifenthrin (Bug-B-Gone Max) • Lawn and Garden Insect Killer	0.3%	
	Permethrin • Total Kill Lawn and Garden Insect Killer	2.5% L	
Cutworms	Entomopathogenic nematode products		Cutworm populations of 3 - 8 worms/ sq yd may warrant treatment. To sample cutworms, use the soap flushing technique. Mix 1 tbsp of dishwashing detergent into 1 gal of water and pour it on to the area to test. Cutworms (and other soil invertebrates) will move to the surface in a few minutes. Two generations can occur in Virginia. Apply materials in the early evening. Most insecticides used for cutworm control are stomach poisons, and the larvae feed at night. Do not water the treatment in unless specified on the label and do not mow for several days after treatment. Cutworms are highly mobile, so treated areas are likely to become reinfested from surrounding areas. Cultural methods of management: plant endophyte enhanced fescue and ryegrass, turf more than 2.5 inches in height seldom requires treatment for cutworms, when mowing remove clippings (adult cutworm moths lay eggs at the tip of grass blades).
	Carbaryl (Sevin)	22.5% L	
	Spinosad • Bull's Eye Bioinsecticide	EC	
	Bifenthrin (Bug-B-Gone Max) • Lawn and Garden Insect Killer	0.3% L	
Mites (Clover mite)	Diatomaceous Earth	D	Clover mites are more nuisances than pests, though they may build up populations near building foundations that can cause silvering of turf. As their name suggests, they are not primarily feeding on grasses. The nuisance they cause occurs when they invade houses. When crushed they cause a red stain on the area. Populations high enough to warrant treatment occur in late winter or early spring, and occasionally in the fall. Control is usually only needed around the perimeter of structures – often only on the south side. Bare ground within 5 feet of the structure can be effective.

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Table 5.2 - Recommended Use (cont.)

Insect Pest	Insecticide	Formulation	Remarks
Sod Webworms	Entomopathogenic nematode products		Sod webworm problems on turf are most noticeable in high-maintenance conditions where grass is kept short. Two generations per year occur in Va. Webworm densities of 15/sq yd warrant treatment. Young larvae, which are most susceptible to treatment, can be expected in turf about 2 weeks after adults are present; late June and again in early September. Unfortunately, by the time damage is noticeable, the larvae are not susceptible to <i>Bt</i> products because they are too old. Spring and early summer treatments may be effective against the larvae that have overwintered. Do not mow for 1-3 days after treatment. Cultural methods of management: plant endophyte enhanced fescue and ryegrass, damage is seldom noticeable in turf more than 2.5 inches in height.
	Carbaryl (Sevin)	22.5% L	
	• Lawn Insect Granules	0.02 G	
	Lambda-Cyhalothrin	0.15 G	
	• Complete Soil and Turf Insect Killer		
	Triazide	0.1 G	
• Above and Below Ground Insect Control			
	Spinosad	EC	
	• Bull's Eye Bioinsecticide		
	Bacillus thuringiensis var. kurstaki (Bt)	20% WP	
	• Sod Webworm Attack	0.048 D	
	• Dipel Dust	10% F	
	• Bactospeine		
White Grubs (Japanese beetle, masked chaffer, Asiatic garden beetle, etc.)	Bacillus popilliae (Milky Spore disease) for Japanese beetle only; not effective on other grub species.	0.02% WP	White grubs are actually several species of scarab beetle larvae. When using any of the milky spore disease products, be aware that Japanese beetle larvae are most susceptible. Other species will not be controlled by this product. Follow label instructions for application. When using these products, be aware that control is not immediate. Milky spore is a slow-acting disease agent; grubs will take up to 30 days to die. However, when the disease is established, control can be effective for years without further application. After application, the disease perpetuates and spreads by infecting and being transported by grubs. If another insecticide is applied to an area treated with milky spore, this will slow the spread of the disease and is therefore not desirable. Be patient. White grubs can also be controlled by entomopathogenic nematodes. Not all species of nematodes available commercially will provide adequate control. The species of nematode is provided on the product label under the "Active Ingredients" section. Products with <i>Steinernema carpocapsae</i> in this section should not be used for grub control. These products should be applied only when the pest is present. Nematodes should be applied late in the day to avoid exposure to UV light damage, and soil temperature should be at least 60°. Early spring treatments are usually not effective because soil temperatures are too cold. Watering before and after application provides the best results. Several chemical insecticides are available for grub management. These products should be applied at the labeled rate and watered in with 1/2 inch of water. Timing is important, make sure the grubs are present. Most insecticides provide the best control when used against young grubs. Populations high enough to warrant treatment are 6 - 10 grubs/sq ft. Cultural management: reducing thatch to less than 1/2 inch will increase penetration of any treatment applied to the lawn.
	• Milky Spore		
	Beauveria bassiana ¹ (Pathogenic fungus)	ES	
	• Naturalis - T	WP	
	Entomopathogenic Nematodes		
	Products with <i>Steinernema riobrave</i> or <i>Heterorhabditis</i> sp. as active ingredient		
Halofenozide	1.5 G		
• GrubStop			
Imidacloprid			
• GrubEx	0.2 G		

¹Do not apply within several days of fungicide.

Weeds

Shawn D. Askew, Associate Professor, Virginia Tech
Jeffrey F. Derr, Extension Weed Scientist, Hampton Roads AREC

Turfgrasses are used to beautify grounds around homes, businesses, industries, parks, educational facilities, and on golf courses. Quality is a relative term that is dependent upon the level of management a lawn is provided. High-quality lawns do not happen by accident. High quality is dependent on many factors such as turfgrass variety, fertilization, irrigation, soil type, and pest management. One important consideration is the correct use of herbicides for weed control.

Weeds will compete with turfgrasses in lawns for space to grow and for water and nutrients. Sometimes weeds grow faster and appear above the desired clipping height in 1-2 days. Uneven texture and height of weeds gives an undesirable appearance. When weeds are controlled and other management practices are improved, the quality of the lawn is improved.

Many herbicides are available for weed control in lawns. This publication is directed toward lawn turfgrasses including **bluegrass, tall fescue, fine fescue, perennial ryegrasses, and bermudagrass**. These recommendations are **not** intended for bentgrass or bermudagrass under golf green management.

Preemergence Control of Crabgrass

Annual grasses are effectively controlled with preemergence and postemergence herbicides. Crabgrass, foxtail, and barnyardgrass are effectively prevented by a number of preemergence compounds. Each basic herbicide ingredient may be formulated into many products (sometimes 25 or more). With a wide variety of formulations, it is important to follow label instructions carefully. Preemergence herbicides are applied in early spring before seedling crabgrass emerges. Generally, it is too late for effective control if you see the seedling emerging in the lawn. Preemergence herbicides applied in spring will be sufficiently degraded or lost during the summer to allow fall seeding of thin turfgrass areas.

Basic Choices of Preemergence Herbicides

Benfen (Balan): Apply 2-3/4 lb of 2.5% granular (gran) per 1000 sq ft in late winter or early spring before crabgrass seedlings emerge. A second application after 2 months may be required to maintain effective crabgrass control into late summer and fall.

Bensulide (Betasan): Follow label directions for proper rate. Suggestions are 7-1/2 oz of a 4 lb/gal EC, 3-1/4 lb of 7% gran, or 1.8 lb of 12-1/2% gran per 1000 sq ft for crabgrass control. When the low label rate of 7-1/2 lb active ingredient (a.i.) per acre (6 oz of a 4 lb/gal formulation) is used, a second application may be desirable to prevent late germinating crabgrass establishment. This application may be made about 4 months after the initial treatment.

Dithiopyr (Dimension): Use 1-1/2 oz of a 1 lb/gal EC per 1000 sq ft for preemergence crabgrass control. The most optimum timing is at crabgrass germination period. It may be used in warm and cool season turfgrasses. Dimension is for use by professional turfgrass applicators only. Early postemergence control of crabgrass (before crabgrass begins to tiller) is also provided by dithiopyr (see under postemergence).

DCPA (Dacthal): Use 1/3 lb of 75% wettable powder (WP) or 4-1/2 lb of 5% gran per 1000 sq ft. A second application after 2 months at one-half the regular rate is required to control late germinating crabgrass. Newly seeded turfgrass may be treated with DCPA after turfgrass has grown sufficiently to require 2 clippings.

Oxadiazon (Ronstar): Use 3 to 4 lb of 2% gran or 2.2 oz of 50WP per 1000 sq ft in early spring prior to crabgrass emergence. Lawns containing red fescue are not sufficiently tolerant for Ronstar treatment. Excellent results have been obtained on bluegrass and bermudagrass lawns. Tall fescue and perennial ryegrasses are sufficiently tolerant to oxadiazon at the low label rate (2-1/3 lb of 2% gran per 1000 sq ft). Ronstar is not used on home lawns.

Pendimethalin (Turf Weedgrass Control, PreM): Apply in spring before emergence of crabgrass using 2.7 lb of Turf Weedgrass Control 1.71 gran per 1000 sq ft. This rate is equivalent to 2 lb per acre of pendimethalin. Use spreader settings provided on product as a guide for calibration. Professional applicators may use a 60 WDG formulation (PreM, Weedgrass Control 60WP) at 1.2 oz per 1000 sq ft.

Prodiamine (Barricade): The rate of Barricade 65WG varies with the type of turfgrass and the annual grass being controlled. For crabgrass control, use 0.3-0.4 oz of 65% WG in bermudagrass, tall fescue, bluegrass, red fescue, perennial ryegrass, and some creeping bentgrasses (not putting greens).

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Siduron (Tupersan): Apply in spring just before expected emergence of crabgrass. Use 7.3 oz of 50% WP per 1000 sq ft on established turfgrasses or 4-1/2 oz of 50% WP on new spring plantings. A second application of 4-1/2 oz of the 50% WP is needed about 1 month later in a new lawn to maintain a desirable level of crabgrass control during the summer. **Do not use on bermudagrass lawns.** Tupersan can be used at any stage of turfgrass development. Approximately 1/2 inch of rainfall or irrigation is necessary within 3 days after treatment for best results.

Bensulide + oxadiazon (Goosegrass/crabgrass control): Apply 2.6 lb of 5.25 + 1.31 gran per 1000 sq ft in spring before crabgrass emergence.

Benefin + trifluralin (Team): Apply 3.5 lb of 1.3 + 0.7 gran per 1000 sq ft in spring before crabgrass germination and may repeat the application for late season control.

Goosegrass Control

Oxadiazon (Ronstar): Apply 3-1/2 to 4-1/2 lb of 2% gran per 1000 sq ft for goosegrass control in bermudagrass and bluegrass. In perennial ryegrass and tall fescue, use 2-3/4 to 3-1/4 lb of 2% gran per 1000 sq ft. Oxadiazon (one application) has consistently given a high level of goosegrass control for a full season. Ronstar is not for use on home lawns.

Prodiamine (Barricade): The maximum amount of Barricade per 1000 sq ft varies with the type of turfgrass and the annual grass to be controlled. Apply 0.4 oz of 65 WG per 1000 sq ft before any annual grass germination. In bermudagrass and tall fescue, repeat with 0.4 oz after 60 days. In bluegrass and perennial ryegrass, repeat with 0.15 oz per 1000 sq ft. Red fescue and creeping bentgrasses are not sufficiently tolerant to receive a second treatment. Do not use on putting greens.

Benefin + trifluralin (Team): Apply 3.5 lb of 1.3 + 0.7 gran per 1000 sq ft in spring before crabgrass germination and repeat the application (2 lb per 1000 sq ft) just prior to goosegrass germination. Oxadiazon may be substituted for the second treatment if desired (oxadiazon has given a high level of goosegrass control).

Benefin plus oryzalin (XL Herbicide): This combination of herbicides may be used for crabgrass, goosegrass, and other annual grasses in warm-season turfgrasses (bermudagrass). For crabgrass control, use 2-1/2 lb of a 1% plus 1% formulation in early March. Repeat the treatment after 8 weeks in areas where crabgrass has been observed during previous years. Oxadiazon may be substituted for the second treatment if desired. Do not use on cool season turfgrasses.

Bensulide + oxadiazon (Goosegrass/crabgrass control): Apply 2.6 lb of 5.25 + 1.31 gran per 1000 sq ft in spring before goosegrass germination. This treatment provides preemergence crabgrass control; however, application in early spring is necessary. Goosegrass germinates a few weeks later in the season than crabgrass.

Postemergence Control of Summer Annual Grasses

DSMA, MSMA, and others (several products): Various postemergence herbicides are available for crabgrass control; however, some discoloration of the turfgrasses is expected for 2-3 weeks after each use. For best results, apply the herbicides to the infested area while crabgrass is small (less than 1-inch tall) and repeat the application 7-10 days later. Many formulations are available and usually contain the words "Crabgrass killer" in the trade name. The active ingredient is usually one of the following: DSMA, MSMA, DMA, MAMA, and other arsenicals. Label directions must be followed for the correct rate from the various formulations.

Dithiopyr (Dimension): Use 1-1/2 oz of a 1 lb/gal EC per 1000 sq ft for postemergence crabgrass control. The optimum timing is at crabgrass germination and before any tillering is observed. It is used on cool and warm season turfgrasses and may be mixed with MSMA or Acclaim for postemergence control of crabgrass which has begun to tiller (up to 3 tillers). It is for use by professional turf applicators.

Fenoxaprop (Acclaim) Use 0.34 oz of a 1 lb/gal EC for postemergence control of seedling untiltered crabgrass. This herbicide may be tank mixed with preemergence herbicides for longer control periods. Acclaim may be repeated after further emergence of crabgrass. Crabgrass of up to four tillers may be controlled; however, the required rate increases to 0.73 oz per 1000 sq ft. Do not use on bermudagrass turf. Avoid use on drought stressed crabgrass.

Table 5.3 - Annual Grass Control with Preemergence and Postemergence Turfgrass Herbicides¹

Herbicide	Crabgrass	Goosegrass	Annual bluegrass	Foxtail	Sandbur	No. of annual treatments ²
Preemergent						
Benefin	S	I	I	S	I	2
Bensulide	S	R	S	S	—	1-2
DCPA	S	I	I	S	I	2
Dithiopyr	S	I	I	S	—	1
Oryzalin	S	I	S-I	S	S-I	2
Benefin +						
oryzalin	S	I	S-I	S	S-I	1
Oxadiazon	S	S	I	S	I	1
Bensulide +						
oxadiazon	S	S	S	S	I	2
Pendimethalin	S	I	I	S	I	2
Prodiamine	S	I	I	S	—	1
Benefin +						
trifluralin	S	I	S-I	S	S-I	2
Siduron	S	R	R	S	—	2
Postemergent						
Dithiopyr	S	I	I-R	S	—	1
DSMA, MSMA	S	I-R	R	S	I	2-6
Fenoxaprop	S	I	I-R	S	—	2
Dithiopyr +						
MSMA	S	I	I-R	S	—	1
Dithiopyr +						
fenoxaprop	S	S-I	I-R	S	—	1

¹S=weed susceptibility; I=intermediate tolerance, good control at times with high rates, sometimes poor, may require more treatments per year; R=resistant in most instances, poor control usually less than 70%.

²Annual treatment requirement to give listed performance rating. Lower label rates require additional applications.

Table 5.4 - Tolerance of Established Turfgrasses to Weedy Annual Grass Herbicides¹

Herbicide	Kentucky bluegrass	Bermudagrass	Tall fescue	Perennial ryegrass	Fine fescue	Zoysiagrass
Preemergent						
Benefin	T	T	T	T	S	T
Bensulide	T	T	T	T	T	T
Bensulide + oxadiazon	T	T	T	T	—	T
DCPA	T	T	T	T	T	T
Dithiopyr	T	T	T	T	—	T
Oryzalin	I	T	T	I	—	T
Oxadiazon	T	T	T	T	S-I	T
Pendimethalin	T	T	T	I	T	T
Prodiamine	T	T	T	I-T	I	T
Siduron	T	I	T	I	T	T
Benefin + oryzalin	S-I	T	T	I	S	T
Benefin + trifluralin	T	T	T	I-T	I	T
Postemergent						
Dithiopyr	T	T	T	T	—	T
DSMA, MSMA	I-T	T	I-T	T	I	I-T
Fenoxaprop	T	S-T	T	I-T	T	T

¹Relative tolerance is represented by: T=tolerant; I=use with caution at lower rates, intermediate or marginally tolerant, may cause injury and thinning; S=turfgrass is not sufficiently tolerant and/or not registered for use.

Control of Perennial Weedy Grasses

Dallisgrass: The labels of postemergence crabgrass killers (DSMA, MSMA) contain instructions for dallisgrass control. Usually, the higher rate listed on the label is needed and 3 applications at 7 day intervals are required. Remember, the turfgrass will be discolored (yellowish) for 4-6 weeks. The application is made during active growth of dallisgrass and the turfgrass. Manage the turfgrass to encourage complete cover during a short interval after removing the dallisgrass.

Orchardgrass, Quackgrass, Bermudagrass, Tall Fescue: These undesirable perennial grasses cannot be selectively controlled. For non-selective control, use **glyphosate** (Roundup) as directed on the product label. The undesirable perennial grass should be allowed to grow to 4-6 inches before treatment. Water the area to encourage regrowth and treat again after three weeks. At 2 weeks after the last treatment, remove the shoots of the dead grasses and reseed in the surface of the soil. The area may also be resodded if desired.

It is essential that the weedy perennial grass be in an active growth stage at the time of treatment.

Broadleaf Weed Control

Phenoxy herbicides (2,4-D and related compounds) are taken up through plant foliage and then moved throughout the plant. They are extremely active in low concentrations and care must be taken to see that they do not contact desirable ornamental and garden plants. When applied as a spray, spray drift must be prevented. Spray when the wind is not blowing, keep the sprayer pressure low (20 to 30 psi), use a nozzle that will deliver large droplets rather than a fine mist (8003 fan type, TK 2.5 flooding tip, or equivalent), and keep the nozzle as close to the ground as possible. Hose proportioners are widely advertised for applying the pesticides. It is difficult to apply growth regulator herbicides through hose proportioners without drift to desirable plants or uneven coverage resulting. Do not use a sprayer that has contained a growth regulator herbicide to spray shrubs and garden plants or injury may occur.

Several herbicides have been combined with fertilizers to facilitate application. As the 2,4-D-like materials are primarily active through the foliage, applications must be made at the time when the material will adhere. This is usually in the morning when a light dew is on the grass and weeds. Dicamba (Banvel-D) is active through the soil and taken up by the plant roots as well as through the plant foliage. Because of its soil activity, granular formulations of dicamba usually give better control of many weeds than the 2,4-D-like materials. It also controls weeds such as dock and red sorrel (sheep sorrel) that are resistant to the phenoxy herbicides. Numerous cases of injury have resulted when “weed-and-feed” formulations containing dicamba were applied in the root area of desirable ornamentals. Injury is increased by over-application in an attempt to fertilize shrubs and trees with the “weed-and-feed” materials. Movement of dicamba in soil is influenced by soil type and rainfall. Sandy soil or heavy rainfall increase the chance of injury.

2,4-D: Some common weeds that are controlled with 2,4-D in lawns are bittercress, buttercup, wild carrot, catsear, chickory, cranesbill, dandelion, hawkweed, mustards, pennycress, broadleaf and narrow-leaf plantains, pepperweed, pony foot, shepherds’ purse, sowthistle, curl thistle, musk thistle, and others. Spotted knapweed and wild garlic are controlled with some difficulty. Use 1-1/2 lbs of 2,4-D in 30-50 gals of water per acre. This would be equal to about 2-1/4 tablespoons (4 lbs per gal acid equivalent) of 2,4-D in 1 gal of water for each 1000 sq ft. Apply either in late fall or early spring when the weeds and turf are actively growing. Active growth of weeds is usually sufficient when mid-day temperatures exceed 60°. The late fall is usually preferred because there is less likelihood of injury to desirable plants from spray drift. A large number of lawn weeds are young and more susceptible in the fall. Do not apply near susceptible plants (tomatoes, grapes, roses, beans, etc.). Do not use on new turf until grass has been mowed twice. White clover will be damaged, but recovers. Spraying during hot dry periods may cause injury to the grass.

Dicamba (Banvel): Dicamba kills certain weeds that are resistant to 2,4-D. Dicamba is a good selection for knotweed, smartweed, curly dock, red sorrel, bedstraw, chickweeds, ground ivy, blackmedic, knawel, white clover, yarrow, lespedeza, prostrate and spotted spurge, purslane, henbit, and several of the weeds listed for 2,4-D. Dicamba is used at a lower rate than 2,4-D. Use 2 tsp of a 4 lb/gal Banvel formulation in 1 gal of water per 1000 sq ft. Do not apply dicamba to the root area of shallow-rooted shrubs and trees. Dicamba fails to adequately control plantains.

2,4-D and dicamba (several formulations): A tank mixture of 2,4-D and dicamba has consistently controlled a wide range of broadleaf weeds (see list under both 2,4-D and dicamba above). Several formulations are available in which the 2 herbicides are already mixed for use on turfgrasses. The ratios of 2,4-D to dicamba in the formulation mixtures are usually about 3 to 1 or 4 to 1, respectively. The total active ingredient should not exceed about 1-1/2 lb/A including 2,4-D and dicamba combined for most weeds.

Mecoprop (MCP): White clover, chickweeds, hop clover, lespedeza, and spotted spurge (seedlings) are controlled quite well with mecoprop at 1-1/2-2 lb/A (4 tbs of 2.5 lb/gal acid-equivalent mecoprop in 1 gal of water per 1000 sq ft).

2,4-D plus mecoprop (2 Plus 2): A tank mixture or formulation containing both is more commonly used than mecoprop alone. Mecoprop has a limited spectrum of susceptible broadleaf weeds and 2,4-D is mixed with mecoprop to provide better control of a wide range of weeds. See weeds listed under 2,4-D and mecoprop for the effectiveness of the mixtures.

2,4-D plus mecoprop plus dicamba (Trimec Classic): Tank mixtures and formulations of three-way mixtures are sometimes used. These mixtures are utilized to reduce the level of dicamba needed to obtain good weed control. These are excellent formulations of broadleaf herbicides that provide a broad spectrum of weed control. In many instances, however, all three active ingredients are not required for excellent weed control. In some cases the amount of dicamba in the formulated mixtures is too low.

2,4-D plus dichlorprop plus Mecoprop (Weedestroy) Use 0.75 to 1.1 oz of 4.8 lb ai/gal formulation per 1000 sq ft after broadleaf weeds are growing actively. Dandelions, plantain, white clover, chickweed, henbit, and other weeds that are rosettes during winter are best controlled with fall applications. Yellow woodsorrel, a summer annual requires treatment in mid to late spring. Groundivy responds to dichlorprop but may require more than one application per year. Knotweed and spurge must be treated in spring or summer, respectively, while these weeds are in seedling stage. Use in lawns, parks, golf courses, athletic fields, and industrial turfgrass areas. Do not use on bentgrass greens or tees. May be used at 6 to 10 weeks after seeding new lawn (mow at least twice).

Triclopyr (Turflon Ester): Triclopyr is usually tank mixed with 2,4-D or other broadleaf herbicides to provide control of a broad spectrum of weeds. Use 0.75 oz. of a 4 lb. ai/gal formulation per 1000sq.ft. alone or 0.38 oz in tank mixtures with other broadleaf herbicides on bluegrass, tall fescue or perennial ryegrass. Do not use on other turfgrasses unless injury can be tolerated.

2,4-D plus triclopyr (Turflon D): A broad spectrum of broadleaf weeds is controlled using 1.1 to 1.5 oz of a 2 plus 1 lb/gal formulation. For certain hard-to-kill broadleaf weeds, a second application may be made after 4 weeks (groundivy, wild vio-

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lets, woodsorrel, spurge, and speedwell). Apply second application only if needed for living plant or regrowth. This formulation may be used in cool-season turfgrasses (tall fescue, bluegrass, and perennial ryegrass). Do not use on bentgrass or St. Augustinegrass unless injury can be tolerated. Turflon D is to be used only under the direct supervision of commercial applicators responsible for turf weed control programs. Tank mixtures of Turflon Ester with 2,4-D are also effective on these weeds.

Triclopyr plus clopyralid (Confront): Use at 0.6-0.75 oz per 1000 sq ft after broadleaf weeds are actively growing. Use only on Kentucky bluegrass, tall fescue and perennial ryegrass. Confront provides control of blackmedic, white clover, henbit, cat-sear, common chickweed, mouseear chickweed, dandelion, Shepherds' purse, pepperweed, musk thistle, and others.

Do not apply Confront to runoff areas where water flows onto susceptible crops.

Do not apply to soils containing sinkholes over limestone bedrock or fractured surfaces.

Do not apply to sand or loamy sand soils, over shallow water table.

The availability of many formulations of the various broadleaf herbicides that vary in amount of active ingredient make it difficult to establish a general rate to apply to 1000 sq ft or to determine the proper amount of formulation to use. With a 4 lb/gal formulation, 1 qt contains 1 lb of active ingredient and a rate given in lb/A is equal to qt/A. To convert to small areas, 1 qt/A = 1-1/2 tbsp/1000 sq ft.

Table 5.5 - 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

The relative effectiveness of commonly used herbicides for selected weeds is listed in the following table, using S = weed susceptible; I = intermediate, good control at times with high rates, sometimes poor, may require more than one treatment; R = resistant weed 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 it 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.

Table 5.6 - Broadleaf Weed Control in Bluegrass, Tall Fescue, Perennial Ryegrass, and Common Bermudagrass

(Use caution when applying triclopyr or clopyralid to bermudagrass-see label restrictions)

Weed	Classification	Response to Herbicides (lb/A)									Preferred Time to Treat
		2,4-D 1.5-2.0	Dicamba 0.33-0.5	2,4-D+ Mecoprop 1+1	2,4-D + Mecoprop +Dicamba	2,4-D + Dicamba 1.0+0.33	2,4-D + Dichlorprop + Mecoprop	2,4-D + Triclopyr 1.0+0.5	Triclopyr + Clopyralid 0.56+0.19		
Bedstraw	A	I-R	S	I	I-R	S	—	—	—	April & May	
Bindweed	P	S	S	S-I	S	S	S	S	—	May & June	
Bittercress	WA or B	S	S	S	S	S	S	S	—	Oct & Nov	
Blackmedic	A, B, & P	R	S	I	S	S	S	S	S	April & May	
Buttercup	WA, B, & P	S-I	I	S	S	S	S	I	S	Oct & Nov	
Buttonweed Virginia	P	R	R	R	I-R	I	I	I	I	May & repeat	
Carpetweed	SA	S	S	S	S	S	S	S	—	May & June	
Catsear Dandelion	P	S-I	S	S	S	S	S	S	S	Oct & Nov	
Chickweed Common	WA	R	S	S	S	S	S	S	S	Oct & Nov	
Mouseear	P	I-R	S	S-I	S	S	S	S	S-I	Oct & Nov	
Chicory	P	S	S	S	S	S	S	S	—	Oct & Nov	
Cinquefoil Common	A	S	S	S	S	S	S	S	—	May & June	
Clover Crimson	SA	S	S	S	S	S	S	S	S	May & June	
Hop	SA	I	S	S	S	S	S	S	S	April & May	
White	P	I	S	S	S	S	S	S	S	Oct & Nov	
Daisy Oxeye	P	I	I	I	I	I	I	I	—	Oct & Nov or May	
Dandelion	P	S	S	S	S	S	S	S	S-I	Oct & Nov	
Dock	P	I	S	I	I	S	I	I	I	Feb - April	
Dogfennel	P	R	S	I-R	I-R	S	I	I	S-I	Oct & Nov or April	
Garlic Wild	P	I	I	I	I	S-I	I	—	—	Oct - Nov & Feb - March	
Geranium Carolina	WA	S	S	S	S	S	S	S	—	April - May	
Ground Ivy	P	I-R	S-I	I	I	S-I	I	S-I	S-I	April - May	
Hawkweed	P	S-I	S-I	S-I	S-I	S	S-I	S-I	I	Aug & Sept	
Healall	P	S	S-I	S-I	S-I	S	S	—	—	Oct & Nov	
Henbit	WA	I	S	I	S-I	S	S	S	S	Oct & Nov	
Honeysuckle	P	S-I	S	S-I	S	S	S	S	—	May & June	

Table 5.6 - Broadleaf Weed Control in Bluegrass, Tall Fescue, Perennial Ryegrass, and Common Bermudagrass (cont.)

Weed	Classification	Response to Herbicides (lb/A)								Preferred Time to Treat
		2,4-D 1.5-2.0	Dicamba 0.33-0.5	2,4-D+ Mecoprop 1+1	2,4-D + Mecoprop +Dicamba	2,4-D + Dicamba 1.0+0.33	2,4-D + Dichlorprop + Mecoprop	2,4-D + Triclopyr 1.0+0.5	Triclopyr + Clopyralid 0.56+0.19	
Horse Nettle	P	I-R	I	I-R	I-R	I	I	I	—	May & June
Horse Weed	WA,SA	I	S	S-I	S-I	S	—	—	S	Oct or May
Knapweed Spotted	B	I	S	I	I	S	I	S	—	Oct & Nov
Knawel (German Moss)	WA	R	S	I	I	S	S	S-I	—	Oct & Nov
Knotweed	SA	R	S	I	I	S	I	—	—	March - April
Lambs- Quarters	SA	S	S	S	S	S	S	S	S	April & May
Lespedeza	SA	I-R	S	S-I	S	S	S	S	I	April & May
Mallow Common	SA	I-R	S-I	I	I	S-I	S-I	—	S-I	April & May
Mugwort	P	I-R	S-I	I-R	I-R	S-I	I	—	—	March
Mustards	WA & B	S	S	I	S-I	S	S	—	—	Oct & Nov
Onion Wild	P	I	I	I	I	S-I	I	—	—	Oct - Nov & Feb - March
Ornamental Plants	P	S-I	S	S-I	S-I	S	S	S	—	Most likely to injure April to June
Oxalis	A,P	I-R	R	I-R	I-R	I	S	I	I-R	April - May
Pennycress	A	S	S	S	S	S	—	—	—	Oct & Nov
Pepper Weed	WA or B	S	S	S	S	S	S	—	S-I	Oct & Nov
Pigweed	SA	S	S	S	S	S	S	S	—	April & May
Plantains	P	S	I-R	S	S	S	S	S	S-I	Oct & Nov
Poison Ivy	P	I	S-I	I	I	S-I	I	S-I	I	June
Pony Foot	P	S	S-I	S-I	S-I	S	—	—	—	Oct & Nov
Poorjoe (Diodia)	A	S-I	—	S-I	S-I	S	—	—	—	May & June
Prostrate Spurge	SA	I	S	I	S-I	S	S-I	S-I	I	April - May
Purslane	SA	I	S	I	I	S	I	S-I	—	May & June
Red Sorrel	P	R	S	I	I	S	I	S-I	S-I	Oct & Nov
Shepherds' Purse	WA	S	S	S	S	S	S	S	S-I	Oct & Nov
Smartweed	SA	I-R	S	I-R	I	S	I	I	I	April & May
Sowthistle	WA	S	S	S	S	S	S	S	—	Oct & Nov
Speedwell Corn	SA or WA	R	R	R	R	I-R	I	I	I	April
Spotted Spurge	SA	I-R	S-I	S-I	S-I	S-I	S-I	S-I	I	May & June

Table 5.6 - Broadleaf Weed Control in Bluegrass, Tall Fescue, Perennial Ryegrass, and Common Bermudagrass (cont.)

Weed	Classification	Response to Herbicides (lb/A)								Preferred Time to Treat
		2,4-D 1.5-2.0	Dicamba 0.33-0.5	2,4-D+ Mecoprop 1+1	2,4-D + Mecoprop +Dicamba	2,4-D + Dicamba 1.0+0.33	2,4-D + Dichlorprop + Mecoprop	2,4-D + Triclopyr 1.0+0.5	Triclopyr + Clopyralid 0.56+0.19	
Star-of-Bethlehem	P	R	1-R	R	R	1-R	R	—	—	April
Teasel, Common	B	S	S	S	S	S	S	S	—	April & May
Thistle Bull	B	S-I	S	S-I	S-I	S	S-I	S-I	—	Oct & Nov
Canada	P	I	I	I-R	I	S-I	I	I	I	Oct & Nov
Curl	B or P	S	S	S	S	S	S	S	—	April
Musk	B	S	S	S	S	S	S	S	I	April
Vegetables	A	S	S	S	S	S	S	S	S	Most likely to injure April to June
Violet	P	I-R	I	I-R	I-R	I	I	I	I	April
Wild Carrot	B	S	S	S	S	S	S	S	I	Oct & Nov
Wild Strawberry	P	R	S-I	R	I-R	S-I	I	I	—	Oct & Nov
Yarrow	P	I	S	I	I	S	I	I	—	Oct & Nov
Yellow Rocket	B or P	S-I	S-I	S-I	S-I	S	S	S	—	Oct & Nov
Yellow Woodsorrel	A	R	R	I-R	I	I	S	I	I-R	April & May

Table 5.7 - Tolerance of Established Turfgrasses to Postemergence Broadleaf Herbicides¹

Herbicide	Kentucky bluegrass	Tall fescue	Perennial ryegrass	Fine fescue	Bermudagrass	Zoysiagrass
2,4-D	T	T	T	T	T	T
Dicamba	T	T	T	T	T	T
Mecoprop	T	T	T	T	T	T
Triclopyr	T	T	I-T	I	I	S
2,4-D + dicamba	T	T	I-T	T	T	T
2,4-D + mecoprop	T	T	I-T	T	T	T
2,4-D + triclopyr	T	T	I-T	I	S	S
2,4-D + mecoprop + dicamba	T	T	I-T	T	T	T
2,4-D + dichlorprop + dicamba	T	T	I	I-T	I	S-I
2,4-D + dichlorprop + mecoprop	T	T	I-T	T	T	I-T
MCPA + mecoprop + dicamba	T	T	I-T	T	T	I
MCPA + mecoprop + dichlorprop	T	T	I-T	T	T	S-I
Triclopyr + clopyralid	T	T	I-T	I	I	S-I

¹Relative tolerance is represented by: T=tolerant; I=use with caution at lower rates, intermediate or marginally tolerant, may cause injury and thinning; S=turfgrass is not sufficiently tolerant and/or not registered for use.

St. Augustinegrass and Centipedegrass

These warm-season grasses are utilized in some home lawns in southeastern Virginia. St. Augustinegrass and centipedegrass are sensitive to certain herbicides used in other turfgrasses so check that these grasses are on the label when choosing a product for weed control. Do not apply siduron (Tupersan) to these turfgrasses. These grasses are sensitive to the organic arsenicals (MSMA, DSMA, CMA) used for postemergence crabgrass and nutsedge control so they cannot be applied. These grasses also have less tolerance to 2,4-D and related postemergence herbicides than other turfgrasses.

Crabgrass, goosegrass, and sandbur control

Most of the preemergence crabgrass herbicides listed for use in bermudagrass can be used in established St. Augustinegrass and centipedegrass. Options include benefin (Balan), benefin + trifluralin (Team), dithiopyr (Dimension), pendimethalin (Pendulum, Halts, others), and prodiamine (Barricade). Dithiopyr can be used early postemergence (prior to tillering) to control 1- to 3-leaf crabgrass. There is no chemical readily available for control of tillered crabgrass in St. Augustinegrass or centipedegrass. Imazaquin (Image) can be used for sandbur control.

Broadleaf weed control

In established St. Augustinegrass and centipedegrass, isoxaben (Gallery, Portrait) can be applied for preemergence control of broadleaf weeds from seed. For postemergence control, reduced rates of the 2,4-D combination products, such as Trimec Southern, Southern Weed Killer for Lawns, or Weed-B-Gon for Southern Lawns, can be used with caution. Products containing atrazine can be used for preemergence and postemergence control of winter weeds. Do not apply during greenup and keep away from ornamentals and other turfgrass species. See the label for directions on use. Imazaquin (Image) can be used for the control of certain broadleaf weeds. Do not use Image for winter weed control in St. Augustinegrass.

Yellow nutsedge control

Halosulfuron (Sedge Hammer) or bentazon (Basagran) can be used for postemergence yellow nutsedge control. Imazaquin (Image) can be used for suppression of yellow nutsedge.

Zoysiagrass

Crabgrass and Goosegrass Control

Zoysiagrass is utilized in Eastern Virginia lawns to some degree and herbicides suggested for control of annual grasses in established zoysiagrass turfgrass include: benefin, bensulide, oxadiazon, prodiamine, and siduron. Oxadiazon is particularly a good choice where goosegrass is part of the problem. See previous sections for rates and timing of applications. DSMA and MSMA may also be used for postemergence crabgrass control in zoysiagrass turfgrass. Oxadiazon is not used on home lawns.

Broadleaf Weed Control

MCPP and 2,4-D or triclopyr+clopyralid (Confront) are utilized for control of many broadleaf weeds in zoysiagrass turfgrass. Apply triclopyr+clopyralid to Zoysiagrass that is healthy and well established. Read label directions for inclusion of this turfgrass. In many instances, labels will indicate established turfgrasses and will have a list of turfgrasses excluded from label use. In most cases, zoysiagrass turfgrass is not listed as an exclusion. On some labels, tolerant turfgrasses are listed and formulations for use on zoysiagrass can be specifically selected.