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Cooperative Extension Services
Virginia Polytechnic Institute and State University

of Delaware

University of Maryland

Publication 456-015

**1988-89
PEST
MANAGEMENT
RECOMMENDATIONS
FOR**

**FIELD
CROPS**



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Virginia Cooperative Extension Service

Publication 456-000

PEST MANAGEMENT GUIDES FOR VIRGINIA -- 1988-89



Contents:

- Introduction, Regulations and Basic Information for the Safe
and Effective Use of Agricultural Pesticides in Virginia -- Publication 456-001
- Pest Management Guide for Home Vegetable Gardens -- Publication 456-002
- Pest Management Guide for Home Fruit Production -- Publication 456-003
- Pest Management Guide for Home Ornamental Plants -- Publication 456-004
- Pest Management Guide for Commercial Small Fruit Production -- Publication 456-005
- Pest Management Guide for Commercial Grape Production -- Publication 456-006
- Pest Management Guide for Nursery Ornamentals -- Publication 456-007
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- Insect Pest Management for Recreation and Household Areas -- Publication 456-010
- Pest Management Guide for Forest, Christmas Tree, Aquatic,
Right-of-way and Non-crop Areas -- Publication 456-011
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- Pest Management Guide for Tobacco -- Publication 456-014
- Pest Management Guide for Field Crops -- Publication 456-015



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Pest Control Recommendations for Field Crops

This bulletin is divided into three sections -- weed, disease and nematode control, and insect control. The recommendations are according to crop and then pest. In the table of recommendations given under each crop, the pesticidal recommendations are given in units (pints, pounds and so forth) of commercial products. In most cases, the amount of active ingredient to be applied is given; this information will be useful if the pesticide is commercially available at different concentrations. If a pesticide concentration differs from that recommended, determine the amount of a given formulation you need to use to apply the pesticide at the recommended rate. For example, if the recommended rate is 1 pound actual, then you should use 2 pounds of a 50 percent wettable powder formulation. If the formulation is a liquid, you must know the pounds of actual material per gallon to make this calculation.

To the best of our knowledge all recommendations (rates) in this publication are in accordance with those on product labels. However if there is disagreement between recommendations in this bulletin and what is stated on the label, *always* follow the label directions.

Pay particular attention to the columns *Time limit: days before harvest* and *Remarks*. If you have any questions about a recommendation given in this bulletin, consult your county Extension agent.

When trade names are included, no discrimination against similar products is intended.

Guide to Abbreviations

A	= acre
AS	= aqueous solution
DF	= dry flowable
DG	= dispersible granule
E	= emulsion
EC	= emulsifiable concentrate
F	= flowable
G	= granular
L	= liquid
LC	= liquid concentrate
S	= sprayable
SP	= soluble powder
W, WP	= wettable powder
WDG	= wettable dispersible granule

Other formulations also may be registered.

This bulletin can be used for more than one growing season. However, before using a 2nd year, check with your county Extension agent for any changes in recommendations.

Use Pesticides Correctly and Safely

Read and Follow the Label

Your best guide to the correct and safe use of any pesticide is the *product label*. Pesticide labels contain such important and pertinent information as the brand or trade name, the amount of active ingredient, directions for use, environmental hazards, what to do in the case of an accident, and storage and disposal directions.

One of the Most important features of pesticide labels is that they are required by law to carry certain *signal-words* that indicate their relative hazard to humans. Highly toxic pesticides must carry the signal-word **DANGER** along with the word **POISON** and the skull-and crossbones symbol. The approximate amount of a highly toxic pesticide needed to kill the average person is a taste to a teaspoonful. In the case of moderately toxic pesticides, the required signal-word on the label is **WARNING** with the approximate lethal dose being a teaspoonful to a tablespoonful. Those pesticides that are designated to be of low toxicity or comparatively free from danger will carry the signal-word **CAUTION**, and an ounce to more than a pint is the approximate amount needed to kill the average person.

Apply Pesticides Properly

In addition to and in conjunction with information provided on the pesticide label, we offer the following suggestions that should assist you in carrying out an effective and save spraying operation:

- If you are in doubt about the use of or need for a pesticide on a crop, contact your county Extension agent for advice or assistance.
- Do not use a pesticide on a crop or for a pest not listed on the label.
- Do not use any pesticide at a rate higher than that recommended or specified on the label. Overdosing is expensive and illegal.
- Make sure your sprayer is calibrated properly.
- Wear a protective mask or clothing, if the label so directs.
- Do not spray when temperatures are over 85^oF or under high wind conditions. Avoid spray drift on people, animals and nearby crops.
- Spray in late afternoon or evening to avoid killing honey bees and other pollinating insects.
- Cover the foliage uniformly with spray, but do not use excessive amounts of water. Too much water can weaken the potency of a finished spray.
- never harvest a crop sooner than the indicated time interval (limit) between last spraying and harvest.
- In the case of accidental poisoning, contact your physician or call the nearest Poison Control Center. See listing on back cover.

Disclaimer

Commercial products are named in this publication for informational purposes only. The Virginia Cooperative Extension Service does not endorse these products and does intend discrimination against other products which also may be suitable.

Disease and Nematode Control for Field Crops

E.L. Stromberg and P.M. Phipps, Virginia Polytechnic Institute and State University
 A.P. Grybauskas, The University of Maryland
 R.P. Mulrooney, University of Delaware

Disease control in field crops is optimized through the development of a long-term management program. Prevention and risk reduction through the integration of various cultural practices including crop rotation, tillage, fertilizer management and pesticides are the goals of an effective and economical disease management program. The starting point of any management program is the selection of locally adapted, disease resistant cultivars. Because of the importance of this selection, tables providing descriptions of reactions of commonly grown cultivars to prevalent diseases have been included in this section. Please note that the lists are not all inclusive because new cultivar releases may be made after printing or lack of adequate testing prevents inclusion at printing. Updates are available through your local county Extension office.

The remainder of this section is a compilation of recommended chemical disease control measures that were registered at printing. It is not intended to be an exhaustive index of all registered fungicides and nematicides. The information in this section is provided as a guide to available products but does not substitute for or supersede the information found on the pesticide label of a specific product. Trade names are included to aid in the identification of the specific active ingredient of a pesticide known to be effective. No discrimination against a similar product is intended or implied by omission. Mention of a commercial product does not constitute an endorsement by the authors or by their respective Extension services. Consult the pesticide label for any changes in rate, timing, handling or registration. Use pesticides only as directed.

Corn and Sorghum Diseases

Seed and Seedling Diseases

In the rare event that seed corn is purchased with a seed treatment that does not include a fungicide, or control of a specific problem is required, choose a product that contains one of the recommended pesticides or pesticide combinations listed below. For any seed treatment, the slurry or commercial misting type applications are recommended because these methods provide the best adhesion of the product and the most uniform coverage. Because a wide variety of formulation and mixtures exists, read the individual labels for rates and restrictions.

Table 1. Fungicide seed treatments for corn and sorghum.

Crop	Disease(s)	Fungicide Common name	Fungicide Trade name	Remarks
Corn	Seed decay, damping-off and seedling blights	thiram thiram captan captan captan	Thiram-30 Flowable Gustafson 42-S Captan 30-DD Captan 300, 400 Captan 400-DD	General use seed treatments. Use according to label instructions. Do not use treated seed for food, feed or oil.
	Seed decay and seedling diseases including <i>Rhizoctonia solani</i>	carboxin carboxin + thiram PCNB + etridiazole	Vitavax-34 Vitavax-T Terra-Coat L-205	Use according to label instructions. Do not use treated seed for food, feed or oil.
Sorghum	Seed decay and seedling blights, damping-off and kernel smut	captan captan captan captan	Captan 30-DD Captan 300 Captan 400 Captan 400-DD	General use seed treatments. Use according to label instructions. Do not use treated seed for food, feed or oil.
	Seed decay and seedling, damping-off, covered kernel smut, and loose kernel smut	thiram thiram	Gustafson 42-S Thiram-30 Flowable	Use according to label instruction. Do not use treated seed for food, feed or oil.
	Seed and soil-borne seedling diseases including those caused by <i>Rhizoctonia solani</i>	PCNB +	Terra-Coat L-205	Use according to label instruction. Do not use treated seed for food, feed or oil.

Foliar Diseases of Corn

Some chemical control measures are registered for foliar diseases of corn. However, their use is limited to the production of seed corn and is not recommended for general production. Use resistant hybrids when available especially in continuous, no-till production systems. Many disease causing organisms are harbored in infested corn debris and, thus, are more readily available to infect corn in systems where debris remains on the soil surface and is allowed to build up. Ask your seed supplier for information on hybrids with resistance to southern corn leaf blight and northern corn leaf blight. In Virginia and Maryland gray leaf spot is a predominant foliar disease in the mountainous and piedmont production areas. Listed below are several hybrids that have exhibited a degree of resistance to this disease. This list is not all inclusive. Consult publications available from Virginia and Maryland Extension services for more information on hybrid performance in the presence of gray leaf spot.

Table 2. Corn hybrids that have exhibited a degree of resistance to gray leaf spot in evaluation conducted in Virginia and Maryland.

Medium-full maturity	Early maturity
Pioneer Brand 3192 Pioneer Brand 3233 DeKalb Pfizer Genetics DK 789 DeKalb Pfizer Genetics DK 689 Northrup-King PX 79	Pioneer Brand 3352

Note: none of the commercial hybrids tested is immune.

Nematode Diseases of Corn

The need for a nematicide should be based on the results of a soil test for the presence and level of plant pathogenic nematodes and the previous site history. The best time to collect samples for nematode testing is in the fall immediately after harvest. Consult your county Extension office for information on proper soil sampling procedures for nematode testing and for information on threshold levels before deciding to use a nematicide. In Virginia the Nematode Advisory Program provides this service. Virginia growers interested in this program should note that soil samples must be collected in the fall no later than November 20. Contact Virginia county Extension offices for literature that details the guidelines for the program.

Table 3. Nematicide recommendations for corn.

Nematode	Nematicide Common name	Nematicide Trade name	Formulated Rate	Remarks
Root-knot Lesion Lance Sting Stunt Stubby root	carbofuran	Furadan 15G	0.5-1.0 lb/1,000 linear row ft; 10.0-13.0 lbs (40 inch rows)	Apply at planting in 7- to 15-inch bands over rows and incorporate into the top 3 in of soil. Labeled for lesion nematode. Consult label for subsequent crop planting restrictions.
	terbufos	Counter 15G	0.5-1.0 lb/1,000 linear row ft (minimum 20-inch row); 13.0 lbs (40-inch row) per acre	Apply at planting in 8 inch bands and incorporate in top 3 to 4 inches of soil directly behind planter shoe but in front of press wheel. Not labeled for root-knot. Consult label for details on restrictions and precautions.
	ethoprop	Mocap 15G	0.5-1.0 lb/1,000 linear row ft; 10.0-13.3 lbs (40-inch rows)	Rate depends on row spacing. Apply at planting in 12- to 15-inch band over row and mix with top 3-4 inches of soil. Do not allow seed contact. Do not use in furrow.
Sting Stubby root		Dansanit 15G	0.9 lb/1,000 linear row ft; 12.0 lbs (40-inch rows) per acre	Apply at planting in a 12-inch band and incorporate in top 3 inches of soil.

Soybean Diseases

Seed and Seedling Diseases

Inadequate stands, lack of uniform stands, and/or death of seedlings are often the result of seed or seedling diseases. The casual agents of these diseases are assorted fungi and bacteria that are either seed-, soil-borne or reside in crop residues. Seed become infected with fungi or bacteria just before harvest, particularly when harvest is delayed because of foul weather. Improper drying and storage also may lower seed quality. In general seed with 85 percent germination by the warm germination test do not need treatment unless they are likely to be planted in cold soils (below 55 F); in dry soils; where low seeding rates are used; or where seed is planted to produce seed. Seed with germination between 75 and 85 percent should be treated with a fungicide. Seed with germination rate below 75 percent generally should not be treated or used for seed. Seed treatments cannot make up for seed of poor quality and low germination. Seed that tests below 75 percent should be recleaned and retested before a final determination is made. Remember, once seed is treated it cannot be used for food, feed or oil.

Table 4. Seed treatment fungicide for soybeans.

Disease	Fungicide Common name	Fungicide Trade name	Remarks
Seed decay, damping-off and seedling blights	captan	Captan-Moly	Apply seed treatments as a slurry or by commercial mist method. Consult label for rates and precautions. Do not use treated seed for food, feed or oil. Note many of the thiram formulations have micronutrients or nitrogen-fixing bacteria inoculant included.
	captan	Orthocide 4 Flowable Seed Protectant	
	captan	Orthocide 4 Soybean Seed Protectant	
	captan	Isotox Seed Treater	
	captan	Agrox D-L Plus	
	captan	Captan 30-DD, 300, 400, or 400-DD	
	captan	Protector II	
	thiram	Gustafson 42-S	
	thiram	Thiram-30 Flowable	
	thiram	Liquid Moly-Co-Thi	
	thiram	Liquid Thi	
	thiram	Stand-up Plus	
	thiram	Double-Noctin L	
	thiram	Triple-Noctin L	
captan + thiabendazole	Protreat 3 Agrosol Flowable Agrosol T		
Seed and seedling diseases including those caused by <i>Rhizoctonia solani</i>	captan + PCNB	Stauffer Captan Terraclor 10-10 or 30-30 Orthocide 10-20 Dust	Do not use treated seed for food, feed or oil.
	captan + carboxin	Orthocide Vitavax 20-20 Enhance	
	carboxin + thiram	Vitavax 200 or M	
	PCNB + etridiazole	Protreat L Terra-Coat L-21, L-205 or SD-205	
<i>Pythium</i> spp., damping-off and early season <i>Phytophthora</i> spp. rot	metalaxyl	Apron 25W Apron FI	Apply as a slurry treatment (2 fl oz/100 lbs of seed. May be combined with other registered seed treatment fungicides. Do not use treated seed for food, feed or oil.

Foliar, Stem and Pod Diseases

Application of foliar-applied fungicides have not been shown to consistently and significantly increase soybean yields in the Middle Atlantic states. However, seed quality generally is improved. This practice is more likely to be beneficial and economical for soybeans that are grown for seed production.

Table 5. Foliar applied fungicides for soybeans.

Disease	Fungicide Common name	Fungicide Trade name		Remarks
Pod and stem blight, anthracnose, <i>Cercospora</i> leaf blight, frog-eye, purple seed stain, and brown spot	benomyl	Benlate 50W	0.5-1 lb/A	Make first application when pods begin to form and a second application 14 days later. Do not use treated vines or plants for forage. Do not use alkaline pesticides in a tank mix. Consult individual labels for other restrictions.
	thiabendazole	Mertect 340F	6-10 oz/A	
	thiophanate methyl	Topsin M 70W	0.5-1 lb/A	
	thiophanate methyl	Topsin M 45W	1.0-2.0 fl oz/A	
	chlorothalonil	Bravo 720	1.5-2.5 pt/A	

Nematode Diseases

The need for a nematicide should be based on the previous site history and the results of a soil test for the presence and level of plant pathogenic nematodes. The best time to collect samples for nematode testing is in the fall. Consult your county Extension office for information on proper sampling procedures for nematode testing and for information on threshold levels before deciding to use a nematicide. In Virginia the Nematode Advisory Program provides this service. Virginia growers interested in this program should note that soil samples must be collected in the fall no later than November 20. In Virginia contact County Extension Office for literature that details the guidelines for the program.

There are cultural practices (rotation, fallow and use of resistant or tolerant cultivars) that will reduce nematode populations. Rotation with nonhost crops and resistant cultivars are particularly effective in controlling soybean cyst nematodes. Only when these measures are not feasible should chemical control measures be considered.

Table 6. Nematode resistant soybean cultivars for Delaware and Maryland.

Cultivar	Maturity group	Soybean cyst race resistance	Root-knot resistance
Fayette	III	1, 3 & 4	S ^a
Asgrow 3307	III	3 & 4	S
Franklin	IV	1 & 3	S
Egyptian	IV	3 & 4	S
Pyramid	IV	3 & 4	S

S = Susceptible, R = resistant.

^aRoot-knot resistance in Fayette is based on 1 year's data.

Table 7. Nematode and virus disease reaction for soybean cultivars adapted for Virginia.

Cultivar	Maturity Group	Soybean mosaic	Virus Diseases		Northern root knot	Southern root knot	Nematodes Cyst (races)	Lesion
			Peanut mottle	Peanut stunt				
Essex	V	S	S	S	S	S	S	R
York	V	R	R	R	R	R	R	R
Bay	V	R	R	R	R	R	R	R
Toano	V	R	R	R	R	R	R	R
Forrest	V	R	R	R	R	R	R	R
Asgrow 5474	V	S	S	S	S	S	R(1,3)	R
Pioneer Brand 9531	V	S	S	S	S	S	R(1,3,4)	R
Pioneer Brand 9561	V	S	S	S	S	S	R(3,4)	R
Pioneer Brand 9571	V	S	S	S	S	R	R(3)	R
Pioneer Brand 9581	V	S	S	S	S	R	R(1,3,4)	R
							R(3,4)	R

S = susceptible, R = resistant, (1,3) = races of cyst nematode.

Table 8. Nematicides registered for use on soybeans.

Nematode	Non-fumigant Nematicides ¹		Formulated Rate	Remarks
	Common name	Trade name		
Root-knot, lesion and stubby root (See Virginia Nematode Advisory Program) ³	carbofuran	Furadan 15G	10-16 oz/1,000 linear row ft 10.0-13.3 lb/acre	Apply preplant or at planting in a 7-12 inch band or in the furrow, and mix with covering soil. Use lower rate if placed in the furrow with the seed.
	aldicarb	Temik 15G	11-22 oz/1,000 linear row ft 14.0-20.0 lb/acre	Apply in 6- to 8-12 inch bands over rows preplant or at planting and mix with top 3-4 inch of soil.
	fenamiphos	Nemacur 15G	8-22 oz/1,000 linear row ft 10.0-24.0 lb/acre (36-inch rows)	Apply preplant or at planting in 6- to 12-in bands in front of planter shoe, and mix with top 3-4 in of soil.
	ethoprop	Mocap 15G	10.0-20.0 lb/A (36-in rows)	Apply preplant or at planting in 12- to 15-in bands over rows, and mix with top 3-6 in of soil. Do not allow contact with seed or use in furrow. Plants also may be more susceptible to injury from metribuzin or propanil herbicides.
Cyst	--	--	--	Use of nematicides alone for the control of cyst nematodes is not recommended. A 2-year rotation scheme using resistant cultivars and nonhost crops is more effective and considerably less expensive
Nematode	Fumigant Nematicides ²		Formulated Rate	Remarks
	Common name	Trade name		
(See Virginia Nematode Advisory Program)	1,3-D 1,3-D	Telone Telone C17	5.2-7.0 gal 6.0-8.0 gal	Apply 2 weeks preplant, 6- to 8-inches deep with single injector shank off-set 3 inches from seed furrow. Seal soil surface immediately with press wheel or other equipment.

¹ Non-Fumigant Nematicides: Non-fumigant nematicides such as Mocap, Furadan, Nemacur, and Temik do not turn into a gas and move through soils as do soil fumigants. They must be incorporated in soil between herbicide application and seeding a crop. Soil temperature is not a limiting factor when apply non-fumigant nematicides.*

² Fumigant Nematicides: Spring treatments with soil fumigants generally produces the best results in Virginia. Follow these simple steps when applying soil fumigants: (A) Work crop remains into soil in fall of year so they are well decomposed before treatment. (B) Tillage to a depth of 8 inches or more is essential; break up all clods and loosen soil thoroughly. (C) At time of treatment, the soil should be between 50 F and 80 F at the five-inch level and with adequate moisture for good seed germination. (D) Soil fumigants used for field application should not be injected to a depth greater than 8 inches. (E) Consult product labels for additional information.

³ Nematode Advisory Program: Growers participating in this program are provided reports on the numbers and kinds of plant parasitic nematodes in soil and recommendations on needs for nematode control. Soil samples for nematode assay must be collected in the fall and not later than November 20. Growers have remarked favorably on the value of this program and in several cases testified that nematode control costs were reduced by as much as 50% by omitting nematicide treatments where damaging populations were not detected. County extension offices have literature that describes guidelines for participating in this program.

Small Grain Diseases

Seed and Seedling Diseases

Fungicide seed treatments, properly applied, are highly recommended and can be considered inexpensive stand establishment insurance. Seed treatments minimize losses from seed decay, seedling blights, and seed- and soil-borne diseases. Slurry applications or commercial liquid applications provide the best adhesion and most uniform coverage and, thus, provide the most effective control. Recent problems with loose smut control have been attributed to poor fungicide coverage and higher levels of smut in seed that is treated. Hopper box treatments have not been providing the necessary coverage to ensure control.

Table 9. Seed treatment fungicides for small grains.

Crop	Disease	Fungicide Common name	Fungicide Trade name	Remarks
Barley, Oats, Rye, Wheat	Seed decay and seedling blights including the scab fungus (seed treatments do not control the head blight phase of scab disease)	captan	Captan 30-DD	Thiram formulations are not registered for oats. Vitavax formulations, Terra-Coat LT-2 and Gustafson LT-2GN are not registered for rye. Terra-Coat L-205 is not registered for rye or oats. Use according to instructions on label. Do not use treated seed for feed or food.
		captan	Captan 300	
		captan	Captan 400	
		captan	Captan 400-DD	
			Orthocide 4	
			Flowable Seed Protectant	
		thiram	Thiram-30 Flowable	
		thiram	Gustafson 42-S	
		carboxin	Vitavax	
		carboxin	Vitavax 75W	
		carboxin + captan	Vitavax 20-20	
		carboxin + thiram	Vitavax 200	
		maneb	Dithane M-22	
		mancozeb	Dithane M-22 Special	
		mancozeb	Manzate D	
		mancozeb	Manzate 200	
mancozeb	Dithane M-45			
mancozeb	Dithane M-45 Flowable M			
PCNB	Gustafson LT-2GN			
PCNB	Terra-Coat LT-2			
PCNB + etridiazole	Terra-Coat L-205			
Barley	Loose smut (<i>Ustilago nuda</i>), covered smut (<i>Ustilago hordei</i>)	carboxin	Vitavax	Use according to instructions on label. Must be applied as a slurry treatment for complete coverage.
		carboxin	Vitavax 34	
		carboxin	Vitavax 75W	
		carboxin + captan	Vitavax 20-20	
	carboxin + thiram	Vitavax 200		
	Covered smut (<i>Ustilago hordei</i>)	PCNB	Gustafson LT-2GN	Use according to instructions on the label. Should be applied as a slurry treatment for complete coverage.
PCNB PCNB + etridiazole		Terra-Coat LT-2 Terra-Coat L-205		
Barley stripe (<i>Helminthosporium gramineum</i>)	imazalil	Fecundal 6.5L	Use according to label instructions.	
	imazalil	Fecundal 10EC		

Crop	Disease	Fungicide Common name	Fungicide Trade name	Remarks
Oats	Loose smut (<i>Ustilago avenae</i>), Covered smut (<i>Ustilago kollerii</i>)	carboxin	Vitavax	Use according to instructions on label. Must be applied as a slurry treatment for complete coverage.
		carboxin carboxin	Vitavax 34 Vitavax 75W	
	Loose smut (<i>Ustilago avenae</i>)	PCNB	Gustafson LT-2GN	Use according to instructions on the label. Should be applied as a slurry treatment for complete coverage.
		PCNB PCNB + etridiazole	Terra-Coat LT-2 Terra-Coat L-205	
Wheat	Loose smut (<i>Ustilago tritici</i>)	carboxin	Vitavax	Use according to instructions on label. Must be applied as a slurry treatment for complete coverage.
		carboxin carboxin carboxin + captan	Vitavax 34 Vitavax 75W Vitavax 20-20	
		carboxin + thiram	Vitavax 200	
	Common bunt or Stinking smut (<i>Tilletia caries</i>)	carboxin	Vitavax	Use according to instructions on label. Must be applied as a slurry treatment for complete coverage.
		carboxin carboxin carboxin + captan	Vitavax 34 Vitavax 75W Vitavax 20-20	
		carboxin + thiram PCNB	Vitavax 200 Gustafson LT-2GN	
	Common root rot (<i>Helminthosporium sativum</i>)	PCNB PCNB + etridiazole	Terra-Coat LT-2 Terra-Coat L-205	Use according to label instructions.
		imazalil imazalil	Fecundal 6.5L Fecundal 10EC	

Foliar diseases

Control of foliar diseases of small grains begins with the selection of well-adapted disease resistant cultivars. Chemical control of foliar diseases generally has been found to be non-economical unless a high yield potential may be realized. Intensive management practices, especially high nitrogen fertility and narrow rows increase both the yield and disease potential in a small grain crop. Use of foliarly applied fungicides under high yield management may be required to control foliar diseases and protect the higher yield potential of the crop. The decision to protect yields with fungicides should be made when the expected yield is roughly greater than 70 bu/A (the cutoff depends on the cost of production and on potential market price), conditions are forecast to be favorable for continued disease development and stage of crop growth. Conditions for powdery mildew are characterized by temperatures between 60 and 75 F and periods of high relative humidity. Leaf rust develops most rapidly when temperatures are between 60 and 85 F and free moisture from showers or dew can be found on leaves from early evening until late morning hours.

Table 10. Wheat cultivars and their disease reactions

Cultivar	Powdery mildew	Leaf rust	Glume blotch	Scab	Spindle streak mosaic virus
Becker	S	S	MS	S	NA
Florida 301	MR	R	NA ^c	NA	NA
Florida 302	MR	R	MS ^c	S	S
Massey	MR	S	MS	S	S
Pike	MS	S	MS ^a	S	S
Potomac	MS	MS	MS ^a	S	S
Saluda	MS-S	MR	MS	S	S
Severn	S	MS	MS	S	S
Tyler	MS	S ^b	MS	S	R
Wheeler	MS-S	S ^b	MS	S	S
Coker brand 747	S	MR	MR-MS ^c	S	S
Coker brand 916	MR	R	MR-MS ^c	S	MR
Coker brand 983	MR	R	NA	S	R
Feland	S	R	MS	S	MS ^b
Hunter	MS	MR	MS	S	MS
Hybrex brand HW3007	MS	MR	MS ^c	S	MS
Hybrex brand HW3021	MS	MR	MS ^c	NA	NA
Hybrex brand HW3023	MS	MR	NA	S	NA
Hyttest brand SR82	MS	S	NA	NA	R
Lincoln	MR-MS	R	NA	NA	R
Magnum	MS	MR	MS	S	S
McNair brand 1003	MS	S	MS	S	S
Pioneer brand 2550	MS	R-MR	MS	S	S
Pioneer brand 2551	MS	MR	MS	S	R
Twain	R	R	NA	NA	R

S = susceptible, MS = moderately susceptible, MR = moderately resistant, R = resistant, NA = not available

^aHas shown moderate resistance in the seedling stage in greenhouse tests.

^bSusceptibility shown in Virginia tests; the intermediate reaction MR-MS is still holding up in Maryland and Delaware tests.

^cFrom observations, no test data available.

Table 11. Barley cultivars and their disease reactions

Cultivar	Powdery mildew	Leaf rust	Scald	Net blotch	Barley yellow dwarf virus
Anson	S	MR	MS	MR	MS
Barsoy	MS	S	S	R	S
Boone	S	S	MS	NA	MS
Henry	MR	MR	MS	MR-MS	S
Maury	R	MR	MS	MS	S
Rapidan	MR	MR	MR	S	NA
Redhill	MR	MR	MR	MR	NA
Surry	R	MR	MS	S	S
Sussex	R	S	R	MR	MR
Wysor	MR	MR	R	MR	MR

S = susceptible, MS = moderately susceptible, MR = moderately resistant, R = resistant, NA = data not available.

Table 12. Foliar applied fungicides for disease control in small grains.

Crop	Disease	Fungicide Common name	Fungicide Trade name	Formulated Rate/Acre	Remarks
Wheat and barley	Powdery mildew	triadimefon	Bayleton 50W	2.0-4.0 oz	Apply when disease covers 5-10% area of upper leaves (See Figure 2), but not before first joint (Stage 6 on Feekes') or 31 Zadoks' scale). See Figure 1. Consider a second application only if disease symptoms are present on the flag leaf or the leaf immediately below the flag leaf at the boot stage (10 on Feekes' or 45 on Zadoks' scale) and conditions are favorable for continued disease development. Total amount of chemical should not exceed 16 oz/acre per year. Do not apply within 21 days of harvest. Follow label instructions for additional precautions.
		propiconazole	Tilt 3.6EC	4.0 fl oz	Apply when disease covers 5-10% area of upper leaves (See Figure 2), but not before first joint (Stage 6 on Feekes' or 31 on Zadoks' scale) or later than flag leaf emergence (Stage 8 on Feekes' or 37 on Zadoks' scale) (See Figure 1). Make only one application per season. Do not graze or feed livestock treated forage or harvest treated crop for hay or silage. Straw may be used for bedding. As of the writing of this guide the label states, "Rotation crops: To avoid possible illegal residues, (1) Do not double-crop treated acreage where Tilt is applied to the first crop. (2) Do not graze or feed forage, fodder, or straw from rotational crops planted in the fall or the spring following treatment."
		triadimefon triadimefon + mancozeb	Bayleton 50W Bayleton 50W + Dithane M45	4.0-8.0 oz 4.0 oz + 2.0 lbs	Apply when rust covers 1-3% of area of upper leaves (See Figure 2), between Feekes' Growth Stages 8-10.5 or Zadoks' Stages 37-58 (See Figure 1). Total amount of triadimefon should not exceed 16 oz/acre per year. Do not apply within 21 days of harvest. Follow label instructions for additional precautions.

Crop	Disease	Fungicide Common name	Fungicide Trade name	Formulated Rate/Acre	Remarks
		propiconazole	Tilt 3.6EC	4.0 fl oz	Apply when rust covers 1-3% of area of upper leaves (See Figure 2), but not later than Feekes' Growth Stage 8 or Zadoks' Stage 37 (See Figure 1). Make only one application per season. Do not graze or feed live-stock forage or harvest treated crop for hay or silage. Straw may be used for bedding. As of the writing of this guide the label states, "Rotation crops: To avoid possible illegal residues, (1) Do not double-crop treated acreage where Tilt is applied to the first crop. (2) Do not graze or feed forage, fodder, or straw from rotational crops planted in the fall or the spring following treatment."
Barley, oats, rye, wheat	Helmintho- sporium leaf blight, Septoria leaf, glume blotch, and tan spot	mancozeb	Dithane M-45	2.0 lbs	Make first application when flag leaf is fully emerged (Feekes' stage 10 or Zadoks' 45) (See Figure 1) and repeat when grain head is visible about 10-12 days later). Do not make last application with 26 days of harvest. Livestock may not graze in treated areas within 26 days of last treatment. Penncozeb is only registered for use on wheat.
		mancozeb	Dithane M-45 Flowable	1.6 qts	
mancozeb	Manzate 200	2.0 lbs			
mancozeb	Penncozeb	2.0 lbs			
Barley, wheat, rye	Helmintho- sporium leaf blight, Septoria leaf and glume blotch	propiconazole	Tilt 3.6EC	4.0 fl oz	Apply not later than flag leaf emergence (Feekes' Stage 8 or Zadoks' 37) (See Figure 1). Make only one application per season. Do not graze or feed livestock treated forage or harvest treated hay or silage. Straw may be used for bedding. As of the writing of this guide the label states, "Rotation crops: To avoid possible illegal residues, (1) Do not double-crop treated acreage where Tilt is applied to the first crop. (2) Do not graze or feed forage, fodder, or straw from rotational crops planted in the fall or the spring following treatment."

Figure 1. Stages of growth of small grains.

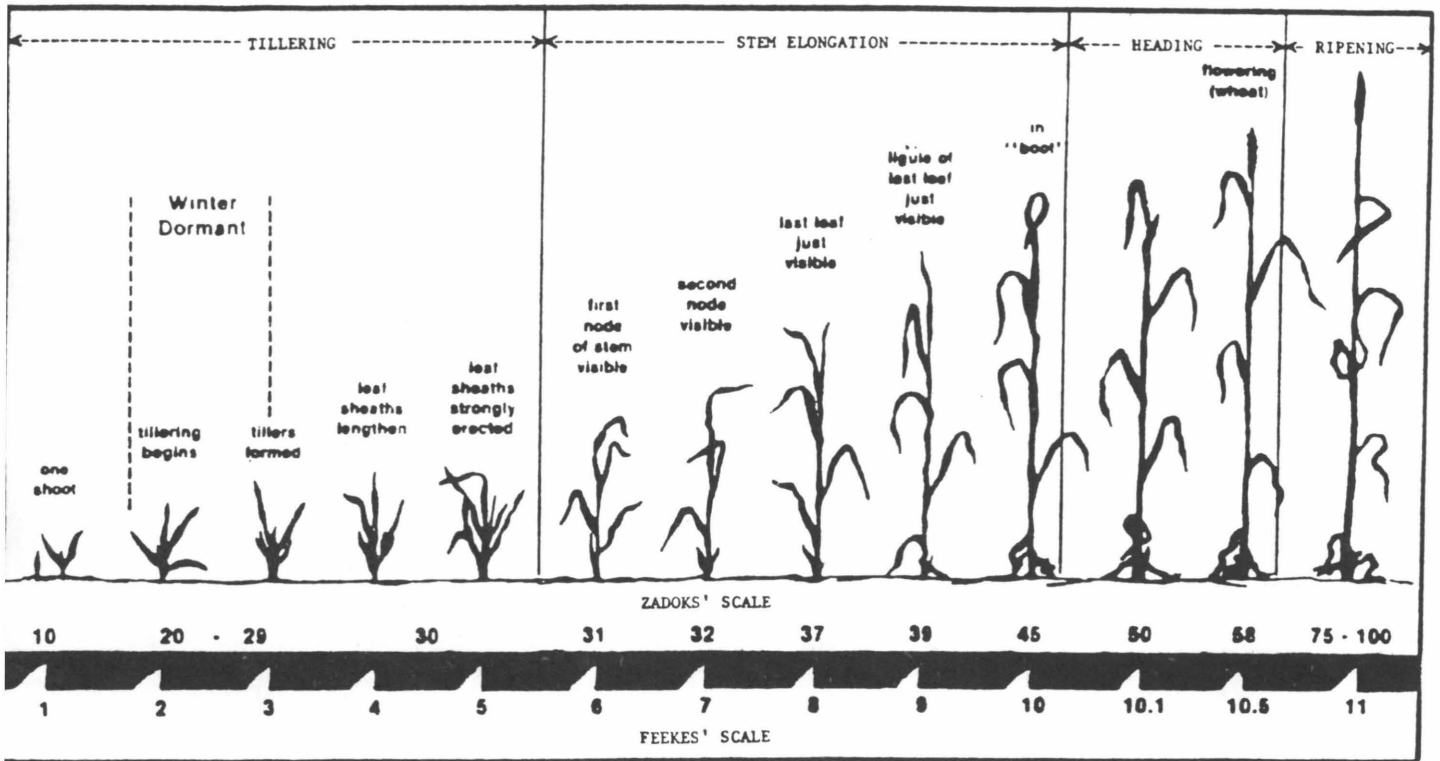
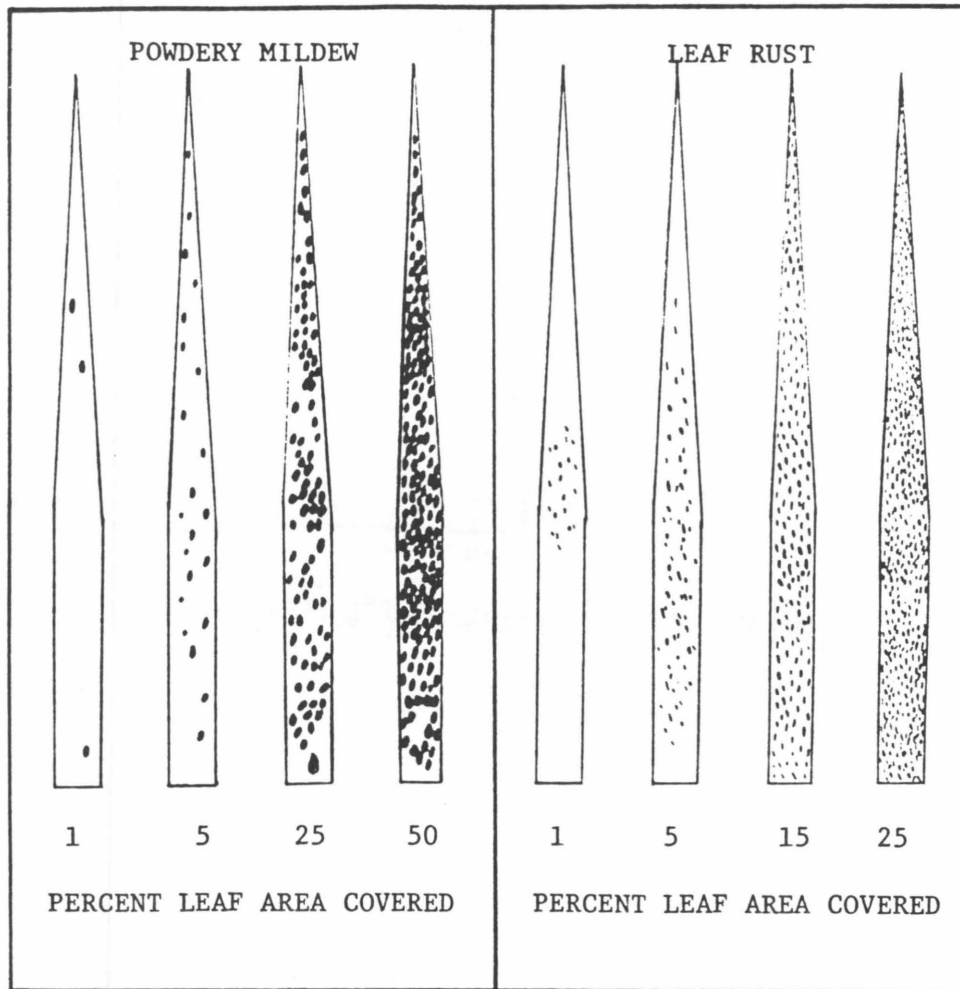


Figure 2. Percent leaf area affected by powdery mildew and leaf rust (After C. James. 1971. A Manual of Assessment Keys for Plant Diseases, Canada Department of Agriculture, Publication No. 1458).



Forage Crop Diseases

Disease control in forage crops is a long-term management problem. Planting locally adapted, disease resistant cultivars and using good cultural practices will help reduce losses from diseases. Stand establishment of forage legumes may benefit from the use of seed protectant fungicides, particularly in spring, no-till seedings, or other conditions that may slow the germination process. In general, cool, wet soil conditions favor seed decay and damping-off diseases.

Crop	Disease	Fungicide Common Name	Fungicide Trade name	Remarks
Alfalfa, clover lespedeza, trefoil, vetch, forage beans, forage soybeans, forage cowpeas, forage velvet beans, and pea vine hay	<i>Pythium</i> spp. damping-off and early season <i>Phytophthora</i> spp. rot	Metalaxyl	Apron 25W	Apply seed treatment materials in a slurry or with commercial mist type equipment. Use 2 oz/ 100 lb of seed. This material can be combined with other other registered fungicides for the control of other seed- and soil-borne diseases.
Alfalfa, clover, lespedeza and trefoil	Seed decay and damping-off	Captan	Captan 400 Captan 400-DD Orthocide 4 Flowable	Apply as a slurry. Follow label instructions.
Alfalfa, clover and other small seeded	Seed decay and damping-off	Thiram	Thiram-30 Flowable	Apply as a slurry. Follow label instructions.

Insect Control for Field Crops

J.L. Hellman, A. Brown and G.P. Dively, The University of Maryland

J. Roberts, J. M. Luna, VA Tech

M. Graustein, University of Delaware

Note: before applying any insecticide to a crop, make sure that a definite insect problem exists. If you are unable to make this determination, contact your county Extension agent for advice or assistance. Use pesticides only when necessary.

Cultural Control Methods

Although the recommendations in this publication deal primarily with chemical control, the use of insecticides on field crops should be considered supplementary to insect control by cultural methods. In most instances, growers who follow accepted cultural practices can expect little trouble from insect pests. This is especially true in the case of insects attacking conventionally tilled field corn.

Some of the most beneficial cultural methods for problem insects affecting field crops are plowing, fertilization and crop rotation.

Deep and clean plowing in the spring destroys insects in the soil (corn earwoms and root aphids) and in dead stalks (European corn borer), as well as those feeding on winter weeds and clover (root webworms and cutworms). Proper fertilization gives corn and other field crops the ability to outgrow insect attacks. Rotating corn prevents trouble with corn root aphids and corn rootworms.

In addition to cultural methods, there are field crop varieties on the market that are resistant to certain insects. For example, some of the field corn varieties show resistance to corn leaf aphids and at least two of the varieties of wheat recommended in Maryland are resistant to Hessian fly.

Note: Any insecticide applied to a crop in bloom will kill honey bees and other pollinating insects. The magnitude of bee loss can be lessened considerably by spraying in late afternoon or evening.

Chemical class, oral LD₅₀^a, worker reentry time, and toxicity of insecticides recommended in this publication

Insecticides	Trade name	Chemical class	Toxicity to Mammals			Worker reentry time in days	Toxicity to		
			Oral LD ₅₀ ^a	Acute oral	Acute dermal		Birds	Fish	Bees
Acephate	Orthene	OP ^b	361	Moderate	Moderate	*	Moderate	Low	NA ^c
Azinphos-methyl	Guthion	OP	11	High	Moderate	1	Moderate	NA	High
Bacillus thuringiensis	Biotrol, Dipel, Thuricide	LO	--	Very low	Very low	*	Very low	Very low	Very low
Carbofuran	Carbaryl	Sevin, C	500	Low	Low	*	Low	Very low	High
	Furadan	C	8	High	Low	*	High	NA	NA
Chlorpyrifos	Dursban, Lorsban	OP	163	Moderate	Moderate	*	Moderate	NA	NA
	Diazinon	OP	76	Moderate	Moderate	*	Moderate	High	High
Dimethoate	Cygon, De-Fend, Rebelate	OP	215	Moderate	Moderate	*	Moderate	Low	High
	Di-Syston	OP	2	High	High	*	Moderate	NA	Moderate
Ethion		OP	70	Moderate	Moderate	1	High	High	Low
Ethoprop	Mocap	OP	62	High	High	*	Moderate	NA	NA
Fensulfóthion	Dasanit	OP	2	High	High	*	High	NA	NA
Fenvalerate	Pydrin	P	450	Moderate	Low	*	NA	High	High
Fonofos	Dyfonate	OP	16	High	High	*	Moderate	NA	NA
Lindane		CH	88	Moderate	Moderate	*	Moderate	High	High
Malathion	Cythion	OP	1,000	Low	Low	*	High	High	High
Methodathion	Supracide	OP	25-65	High	Moderate	*	NA	NA	NA
Methiocarb	Mesurob	C	130	Moderate	Low	*	High	High	High
Methomyl	Lannate, Nudrin	C	17	High	Moderate	*	Low	NA	NA
Methoxychlor	Marlate	CH	5,000	Low	Low	*	Low	High	Low
Methyl parathion		OP	14	High	High	2	High	Low	High
Microencapsulated methyl parathion	Pennacap-M	OP	270	Low	Low	*	High	High	High
Monocrotophos	Azodrin	OP	8	High	Low	1	High	High	High
Parathion		OP	3	High	High	2	NA	NA	High
Permethrin	Ambush, Pounce	P	4,000	Low	Low	*	NA	High	High
Phorate	Thimet	OP	1	High	High	*	Moderate	NA	Moderate
Phosmet	Imidan	OP	147	Moderate	Low	*	Moderate	NA	NA
Terbufos	Counter	OP	4	High	High	*	High	High	NA
Thiodicarb	Larvin	C	66	Moderate	Low	*	NA	NA	Moderate
Trichlorfon	Dylox, Proxol	OP	560	Low	Low	*	Moderate	Low	Low
Trimethacarb	Broot	C	566	Moderate	Low	*	High	High	NA

* Worker cannot enter a treated field without protective clothing until the spray has dried or the dust has settled.

^aBased on technical product.

^bC = carbamate; CH = chlorinated hydrocarbon; LO = living organism; OP = organic phosphate; P = (synthetic)/Pyrethoid.

^cNA = Not available.

Restricted and general use pesticides

Insecticide	Restricted (R) or general (G) use ^a	Insecticide	Restricted (R) or general (G) use ^a
Acephate	G	Methidation	R6
Azinphos-methyl	R3	Methiocarb	G
Bacillus thuringiensis	G	Methomyl	R 4, 8
Carbaryl	G	Methoxychlor	G
Carbofuran	R 1, 2, 3	Methyl parathion	R 2, 4, 6, 8
Chlorpyrifos	G	(microencapsulated)	R 2, 4, 6, 8
Diazinon	G	Monocrotophos	R 6, 8
Dimethoate	G	Parathion	R 2, 3, 6, 7, 8
Disulfoton	R 2, 3	Permethrin	R 7
Ethion	G	Phorate	R 2, 6, 8
Ethoprop	R 2	Phosmet	G
Fensulfothion	R 2, 3	Terbufos	R 1, 2
Fenvalerate	R 7	Thiodicarb	G
Fonofos	R 2	Trichlorfon	G
Lindane	R 5	Trimethacarb	G
Malathion	G		

^aReasons for restrictions are as follows: R 1 = acute oral toxicity; R 2 = acute dermal toxicity; R 3 = acute inhalation toxicity; R 4 = accident history; R 5 = possible oncogenicity; R 6 = effects on birds; R 7 = effects of fish or other aquatic life; and R 8 = effects on terrestrial wildlife.

ALFALFA

Sampling. Sampling for weevil larvae should begin in mid April in order to apply insecticide treatments when necessary. Fields should be sampled on a weekly basis during May. Randomly walk through the field in a "W" or zigzag pattern and collect one entire stem from 30 locations. Place these stems top first in a bucket. After collecting the stems from all the larvae found. Measure 10 stems to get an average plant height for the field.

Decision making. The following tables can be used to make a control decision. To use the tables:

- . Use plant height category that fits the field.
- . Estimate the cost to spray an acre.
- . Estimate the value of crop in dollars per ton of hay equivalent.
- . Find the number of alfalfa weevil larvae from a sample of 30 stems from monitoring the field.
- . In the appropriate table, find the number of larvae that corresponds to the value of the crop and the cost of spray. This is the number of larvae per 30-stem sample that is required before a spray applicaiton would be profitable under these conditions.

Category I plant height, 12-18 in ^a						
Value of hay per ton in dollars	Cost of insecticide application per acre in dollars					
	8	10	12	14	16	20
	Number of larvae per 30-stem sample					
80	68	85	102	119	136	171
100	54	68	81	95	108	137
120	45	57	68	79	91	114
140	39	49	59	68	77	99
160	34	43	51	60	68	86

^aThis table was developed by Pennsylvania State University entomologists for their alfalfa pest management program.

Category II plant height, 18-24 in ^a						
Value of hay per ton in dollars	Cost of insecticide application per acre in dollars					
	8	10	12	14	16	20
Number of larvae per 30-stem sample						
80	75	97	113	131	150	186
100	62	75	90	105	120	149
120	50	62	75	87	100	124
140	43	54	64	75	86	107
160	37	47	56	65	75	93

^aThis table was developed by Pennsylvania State University entomologists for their alfalfa pest management program.

Category III plant height, 24-30 in ^a						
Value of hay per ton in dollars	Cost of insecticide application per acre in dollars					
	8	10	12	14	16	20
Number of larvae per 30-stem sample						
80	78	97	117	137	157	195
100	63	78	94	110	126	156
120	52	65	78	91	105	130
140	45	56	67	78	90	112
160	39	49	58	68	79	98

^aThis table was developed by Pennsylvania State University entomologists for their alfalfa pest management program.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Alfalfa weevil					
Carbofuran (Furadan) ^a 4F	0.25-1 lb	0.5-2 pt	When 50% or more of tips show weevil feed- ing before full-bud stage.	7-28	Follow label directions carefully.
Chlorpyrifos (Lorsban) 4E	0.5-1 lb	1-2 pt	Use IPM guidelines described above	14-21	Some temporary yellowing may occur after application but this will disappear within a week and not cause yield loss.
Methidathion (Supracide) 2ED	0.5-1 lb	1-2 qt		10	This material also labeled for aphids.
Methomyl ^a (Lannate L)	0.9 lb	4 pt		7	Also labeled for beet armyworm and lygus bugs.
Methoxychlor EC PLUS malathion EC combination	1 lb 1 lb	2 qt	(for the combination)	7	This combination also will con- trol pea aphid and meadow spittlebug.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Microencapsulated methyl parathion (PennCap-M) 2 lb/gal	0.5-0.75 lb	2-3 pt		15	Do not use screens or nozzles finer than 50 mesh. Mix with other EC formulated products only when compatibility is known. PennCap-M is highly toxic to bees. Do not spray alfalfa in bloom or allow to drift to weed blooms on which bees are foraging.
Phosmet (Imidan 50% WP)	1 lb	2 lb		7	Do not apply more than once per cutting.

Note: To avoid injury to honeybees, do not apply insecticides during bloom.

Potato leafhopper

Sampling. Begin scouting established alfalfa fields the 1st week after the first cutting. New field seedings should be sampled beginning in late May. Resample each field once a week. Use a 15-in sweep net anytime during the day as long as the foliage is dry. Sweeping wet alfalfa is difficult and the samples are almost impossible to count. Take 20 sweeps at each of five locations in the field. Count the number of adult and nymphal leafhoppers and record the numbers per 100 sweeps. Examine 20 random stems to determine average stem height and the percentage of plants in the bud or flower stage.

Decision making. Use the following table to determine when to apply leafhopper control. If leafhopper counts exceed the critical values at the appropriate alfalfa height, control is recommended. If alfalfa is more than 60% bud or in flower, plan to harvest within 7-10 days and avoid spraying. However, resample the field soon after cutting to determine the need for control.

Economic threshold for potato leafhopper

Average stem height in inches	Number of leafhoppers per sweep	Number of leafhoppers per 100 sweeps
Less than 3	0.2	20
4-6	0.5	50
7-10	1.0	100
11-14	2.0	200

Carbaryl (Sevin) 80S (Sevinmol-4) 4 lb/gal	1 lb	1.25 qt	No time limits	Highly toxic to bees; avoid spraying weeds in bloom or alfalfa beyond 10 percent bloom.
Carbofuran (Furadan) 4F ^a	0.5-1 lb	1-2 pt	14-28	Follow safety precautions on the label.
Chlorpyrifos (Lorsban) 4E	0.5-1 lb	1-2 pt	14-21	Some temporary yellowing may occur after application but this will disappear within a week and not cause yield loss.
Dimethoate (Cygon, De-Fend, Dimethogon) 2.67 lb/gal EC (Cygon 400) 4 lb/gal EC	0.43 lb	1 pt	10	Dimethoate also will control aphids and grasshoppers. Make only one application per cutting.
Microencapsulated methyl parathion (PennCap-M) 2F	0.5-0.75 lb	2-3 pt	15	Do not use screens or nozzles finer than 50 mesh. Mix with other EC formulated products only when compatibility is known. PennCap-M is highly toxic to bees. Do not spray alfalfa in bloom or allow to drift to weed blooms.
Methidathion (Supracide) 2E	1-2 lb	2-4 pt	10	Follow safety precautions on label.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Methoxychlor 2 lb/gal EC	0.5 lb	1 qt		7	Use on second or later cuttings.
Phosmet (Imidan) 50WP	1 lb	2 lb		7	Follow safety precautions on label.

^aRestricted use pesticide.

Note: do not wait until yellowing occurs. These materials should be used as a preventative treatment after hoppers first appear.

Grasshopper

Carbaryl (Sevin) 80S (Sevimol-4) 4 lb/gal	1.5 lb 0.5-1.5 lb	1.8 lb 0.5-1.5 lb		No time limits	Usually only a problem during drought and in new fall field seedings.
Malathion (Cythion) 57% EC	1.25	1 qt		No time limits	
Microencapsulated methyl parathion (Penncap-M) 2F ^a	0.5-0.75 lb	2-3 pt		15	Do not use screens or nozzles finer than 50 mesh. Mix with other EC formulated only when compatibility is known. Penncap-M is highly toxic to bees. Do not spray alfalfa in bloom or allow to drift to weed blooms.
Carbofuran (Furadan) 4F ^a	0.125-0.25 lb	0.25-0.50 pt		7	Follow label directions closely.

Armyworm, cutworm

Carbaryl (Sevin) 80S (Sevimol-4) 4 lb/gal	1.5 lb 0.5-1.5 lb	1.8 lb 0.5-1.5 qt	When insects begin to cause injury	no time limits	A 5-percent Seven bait at 20 lb/A also is effective against cutworms.
Trichlorfon (Dylox, Proxol) 80% SP	1 lb	20 oz		No time limits	Armyworm is primarily a pest of new seedlings. Cutworm is a spring pest.

Pea aphid

Sampling/Decision making. The need to treat for pea aphids is rare (1 year in 10) in Virginia, Maryland and Delaware because lady bird beetles, wasp parasites and other beneficial insects usually control this pest. The best sampling technique requires the same 15-in sweep net used for potato leafhoppers. Ten sweeps at 10 random locations should be used to sample both the aphids and beneficials. If 50 or more aphids per sweep are collected and no beneficials are present, it is recommended that the field be cut early. Avoid spraying first crop because sprays will kill alfalfa weevil parasites.

Dimethoate (Cygon, Defend)	0.43	1 pt		10	One application per cutting.
Malathion (Cythion) 57% EC	1.25	1 qt			No time limits Warm weather favors parasites and predators of aphids; thus control may not be required if the weather forecast predicts a warm trend.
Methomyl (Lannate, Nudrin) ^a	0.45-0.9			—	
Microencapsulated methyl parathion (Penncap-M) ^a 2 lb/gal	0.5 lb	2 pt		15	Penncap-M is highly toxic to bees. Do not spray alfalfa in bloom or allow to drift to weed blooms on which bees are foraging.
Carbofuran (Furadan) ^a 4 lb/gal F	0.25-1 lb	0.5-2 pt	7-28		Follow label directions carefully.

CORN

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Seed-corn maggot					
Diazinon	--	Check label	Treat seed according to label directions before or at planting	0	Prevention treatment is advised on early and no-till plantings before soil is warm enough to promote quick germination.
Lindane (seed treatment)	--			0	Old sod fields, pasture, heavily manured fields, and fields with previous history of maggot damage should be treated regardless of planting time or type of tillage. Note: a formulated Lindane/diazinon combination such as Agrox D-L Plus also can be used.
(Lorsban) chlorpyrifos (seed treatment)	--	Check label		0	
Note: also check the label of the northern corn rootworm and wireworm insecticides for seed-corn maggot control information.					
<i>White grub sampling/Decision making.</i> Sampling should be done 2-3 weeks before planting. Ten to twenty, 1 ft samples should be selected at random per 10 acre field and the soil dug out to the 6-in level. Treatment may be required if counts exceed 0.5 grub per square foot. Most grub species complete their feeding stage by early May in Virginia to mid-May in Maryland and Delaware. Late-planted corn and conventional tilled corn are at lower risk for damage.					
White grub					
Chlorpyrifos (Lorsban) 15G		8-16 oz/1,000 ft row	At planting infurrow or T-Band	0	Planting into pastures, old sod fields, or following soybeans may be at high risk for grub damage.
Terbufos (Counter) 15G ^a		8-16 oz/1,000 ft row	Banded at the high rate	0	
Phorate (Thimet) 15G ^a		6 oz/1,000 ft	Banded	0	
<i>Wireworm sampling/Decision making.</i> First year corn following established sod frequently is attacked by wireworms. Early sampling before planting should include bait stations. Two paired bait stations per acre are made by placing 1/2 cup of an equal mixture of untreated corn/wheat in the soil 4 in deep and 9 in wide. Set bait stations in fields to be planted at least 3 weeks before planting date. Check by digging in about 2 weeks and record the number of wireworms for each station. Economic thresholds for wireworms have not been established on corn; however, if wireworms are found in all bait stations it is recommended to treat the field for control.					
Wireworm					
Carbofuran (Furadan) 15G ^a	1 lb	8 oz/1,000 ft of row		0	Furadan applied in furrow preferred.
Chlorpyrifos (Lorsban) 15G	2 lb	16 oz/1,000 ft of row		0	
Diazinon 14G	3 lb	21 lb	Broadcast and disk in before planting. Follow directions on label.	0	
Fonofos (Dyfonate) 20G ^a	4 lb	20 lb	Broadcast and disk in before planting. Follow directions on label.	0	Fonofos also is formulated as a 10G and thus requires 40 lb of product per acre.
Terbufos (Counter) 15G ^a	1-2 lb	8-6 oz/1,000 ft row	Banded or in-furrow treatment at planting. Check label for details.	0	

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
<p><i>Cutworm sampling/Decision making.</i> Late-planted minimum till fields with heavy spring weed growth on poorly drained soils are the most likely to encounter cutworms. Cornfields should be checked twice a week from the spike through the 5-leaf stage. Leaf feeding is the first sign that cutworms are present. Look for small, irregular holes in leaves and cut plants. Note any leaf feeding that may have resulted from cutworms too small to cut plants and check these areas again in 24-48 hours. If cutworms are present, examine at least 10 sets of 20 plants throughout the field and record the percentage of cut or damaged plants. At the same time, look under clods and trash and dig 1-2 in deep around the base of damaged plants to find cutworms. Record the average size and number of cutworms.</p> <p>As a general guideline, before the 3- to 5-leaf stage, a rescue treatment should be applied if 10% or more of the young plants show fresh leaf feeding and cutworms are present. At the 3- to 5-leaf stage, treatment should be applied if 5% of the plants are cut and there are four or more cutworms per 100 plants.</p>					
Cutworm					
Microencapsulated methyl parathion (PennCap-M) ^a	1.0 lb	4 pt		12	Fields with high populations of weeds such as dock, yellow rocket and coarse grasses are highly favorable to the female cutworm for egg laying. Best control obtained when young larvae are treated.
Permethrin (Pounce) 3.2EC ^a	0.1-0.2 lb	4-8 oz	Preemergent or postemergent	0	This material may be used in a tank mix for preemergent use.
(Ambush) 2E	0.1-0.2 lb	6.4-12.8 oz	Broadcast or banded	0	Check label for details. Should be applied from 5 days before planting up to emergence.
Chlorpyrifos (Lorsban) 15G Lorsban 4E	1.0-2.0 lb	8 oz/1,000 ft/row 2-4pt	Preemergent and foliar uses. For surface cutworms apply just before planting or when larvae first appear, and work into soil 1-2 in. For subterranean cutworms, apply just before planting, and work into soil 3-6 in or apply to no-till corn in a "T" band.	35	The 4E formulation may be tank mixed with herbicides. See label for instructions
Diazinon 14G	2 lb	14 lb		0	
Fenvalerate (Pydrin) 2.4EC ^a (Asana) 1.9EC ^a	0.1-0.2 lb 0.025-0.05	5.33-10.66oz 1.7-3.4 oz	Preemergent, tank mixed or foliar uses--banded or broadcast	21	
Trichlorfon (Dylox, Proxol) 80% SP	1 lb	20 oz		28	Postplanting treatments are most effective against cutworms when applied in late afternoon or evening.
<p><i>True armyworm sampling/Decision making.</i> Survey field edges where margins border small grains or large grassy areas and watch for damaged plants. If armyworm damage is seen, examine 20 plants at each of five locations within the field and record the percentage of damaged plants, the average size, and the severity of injury.</p> <p>Spot treatments may be warranted if infestations are confined to small areas. Control for armyworms is recommended if 35% or more of the plants are infested and 50% or more defoliation is seen on the damaged plants, provided that larvae average less than 0.75 in long. Worms greater than 1.25 in in length usually have completed their feeding.</p>					
True armyworm					
Carbaryl (Sevin) 5% bait	1-2 lb	20-40 lb		0	No-till fields planted with a small grain cover crop, pastures and weedy fields all have a high risk of armyworm infestations.
Methomyl (Lannate-Nudrin) 1.8 lb/gal	0.25-0.5 lb	1-2 pt		0	
Microencapsulated methyl parathion (PennCap-M) ^a	0.5-0.75 lb	2-3 pt		0	Must check label for spraying instructions before use.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Permethrin (Pounce) 3.2EC (Ambush) 2E ^a	0.1 lb	4 oz	Postemergence, tank mixed or postemergent foliar	0	Check label for tank mix details.
Fenvalerate (Pydrin) 2.4E ^a (Asana) 1.9EC ^a	0.1 lb 0.025-0.05	5.33 oz 1.7-3.4 oz	Preemergent or tank mix with herbicides	12	
Trichlorfon (Dylox, Proxol) 80% SP	1 lb	20 oz		0	Armyworms usually migrate from small grains starting in late May.
Chlorpyrifos (Lorsban) 4E	1 lb	1 pt		35	

^aRestricted use pesticide.

Slug, snail sampling/Decision making. Slugs feed at night; thus, late evening observations are required for population estimates. To estimate populations, turn over clods of dirt and surface trash around five plants at 10 locations and determine the average number of slugs associated with each plant. Populations of five more slugs around each plant at spike until the 3-leaf stage may warrant treatment, especially if injury is heavy, plant growth is slow, and cool, wet conditions prevail. Under dry weather but warm growing conditions, 10 or more slugs per plant may be tolerated in early spring.

Slug, snail Mesuroil 75WP	Bait	Prepare bait by applying 2/3 lb Mesuroil to 100 lb cracked corn. Add 1-2 pt water to mixture. Apply 20 lb of prepared bait per acre by means of cyclone seeder when slug or snail damage becomes apparent. Apply only once per season. Application should be made in late afternoon or early evening. Moderate to heavy rains may deactivate the bait, so application should be made during dry weather. Allow 3-4 dry days for control.	Do not apply within 80 days of harvest	Slugs can become serious pests in no-till fields during spring periods of cool, wet weather. Field with heavy layers of manure, crop refuse or thick weed cover run a higher risk of infestation.
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Stalk borer sampling/Decision making. Refer to the sampling procedures for true armyworm. For stalk borers, treatment is suggested if more than 4, 6 and 10% of the plants are initially damaged at the 2-, 3-, and 4-leaf stages, and the worms have not bored into the stalks. Good weed control eliminates egg laying sites. Increased seeding rates should be used in high-risk fields.

Stalk borer Fenvalerate (Pydrin) 2.4E ^a (Asana) 1.9EC ^a	0.2 lb 0.025-0.05	10.66 oz 1.7-3.4 oz	Preemergent or tank mix with herbicides	21	Apply before borers enter emerging corn plants. More than one application may be required.
Chlorpyrifos (Lorsban) 4E	1.0-1.5 lb	1-3 qt	Preemergent or tank mix with herbicides.	35	Damage may be spotty or restricted to weedy areas in the field. No-till fields with history of economic damage have a higher risk of injury.
Permethrin (Pounce) 3.2EC 1.5G Ambush 2EC	0.1-0.2 lb 0.1-0.2 lb	4-8 oz 6.7-13.3 lb --			

Garden symphylan sampling/Decision making. Due to the symphylan's sensitivity to low soil moisture, it moves rapidly up and down in the soil profile. Thus, the typical root hair pruning damage and the purple leaf color may be present but the symphylan may have retreated 2-3 ft into the soil. No sampling method available.

Garden symphylan Fonofos (Dyfonate) 20G ^a	2 lb	10 lb	Broadcast and disk into infested areas before planting	0	Treat only if field history indicates heavy infestations.
Terbufos (Counter) 15G ^a		8-16 oz/1,000 ft of row	Banded or in-furrow treatment at planting. Check label for details.	0	

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Chlorpyrifos (Lorsban) 15G		8-12 oz/1,000 ft of row	Banded at planting. Check label for details.	0	

Northern corn rootworm, western corn rootworm

Sampling. In areas with known rootworm problems, survey each field 2 or 3 times during late July to early August to determine the number of egg laying adults. Scout five locations per 40 A and count the number of northern and western corn rootworm adults on 10 plants at each site. Since the western species is at least twice as destructive as the northern species, multiply the number of western corn rootworm adults by 2 and add to the total of northern corn rootworms before calculating the average per plant.

Decision making. If the average count exceeds two per plant, then a soil insecticide is recommended if the field is to be planted in corn next year. An average count between one and two indicates a moderate potential. Treatment is not necessary if the count falls below one per plant. Or, if the stand is known, treat when the average number of beetles exceeds the table values listed below.

Average number of plants per acre	Average number of beetles per plant continuous corn
14,000	2.8
16,000	2.6
18,000	2.2
20,000	2.0
22,000	1.8
24,000	1.6
26,000	1.6
28,000	1.4

Modified from table developed by Extension entomologists, Purdue University.

Example. Stand count = 18,000 plants. Beetle count = 40 NCR + 80 WCR from 50 plants.

$$\begin{array}{r} \text{WCR damage} \\ 80 \text{ WCR, } 40 \text{ NCR} \\ \times 2 \\ \hline 160 + 40 \\ \hline = 200 \text{ beetles per } 50 \text{ plants} \end{array}$$

Table value for 18,000 = 2.2 beetles

Sample value 200 beetles/50 plants = 4.0 beetles average per plant

Action. Treat next season because our sample value exceeds the table value of 2.2.

**Northern corn rootworm,
western corn rootworm**

Carbofuran (Furadan) 10G ^a	12.3 oz/1,000 ft of row	Apply any one of the materials listed at planting time according to directions on label. Some of the rootworm materials listed also may be applied as a basal sidedress. Check and follow label directions carefully.	0	Rootworm treatments may be necessary only on land with a definite history of infestation that is planted continuously in corn. Some of the rootworm compounds also will control seed corn maggot or other pests. Check label. Some of these materials are formulated as EC's. Note: fields planted with 1st year corn normally do not require rootworm controls.
(Furadan) 15G	8 oz/1,000 ft of row			
Larval control only				
Chlorpyrifos (Lorsban) 15G	8 oz/1,000 ft of row			
Diazinon 14G	8.5 oz/1,000 ft of row			
Ethoprop (Mocap) 10G ^a	12 oz/1,000 ft of row			Note: not all fields have rootworm problems, particularly those on Delaware-Maryland-Virginia Eastern Shore.
Fonofos (Dyfonate) 20G ^a	6 oz/1,000 ft of row			See previous remarks.
Phorate (Thimet) 15G ^a	8 oz/1,000 ft of row			See previous remarks.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Terbufos (Counter) 15G ^a		8 oz/1,000 ft of row	0		See previous remarks.
Trimethacarb (Broot) 15G ^a		8 oz/1,000 ft of row	90		See previous remarks.

European corn borer during the whorl stages

Sampling. Corn should be checked each week for larval feeding in the whorls starting when the plants reach 18-24 in high. Examine 20 consecutive plants in five different areas of the field. Determine the percentage of plants with fresh whorl feeding. Newly hatched larvae feed on the leaves, causing a characteristic "window pane" or "shot-hole" injury that is readily visible as the whorl unrolls. Dissect five infested plants at each location to determine the location and number of live larvae in the whorl or stalk.

Decision making. One borer per plant may reduce yields by 5%. For corn grown under average management conditions, treatment is suggested only if 80% or more of the plants have fresh whorl feeding with live larvae.

The use of carbofuran at planting depends on the likelihood of encountering an economic infestation of corn borers within the first 4-5 weeks. The following guidelines will help determine the highest risk of European corn borer damage to corn and obtain maximum efficacy from soil systemic insecticides based on the time of corn planting. Early plantings (before dogwood bloom) run the highest risk of chemical breakdown or leaching before European corn borer larvae hatch several weeks later, thus planting has a lower rate of European corn borer damage. Midseason plantings (dogwood to crimson clover bloom period) have the highest risk of European corn borer damage, thus the higher rates of soil systemic insecticide should have maximum effect. Late-season plantings (after mid-May) are the lowest European corn borer risk plantings; therefore, preventative treatment is not recommended. However, the best control strategy is scouting followed by a rescue treatment when European corn borer counts exceed action thresholds.

NOTE: Corn grown for silage need not be treated for the European corn borer.

European corn borer

Carbaryl (Sevin) 80S	2 lb	2.5 lb	Note: observing fresh feeding signs generally is not reliable for population estimates. Damaged plant counts generally are higher than exact live borer counts.	0	Direct spray or granules into whorl. Follow label directions carefully.
Carbofuran (Furadan) 15G ^a	1 lb	6.7 lb	A foliar whorl stage treatment recommended rather than at planting treatment	0	Do not make application if Furadan was applied at more than 8 oz/1,000 row ft at planting. Do not make more than two treatments per season.
(Furadan) 4F ^a	0.75-1 lb	1.5-2 pt	Foliar when eggs begin to hatch	30	Do not make more than two applications per season.
Permethrin (Pounce) 3.2EC ^a	0.1-0.2 lb	4-8 fl oz	Foliar when eggs begin to hatch		Application must be made before brown silk stage.
(Pounce) 1.5G ^a (Ambush) 2EC ^a	0.1-0.2 lb 6.7-13.3 lb	0.1-0.2 lb 6.4-12.8 oz	Foliar when eggs begin to hatch		
Chlorpyrifos (Lorsban) 4E 15G	0.75-1.0 lb	1.5-2 pt 8.7 lb			5-6.5 lb formulation when applied by aircraft.
Fenvalerate (Pydrin) 2.4EC ^a (Asana) 1.9EC ^a	0.15-0.2 lb 0.04-0.05 lb	8.0-10.6 oz 2.7-3.4 oz		21	High rate required for moderate to heavy populations.
Methyl parathion (PennCap-M) 2FM ^a	0.25-0.38 lb	2-3 pt			2 pt ground, 3 pt aerial
Phorate (Thimet) 20G ^a	1 lb	5 lb			
Bacillus thuringiensis Dipel 10G	Biological insecticide		10 lb or 12.24 oz/1,000 ft row		One of the safest options--oral LD ₅₀ 20,000 mg/kg

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Flea beetle Carbaryl (Sevin) 80S	2 lb	2.5 lb	Spray young plants when beetles become abundant	0	Treat only if infestation is heavy. Ten or more adults per 1- to 2-leaf stage plant. No preemergence treatments recommended. Note: flea beetles rarely require control.
Methyl parathion ^a (PennCap-M) 2FM ^a		2-3 pt			
Fenvalerate (Pydrin) 2.4E ^a (Asana) 1.9EC ^a	0.1-0.2 lb 0.025-0.05 lb	1.7-3.4 oz			
Chlorpyrifos (Lorsban) 4E		2-3 pt			
Grasshopper Microencapsulated methyl parathion (PennCap-M) ^a	0.25 lb	2 pt		0	Treat field margins when young grasshoppers enter the field from roadsides. Treatment of the entire field seldom necessary.
Fenvalerate (Pydrin) 2.4E ^a (Asana) 1.9EC ^a	0.1 lb 0.025-0.05 lb	5.33 oz 1.7-3.4 oz		0	
Chlorpyrifos (Lorsban) 4E	0.25 lb	0.5-1 pt		35	
Carbaryl (Sevin) 80WP	5.3 lb	0.66 lb		0	
Malathion	1.0 lb	1.5 lb		5	
Carbofuran (Furadan) 4F ^a	0.75-1.0 lb	1.5-2 pt		0	Do not make a foliar treatment if more than 8 oz of 15 G/1,000 row ft was applied at planting.
Dimethoate (Cygon 400) 4E	0.75-1.0 lb	1.5-2 pt		14	
Mite Carbophenothion (Trithion) 8EC ^a	1 lb	1 pt	Apply only once per season	21	Mites increase rapidly usually after an extended dry period. If mites are infesting adjacent soybeans, they also may be found damaging corn. Note: this pest is difficult to control.
Diazinon 4E	0.5 lb	1 pt		0	
Disulfoton (Disyston) 8E ^a	0.5-1 lb	0.5-1 pt		28	
Dimethoate (Cygon 400) 4E	0.5 lb	1 pt		14	
Ethion 8E ^a	1 lb	1 pt		50	
<i>Corn leaf aphid sampling/Decision making.</i> Examine 20 plants in five areas of a field. This aphid species rarely approaches damaging levels because of natural control agents such as lady beetles, lacewings, flower fly predators, and wasp parasites. Treat when 25% of the plants are heavily infested and tassels are 50% out and no beneficials are present. Timing is critical.					
Corn leaf aphid Diazinon 4 lb/gal EC	1 lb	1 qt	When 25% of the plants are heavily infested and tassels are 50% out. Timing is critical.	No time limit	Use resistant hybrids if available.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Malathion (Cythion) 57%EC	1.25 lb	1 qt		5	
Microencapsulated methyl parathion (PennCap-M) ^a	0.5-0.75 lb	2-3 pt			

Japanese beetle (adults) sampling/Decision making

Sampling should begin immediately before pollination to determine the number of beetles present and the potential for silk clipping damage. Pollination takes place during a period of about 36 hours. If the silks have wilted and/or turned brown, pollination is over and silk feeding will not affect yields. Examine 20 plants in five areas of a field to determine the stage of pollination, the number of beetles per plant, and the number of silks cut back to 0.5 in or less. An insecticide treatment may be necessary if 50% of plants have silks cut back to 0.5 inch or less and beetles are present and the plants are still pollinating.

Japanese beetle (adults) Carbaryl (Sevin) 80S	2 lb	2.5 lb	When beetles average over 3 on fresh silks and less than 50% of plants are in silk	No time limits	Direct spray to fresh silks. If corn has been pollinated, there usually is no need for control. Most earworm and borer insecticides also will control beetles.
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Fall armyworm sampling/Decision making

All late-maturing corn, either silage or grain, should be scouted before tassel emergence. Examine 20 consecutive plants in five areas of the field for the presence of whorl feeding.

Larvae will feed in the whorls of the plants causing a shredded or ragged appearance. They may burrow deep enough into the whorl to feed on the growing tip. However, plants infested with fall armyworm generally recover and it is difficult to identify infested plants at harvest. An insecticide treatment should only be considered if 75% of the plants grown for grain exhibit whorl feeding and you can find an average of one larvae per plant. This threshold drops to 50% if you find two or more larvae per plant.

Not recommended to treat silage corn in Maryland.

Fall armyworm Methomyl (Lannate, Nudrin) 1.8 lb L	0.45 lb	2 pt	Spray young plants when fall armyworms infest 15-20% of the plants	0	Important: direct spray into whorl and use a minimum of 50 gal of water per acre. Controls rarely required for silage corn. Please check product label for safety precautions.
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SMALL GRAINS (Barley, Wheat and Oats)

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Time limits: days before harvest	Remarks
<i>Armyworm</i>				
<i>Sampling.</i> Armyworms should be detected while they are still small and easier to control. Check fields once each week starting the 2nd week of May. First examine the debris and undergrowth on the ground surface along field margins and lodged areas. Small worms usually are found curled in a C-shape around the base of the plants or under the debris. Armyworm frass or droppings also may be found on the soil surface. If small armyworms are present in these areas, obtain 10-20 worm counts at 50-pace intervals throughout the field. Note the average size of the worms and whether any defoliation of the flag leaf and/or head clipping has occurred.				
<i>Decision making.</i> As a general guideline, barley should be treated if the number of armyworms exceeds one per linear foot between rows and most of the worms are less than 0.75 in long. Fields with mixed infestations of armyworms and sawfly caterpillars may need treatment even if worm counts of each pest do not exceed threshold levels.				
Since armyworms tend to nibble on the tips of wheat kernels rather than clip heads, populations around two to three worms per linear foot between rows are required to justify control in wheat. In high management fields with 4-in rows, treatment is recommended when armyworm levels exceed three to five per square foot on surface area.				
If the grain crop is close to harvest or the majority of armyworms are longer than 1.5 in and no head clipping has occurred, control may not be needed.				
Armyworm				
Carbaryl (Sevin) XLR	1.2 lb	1.5 lb		
Methomyl ^a (Lannate)	0.225-0.45lb	1-2 pt	7	When larvae are small, and average over one per linear foot of row in barley and five in wheat. Inspect both plants and ground cover of small grains regularly (especially barley fields) starting in early May. Check labels for safety precautions.
Trichlorfon (Dylox, Proxol) 80%SP	1 lb	20 oz	21	
Microencapsulated methyl parathion (PennCap-M)	0.5-0.75 lb	2-3 pt	15	

Grain aphids at tillering during fall and early spring

Sampling. Check grain fields each week starting in the fall or early spring if damage symptoms are evident. Examine 10-20 sites throughout the field. Each site should consist of 5 linear ft of row. More sites may be necessary in large fields. First examine spots of the field that are showing plant stress symptoms, but do not bias your Sampling to these areas. Aphids should be counted on a few plants and then estimated proportionately over the entire area at each Sampling site.

Decision making. Control is rarely needed during the tillering stage. However, treatment is suggested if aphid counts exceed 150 per linear foot of row throughout the field and plant stress is apparent, especially if the greenbug is the predominate species. One exception to this rule applies to wheat under intensive management practices grown in Virginia where the transmission of virus diseases by aphids is more prevalent. Treatment is suggested at the time of side-dressing if aphid counts exceed 15-25 per linear foot of row.

Grain aphids during the heading stage

Sampling. If aphids are active, examine 50-100 heads throughout the field. Do not bias your Sampling by checking a few heads along the field margins where populations normally are higher. Heads should be examined at 10-20 paces starting well into the field. It is important to check for natural enemies at the same time that aphids are being counted. Be careful not to confuse these natural enemies with other pests.

Decision making. The decision to treat depends primarily on the number of aphids, plant maturity and the presence of natural enemies. As a general rule, control is suggested if aphid numbers exceed more than 25 per head, especially if the crop is late and the natural enemy population is low. Control is not advised if the crop is approaching the hard dough stage of if there is good predator/parasite activity. Ratios of one or more predators to every 50-100 aphids are sufficient to achieve biological control.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Time limits: days before harvest	Remarks
Aphids (English grain aphid and greenbugs)				
Dimethoate (Cygon 400) 4 lb/gal	0.43-0.54 lb	0.50-0.66 pt	60	Spring: treat only if aphids are unusually abundant (25 or more head). Fall: Oct-Nov when greenbugs exceed 150/linear ft of row. Small grains usually can tolerate heavier populations of English grain aphid than greenbugs. Use at least 2 gal of water per acre when applied by aircraft.
Malathion (Cythion) 57% EC	1 lb	1.5 pt	7	
Microencapsulated methyl parathion (PennCap-M) 2 lb/gal ^a	0.25 lb	1 pt	15	

Cereal leaf beetle

Sampling. In Maryland the eggs are heavily parasitized. In fact, the rates range from 70-98T; thus, the larval stage will be the best indicator of the potential yield loss. Estimates of larval densities are made by counting the number of larvae observed on a single plant in 10 locations in field, then calculating the number of larvae per plant.

Decision making. A general estimate of loss in wheat is 2-2.25 bu/A per larvae per stem. On the wheat flag leaf, a serious loss in yield can be expected when 50% of the flag leaf surface becomes damaged. This can be accomplished easily by one mature larva per flag leaf. Thus, when larvae average two per stem on oats and one per flag leaf on maturing wheat, controls should be applied. Once wheat has matured and the grain hardened, beetle damage should not reduce yields and controls are not required.

Cereal Leaf Beetle

Carbaryl (Sevin) 80S	1 lb	1.25 lb		
XLR	1 lb	1 qt		
Carbofuran (Furadan) 4F ^a	0.25 lb	0.5 pt	--	Apply before heads emerge from boot.
Guthion ^a	0.38 lb	1.5 pt	30	Primarily a problem on oats but occasionally may attack wheat. Check label for safety precautions.
Malathion (Cythion) 57% EC	1 lb	1.5 pt	7	
Methomyl (Lannate ^a or Nudrin ^a) 1.8L	0.22 lb	1 pt	7	
90 SP	0.22 lb	0.25 lb	7	

Hessian Fly

No insecticidal control practical. Plant wheat only after the Hessian fly safe-planting date in your area. Destroy volunteer wheat plants by tillage methods. Check with your Extension agent for information on resistant varieties.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Time limits: days before harvest	Remarks
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Safe plant dates for Maryland counties

Anne Arundel	Oct. 7	Dorchester	Oct. 9	Queen Anne's	Oct. 7
Allegany	Sept. 27	Frederick	Oct. 2	St. Mary's	Oct. 9
Baltimore	Oct. 2	Garrett	Sept. 20	Somerset	Oct. 10
Calvert	Oct. 8	Harford	Oct. 1	Talbot	Oct. 8
Caroline	Oct. 7	Howard	Oct. 2	Washington	Oct. 1
Carroll	Sept. 28	Kent	Oct. 6	Wilcomico	Oct. 10
Cecil	Oct. 3	Montgomery	Oct. 4	Worcester	Oct. 11
Charles	Oct. 8	Prince George's	Oct. 7		

Safe plant dates for Delaware counties

New Castle	Oct. 3	Kent	Oct. 8	Sussex	Oct. 10
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Grain sorghum

Greenbug Aphid Sampling/Decision making. A minimum of 40 randomly selected plants per field should be examined each week. Aphids are seldom evenly distributed across a field, so examine plants from all parts of the field. Avoid examining only field borders. Examine a greater number of plants for fields larger than 80 A or if making a control decision is difficult.

Consider these factors when making a control decision: the estimates for aphids per plant, leaf damage, percentage parasitized aphids (mummies), and appropriate number of greenbug predators per plant.

Greenbug aphid Malathion 57EC	0.75 lb	1.5 pt	7	Ground application with at least 15 gal water per acre preferred. Aerial application should use at least 5 gal water per acre.
Dimethoate (Cygon, Rebelate) 4E	0.25-0.50 lb	0.5-1 pt	28	
2.67EC	0.22-0.44 lb	0.75-1.5 pt		
Chloropyrifos (Lorsban) 4E	0.25 lb	0.5 pt	30	

Treatment thresholds

Plant size

When to treat

Emergence to about 6 in

Visible damage (plants beginning to yellow) with colonies of greenbugs on plants. Aphid colonies causing red spotting or yellowing of leaves. Before any entire leaves are killed.

Larger plant to boot

Boot to heading

Before the death of one functional leaf.

Heading to hard-dough

When aphid numbers cause death of two normal-sized leaves.

If more than 20% of the greenbugs appear brown and swollen from being parasitized, treatment generally is not necessary and lady bird beetles, lacewing larvae and flower fly larvae are active.

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Time limits: days before harvest	Remarks
Fall armyworm (in whorls) Methomyl ^a (Lannate or Nudrin) 1.8L 90S	0.45 lb	2.0 pt 0.5 lb	14	Difficult to control-ground application or application from helicopter only with high volume. Direct spray into whorls. Treat at 80% infestation (one worm per plant) or 40% infestation (multiple worms per plant). Treat when caterpillars are small. <i>Do not use Lorsban on sweet sorghum.</i>
Chlorpyrifos (Lorsban) 4E	1.0 lb	1 qt	14	

^aRestricted use pesticide.

Fall armyworm and earworm Sampling/Decision making.

Pre-headed sorghum-ragged shothole damage may be evident and at times 40-60% of plant with dramatic heavy leaf damage, but worm control in the whorl stage is rarely justified. Late-whorl heading-begin Sampling heads soon after flowering and continue until the soft dough stage is reached. Sample minimum of 200 plants at 20 sites within a small field 10 A or less. Treat only when larvae damage the head or the developing growing point and worms average two or more per head. Open headed hybrids are damaged less than the compact head types.

Sorghum webworm Sampling/Decision making.

Make frequent head inspections when sorghum is beginning to flower and continue at 5-day intervals until hard dough. To examine heads for sorghum webworm, beat heads on a piece of paper or white handkerchief. Small larvae (less than 0.125 in long) commonly overlooked during head inspections will be detected with this method.

Application of an approved insecticide is suggested when five or more small larvae are found per head.

Corn earworm, fall armyworm, webworm (in seed heads)

Carbaryl (Sevin or Sevimol) 80S	1.6 lb	2.0 lb	21	Ground application with at least 15 gal water per acre is preferred. Aerial application should use at least 5 gal water per acre. Methomyl is preferred for fall armyworm. Use higher rates for serious infestation and by air. Threshold is one medium-to-large earworm or armyworm per head or three webworms per head.
XLR	1.5 lb	3 pt	21	
4L	1.5 lb	3 pt	21	
Methomyl (Lannate or Nudrin) ^a 1.8L 90SP	0.22-0.44 lb	1.0-2.0 pt 2.5-0.50 lb	14	

Sorghum midge Sampling/Decision making.

To determine the presence of sorghum midge, fields should be inspected during midmorning until shortly after noon when midge are most active. Each day a new midge population appears; inspect fields daily. Midge adults can be detected crawling on or flying about flowering grain heads. Use of a clear plastic bag as a trapping device quickly slipped over sorghum heads is helpful in detecting and counting midge adults. Windy weather conditions make the midge more difficult to locate and sample accurately.

To determine the need for chemical control, an assessment of crop development, yield potential and midge density is required. Daily evaluation of these factors is encouraged during flowering.

Midge resistant sorghum hybrids are available commercially and, within limits, provide an additional management tool. At similar infestation levels of ovipositing midge females, resistant hybrids generally suffer one-third the damage that susceptible sorghum hybrids suffer. The antibiosis resistance increases the economic threshold level to five adults per head during flowering compared with one midge per head for susceptible hybrids. When adult midge densities exceed five per panicle during flowering in resistant hybrids, insecticide applications at 5-day intervals are required.

Sorghum midge

Carbaryl (Sevin) 80S	1.4 lb	1.75 lb	21	
XLR	1.5 lb	3 pt	21	
4F	1.5 lb	3 pt	21	
Chlorpyrifos (Lorsban) 4E		0.5 pt	30	Do not apply to sweet sorghum. Do not apply to drought stressed grain sorghum within 3 days of irrigation or rain except when applied in irrigation water.
Methomyl (Nudrin, Lannate) ^a 1.8 90SP	0.22-0.45 oz 0.22-0.45 lb	1-2 pt 0.25-0.50 lb	14 14	
Diazinon 50W	0.25-0.50 lb	0.5-1.0 lb	0 days for foliage feed. 7 for grain	

^aRestricted use pesticide.

SOYBEANS

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
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Mexican bean beetle, green cloverworm

Sampling. During the seedling stage estimate the population of Mexican bean beetle by directly counting the number of beetles and/or larvae per 3 ft or row in at least five locations. After the seedling stage, in rows of 20 in or wider use a 3 by 3 ft shake cloth by placing it between two adjacent rows with sticks flush against the stems. Shake the plants over the cloth and count the number of beetles and larvae that fall on to it. In narrow row beans (less than 20 in) count the number of each stage in 3 ft or row in at least five locations.

Decision making. Spray only when Mexican bean beetles and/or leaf feeding caterpillars are actively feeding. At seeding: spray when defoliation reaches 40% with 2-3 beetles per plant throughout the field. Prebloom: defoliation should exceed 30% with 20 or more adults and/or larvae per 3 ft row. Bloom and podset: defoliation should exceed 15% with 16 or more adults and/or larvae per 3 ft of ros. Note: consider the relative size and age composition of the population. If eggs and pupae of the Mexican bean beetle are the predominant stages. It is advisable to wait until egg hatch or adult emergence before treating. Also consider the presence of natural controls such as cloverworms infected with fungal disease and parasitized Mexican bean beetle larvae (mummies).

Mexican bean beetle, green cloverworm

Bacillus thuringiensis (many brands)*	Biological control	Many formulations follow label directions		0	Bacterial biological control agent. May also help control other caterpillar pests. Will not control beetle or sucking insect pests.
Fenvalerate* (Pydrin) 2.4EC ^a (Asana) 1.9EC ^a	0.05-0.1lb 0.0125-0.025	2.66-5.33oz 0.85-1.7oz	Mexican bean beetles begin to reach peak numbers in Virginia and on the Maryland lower shore in early August. On the Eastern shore and in Delaware they begin to peak during middle to late August. Full season beans in bloom or podding are, in general, most susceptible to economic injury (yield/loss). Note: before spraying for caterpillars, check for diseased ones that appear limp or greenish white. Natural diseases have caused rapid declines in caterpillar populations.	21 21	Check label for precautions
Malathion* (Cythion) 57%EC	1.9 lb	3 pt		3	
Methomyl* (Lannate, Nudrin) 1.8L ^a	0.22-0.45 lb	1-2 pt		14	Wait 3 days to feed or graze as forage or 7 days to feed as hay.
(Lannate LV) 2.4 lb/gal ^a	0.22-0.45 lb	0.75-1.5 pt		14	
Microencapsulated methyl parathion (PennCap-M) 2 lb/gal	0.5-0.75 lb	2-3		20	Do not use screens or nozzle tips finer than 50 mesh. Mix with EC formulated products only when compatibility is known.
Permethrin* (Pounce) 3.2E ^a (Pounce) 25WP (Ambush) 2E (Ambush) 25WP	0.05-0.1 lb 0.05-0.1 lb 0.5-0.1 lb 0.05-0.1 lb	2-4 3.2-6.4 oz 3.2-6.4 oz 3.2-6.4 oz		60 60 60 60	Do not make more than two applications per year. Do not plant rotational crops within 60 days of applications.
Thiodicarb* (Larvin) 3.2F	0.75 lb	30 oz		28	Do not feed forage, hay or straw to livestock. Apply in a minimum of 2 gal finished spray by air or 5 gal by ground.

Thrips sampling. Visually examine 20 plants in five locations in the field.

Thrips

Acephate (Orthene) 75S	0.5-1 lb	0.66-1.3 lb	Treat when injury first appears and an average of eight thrips per leaflet are found. Injury appears as a silvery discoloration. Leaves often become puckered and may turn brown and die. Thrips rarely require treatment.	14	Do not graze or cut vines for hay or forage.
Carbaryl (Sevin) 80S (Sevin XLR) 4 lb/gal	1 lb 1 lb	1.25 lb 1 qt		0 0	

Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Thrips (continued)					
Methomyl (Lannate, Nudrin) 1.8L ^a	0.22-0.45 lb	1-2 pt		14	Wait 3 days to feed or graze as forage or 7 days to feed as hay.
(Lannate LV) 2.4 lb/gal ^a	0.22-0.45 lb	0.75-1.5 pt		14	
Microencapsulated methyl parathion (PennCap-M) 2 lb/gal	0.5-0.75 lb	2-3 pt		20	Do not use screens or nozzle tips finer than 50 mesh. Mix with EC formulated products with known compatibility only.

Potato leafhopper sampling. Using a standard 15-in sweep net, take five sweeps in each of five locations in the field. Count the number of leafhoppers in the net at each location and empty the net before proceeding to the next location. A single sweep consists of a swath of the net along the row in the top one-third of the plant in one direction only.

Potato leafhopper Acephate (Orthene) 75S	0.5-1 lb	0.66-1.33 lb	Treat when injury first appears as yellow wedge-shaped areas on the leaves or leaf stippling and distorted veins and four leafhoppers are present per sweep in healthy beans or eight per sweep in stressed beans.	14	Do not graze or cut vines for hay or forage.
Carbaryl (Sevin XLR) 4 lb/gal (Sevin) 80S	1 lb 1 lb	1 qt 1.25 lb		0 0	
Fenvalerate (Pydrin) 2.4EC ^a (Asana) 1.9EC ^a	0.05-0.1 lb 0.0125-0.025	2.66-5.33 oz 0.85-1.7 oz		21 21	Do not feed or graze livestock on treated plants. Do not apply more than 42.6 oz of product per season.
Permethrin (Ambush) 2E ^a (Ambush) 25WP ^a (Pounce) 3.2EC ^a (Pounce) 25WP ^a	0.05-0.1 lb 0.05-0.1 lb 0.05-0.1 lb 0.05-0.1 lb	3.2-6.4 oz 3.2-6.4 oz 2-4 oz 3.2-6.4 oz		60 60 60 60	Do not graze or feed forage hay. Do not plant rotational crops within 60 days of last application. Do not make more than two applications per season.

Spider mite sampling/Decision making. Examine 20-30 plants in each of five locations sampling primarily along field edges and weedy areas. Spider mites are dispersed passively by wind or actively crawl from adjacent weed or cultivated crop hosts into soybean fields. After females settle on a suitable plant, they begin to feed and lay eggs within a few hours. The life cycle is completed in 7-14 days depending on the temperature. As the population increases, young females disperse from infested plants by producing fine webbing, which serves as a bridge between adjacent plants and allows individuals to be blown more easily by the wind. Numerous generations occur each year in the mid-Atlantic area.

Spider mites use their needlelike mouthparts to pierce individual tissue cells on the undersides of soybean leaves. They extract the entire content, leaving empty and irreversibly damaged cells. Numerous empty cells result in the yellow or white stippling characteristic of mite-injured leaves. This stippling injury is first noticed at the base of the leaf when 20-30 mites are present on the underside. Extensive feeding by large numbers of mites (300-600 per leaf) causes the leaves to turn yellow or brown on the margins, and eventually die and drop from the plant. Yield reductions begin when 50 percent of the plants show stippling, yellowing or defoliation over more than one-third of the leaf.

Mite outbreaks usually are associated with hot, dry weather, which accelerates reproduction and development. During periods of high humidity and field moisture, a fungal disease can reduce populations but high temperatures can nullify these effects. Outbreaks also are associated with the application of certain insecticides, which kill natural enemies and/or seem to make the soybean plant more nutritionally suitable for mites.

Check each week for mites, starting in early July through August, especially during a hot, dry season. Concentrate on the field borders and look for the early signs of white stippling at the base of the leaves. Do not confuse mite damage with dry weather injury, mineral deficiencies and herbicide injury. If feeding injury is evident, press the underside of a few damaged leaves on white paper to reveal any crushed mites. Determine the extent of the infestation and assess the level of injury by examining 20-30 plants in the infested area. Field infestations often show defoliated or injured plants at some localized point, with injury becoming less evident and extending in a widening arc into the field. Spot treat with miticides if these isolated infestations are confined to field edges.

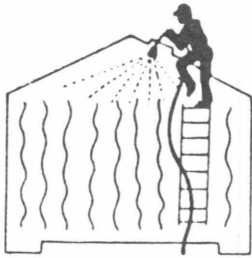
Insecticide and formulation	Rate of active ingredient	Rate of formulation per acre	Where and when to apply	Time limits: days before harvest	Remarks
Spider mite Dimethoate (Cygon 400) 4 lb/gal	0.5 lb	1 pt	Spot treat during July and August when injury first appears. Injury is white stippled areas on the undersides of the leaves near the base of the leaf veins. Treat entire field if mites are numerous (20-30 per leaflet) and injury is apparent over one-third of the leaf area. For severely stressed beans, wait until populations reach 100 per leaf as control is poor and yields have already been reduced.	21	Do not feed or graze within 5 days of the last application.
Dimethoate (Cygon 400)	0.5 lb	1 pt		21	Do not feed or graze within 5 days
+ Parathion 8E ^a	+ 1 lb	+ 0.5 pt			Do not apply within 20 days of cutting for hay or forage use.
Chlorpyrifos (Lorsban) 4E	0.25-0.5 lb	0.5-1 pt		28	Do not apply last two sprays closer than 14 days apart. graze in treated areas or feed forage hay or straw to meat or dairy animals. Note: the use of vegetable oil as an adjuvant may improve control.

Sampling for podworms. There are two methods of sampling podworm populations. The most accurate is the standard 3 by 3 ft shake cloth that works best in wide row (20 in or more) soybeans. In at least five locations of a field, place the shake cloth on the ground with sticks flush against the beanstalks on both sides. Shake the beans vigorously to knock the worms on to the cloth. Count the worms. This sample represents 6 ft of row. It often is difficult to use a shake cloth in narrow row (less than 20 in) beans. A standard 15-in sweep net can be used. Take five sweeps in each of five locations in the field. Count the number of podworms at each location and empty the net before proceeding to the next location. A single sweep consists of a swath of the net along the row in the top one-third of the plant canopy in one direction only. Sample once a week beginning in early August. Begin sampling twice a week after the first podworms are found.

Corn earworm (and certain other podworms)

Carbaryl (Sevin) 80S	2 lb	2.5 lb	Treat during pod and bean development whenever the following thresholds are reached and worms exceed 0.5 in in length: in wide rows three to five worms per 3 ft of row or five worms per 25 sweeps; in narrow rows 1.5-3 worms per 3 ft row or three worms per 25 sweeps. Note: podworms are susceptible to naturally occurring diseases and parasites. The presence of diseased worms may indicate that population collapse is imminent. Adult females start laying eggs on soybeans when the field corn in adjacent areas begins to dry and turn brown. Late-blooming fields with an open canopy have a higher risk of attack. Growers must check fields during and after podfill period.	0	
(Sevin XLR)	2 lb	1.5 qt		0	
Fenvalerate (Pydrin) 2.4EC ^a	0.1-0.2lb	5.33-10.66oz		21	Do not feed or graze livestock on treated plants. Do not exceed 42.6 oz per season.
(Asana) 1.9EC ^a	0.025-0.05	1.7-3.4 oz			
Methomyl (Langate, Nudrin) 1.8L (Lannate) LV 2,4	0.22-0.45 lb	1-2 pt		14	Wait 3 days to feed as forage 7 days to feed as hay.
	0.22-0.45 lb	0.75-1.5 pt		14	
Microencapsulated methyl parathion (Penncap) 2F ^a	1 lb	4 pt		20	Do not use screens or nozzle tips finer than 50 mesh. Mix with EC formulated products only when compatibility is known.
Permethrin (Ambush) 2E ^a	0.1-0.2 lb	6.4-12.8 oz		60	Do not make more than two applications per year. Do not plant rotational crops within 60 days of application. Use high rates for large earworms or any size fall or beet armyworms.
(Ambush) 25WP ^a	0.05-0.1 lb	3.2-6.4 oz		60	
(Pounce) 3.2E ^a	0.1-0.2 lb	4.0-8.0 oz		60	
(Pounce) 25WP ^a	0.05-0.1 lb	3.2-6.4 oz		60	
Thiodicarb (Larvin) 3.2F	0.25-0.4 lb	10-16 oz		28	Do not feed forage, hay or straw to livestock. Apply in a minimum of 2 gal finished spray by air or 5 gal by ground.

^aRestricted use pesticide.



Stored Grain Insect Control

*J.E. Roberts, Sr., Extension Entomologist, VA Tech
William F. Wilcke*

Why Control Stored Grain Insects

The mere presence of 2 weevils, or 1 weevil and 10 other beetles, or 25 beetles per 1,000 grams, (about 1 quart) of corn, causes the corn to grade "weevily" and reduces the value of the grain on the market. Two weevils, or 1 weevil and 2 beetles, or 3 beetles per 1,000 grams will grade wheat "weevily".

Insects may hollow-out the grain, destroy the germ and cause "hot spots" which result in spoilage and fungal growth. Weevils can cause grain shrinkage and dockage losses amounting to 10 to 45 cents per bushel. Grain caterpillars can spin a solid web over stored grains which results in lower market grades and poorer quality feeds, and interferes with aeration and fumigation.

Insects Attaching Whole Kernels

Primary insects attacking whole kernels include rice weevil, granary weevil, and angoumois grain moth. They have powerful mouth parts that allow them to bore into sound kernels.

Insects Attacking Only Cracked Grain

Insects considered secondary pests and attacking only cracked grains or flour include the Indian meal moth, confused flour beetle, and sawtoothed grain beetle.

How to Control Stored Grain Insects

Grain Storage Facilities

The ideal storage place for grain, as far as insects are concerned, is a weather-tight, rodent proof, steel structure separated from areas where hay, straw, feed, and animals are housed, and one which can be easily cleaned and inspected.

Store Only Dry Grain

You will have less trouble and loss of grain if you store only grain that is clean, not cracked, and that has a moisture content of 13 percent or lower. Higher moisture invites insects and promotes heating and fungal growth, which in turn causes spoilage. Temperature below 60 degrees F greatly reduces insect flicking and reproduction.

Clean the Bins

Insects live from season to season around farm buildings and in accumulations of grain, feed, straw, hay, and litter. Never place newly harvested grain on top of old grain. It is best to remove all old grain and feed it, then treat the empty bin before the new grain is stored. If this is not possible, then fumigate old grain before new grain is added.

Clean grain bins thoroughly at least 2 weeks before putting grain in them. Clean wooden bins very carefully, because grain and dust tend to collect on walls and floors and encourage infestations.

Remove all leftover grain from bins and sweep down the walls, ceilings, sills, ledges, and floors. Try to remove fines that have accumulated under perforated bin floors. Outside, remove spilled grain from around bins. Clear trash and litter from the bin areas.

Feed rooms, feed bins, stables, mangers, and animal feeders harbor many insects that are likely to spread to bins of grain. Do not store grain near them. Wagons, trucks, combines, and other farm equipment in which waste grain accumulates can also be sources of infestation.

Spray Bins Thoroughly

After you have cleaned the bin spray all surfaces inside and, if possible, outside the bin. Surface sprays leave a thin layer of insecticide that kills insects that crawl over it.

Thoroughly spray seams, corners, and cracks where particles of grain accumulate. You can use a garden or power sprayer. Spray the bin 2 weeks before you fill it. Do not add grain for at least 24 hours until walls have dried thoroughly. Space under floors of metal grain bins should be thoroughly fumigated if you weren't able to remove the fines.

To make enough spray to treat 1,250 square feet, use one of the mixtures shown in Table 1.

Table 1. Spraying Recommendations for Empty Bins

Pesticide Formulation	Amount of Pesticide Formulation Per 2-1/2 Gallons of Water (Treats 1,250 sq. ft. of Surface)
Methoxychlor 50% WP	1 lb.
Methoxychlor 25% EC	25 oz.
pyrethrins 6% EC combined with piperonyl butoxide 60%	5.3 oz.
malathion--premium grade (Cythion) 57% EL	1/2 pt.
Reldan 4E	3 oz.
WP = wettable powder EC = emulsifiable concentrate EL = emulsifiable liquid	lb. = pound qt. = quart pt. = pint oz. = ounce

Special Note: When you use a spray mixture to treat bins, to treat grain while binning, or as a surface dressing, mix only one day's supply at a time. Mix in a clean, rust-free container. Do not use sprays that were mixed the previous day.

Treatment of Grain Going into Storage

After the bin or storage area has been thoroughly cleaned and treated, you can go one step further to protect against insect infestation by applying an insecticide to the grain as it goes into the storage area. To make enough spray to treat 1,000 bushels of grain, mix one of the pesticide formulations shown in Table 2.

Table 2. Recommendations for Treating Grain Going into Storage

Pesticide Formulation	Amount to Mix in 5 Gallons of Water and Apply to 1,000 Bushels of Grain
<u>Sprays</u>	
malathion--premium grade (Cythion) 57% EL	1 pt.
Pyrethrins 6% plus piperonyl butoxide 60%	21 oz.
malathion 6% with red wheat base	10 lbs./1,000 bu. [1]
Actellic 57%	11 oz. [2] Corn and Grain Sorghum only
Reldan 43.2%	[2] Barley 9.2 oz. Oats 6.2 oz. Sorghum 10.7 oz. Wheat 11.5 oz.

[1] This is a special formulation of malathion for grain protection. A special applicator is available from the manufacturer of this product.

Mechanical applicators are available commercially to apply insecticide to grain as it is being placed into storage. These units can be used on augers, elevators, or conveyor belts for conveying rates from 200 to 400 bushels per hour. A simple applicator that drips insecticide onto grain entering an auger is shown in Fig. 1.

Regardless of type of applicator used, the conveying rate must be known. As a guide in determining the conveying rate, Tables 3 and 4 used together show approximate auger capacities. Auger capacity varies with auger diameter, kind of grain, grain moisture, angle of incline of the auger, and auger speed in revolutions per minute (rpm). Top off with B.T. if treated with malathion.

[2] Actellic and Reldan will control malathion resistant Indian meal moth larvae. If malathion is used as a grain protectant, bins should be "top treated" with Dipel. See discussion on the use of Dipel under heading entitled "Control of Resistant Indian Meal Moth."

Table 3. Estimated Auger Capacities

Values are for dry (14%) shelled corn. Capacities for wheat, grain sorghum, barley, and rye are slightly less. Reduce values 25% for soybeans or oats. Multiply bu/hr values by 50 to get approximate lb/hr capacity for meal or ground feeds. Multiply values by 0.6 for wet grain.

Auger diameter (in.)	Auger speed (rpms)	Capacity (bu/hr) at various incline angles				
		0°	25°	35°	45°	90°
4	900	560	500	480	450	270
6	600	1500	1350	1290	1190	710
8	450	2210	1990	1890	1760	1050
10	360	3300	2970	2830	2620	1570
12	300	4520	4070	3870	3590	2150
14	260	6230	5610	5340	4950	2960
16	225	8040	7240	6870	6390	3830

Table 4. Auger-Speed Conversion Factors

Multiply capacity values from Table 3 by these relative capacity values to adjust for different auger speeds.

Relative auger speed Actual speed/Table 3 speed	Relative capacity Actual capacity/Table 3 capacity
1.25	1.17
1.00	1.00
0.75	0.79
0.50	0.56
0.25	0.29

Example: Estimate the conveying rate for an 8" auger, inclined 35°, turning @ 335 rpm, handling dry wheat.

Capacity with dry shelled corn @ 450 rpm = 1890 bu/hr (Table 3)

Relative speed = 335 rpm/450 rpm = 0.74 = about 0.75

Relative capacity from Table 4 = 0.79

Adjusted capacity = 1870 x 0.79 = 1493 bu/hr

Because auger capacity is slightly less for wheat than shelled corn, 1400 bu/hr would be a good estimate.

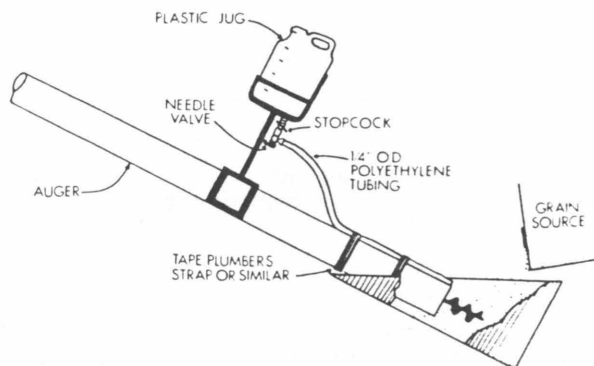


Figure 1. One type of drip applicator used to treat grain going into storage.

Control of Resistant Indian Meal Moth

Indian Meal Moth Resistant to Malathion

Malathion should not be relied upon to control Indian meal moth, because the insect has developed resistance to it. However, we should continue to use malathion as a surface treatment of stored grain in bins, because it is still effective against other pests.

VAPONA RESIN STRIPS are thin, plastic strips impregnated with the insecticide Vapona. When these strips are hung in a closed area, they give off a lethal amount of fumigant that kills flying insects. To be successful with Vapona strips, the area to be protected must be closed and not ventilated. Air exchange reduces the concentration of the fumigant to the point that it will not kill insects.

The strips will control Indian meal moths in tight storage areas if they are hung above the grain; one strip for each 1,000 cubic foot of air space over the grain. The strips must be hung before moths begin to emerge in the spring. Strips should last 2 to 4 months, under ideal conditions. If strips are used, check grain once each month for a buildup of insects. Replace strips if pests are seen.

DIPEL containing spores and toxin, (*Bacillus thuringiensis*) is sold as a wettable powder or dust to control and prevent the infestation of Indian meal moths. Apply: 1) DIPEL WP in a constantly agitated water suspension to the top four inch surface layer of grain in the bin. Use a sprinkler can or sprayer to apply the dosage into the grain stream as the last (top) four inch layer of grain is augered into the bin. Mix 1/10 lb. DIPEL WP per gallon of water and apply 0.6 pint of this mixture per bushel as the last grain is augered into storage. Or sprinkle this dosage onto the surface of the grain in the bin and mix thoroughly with a scoop or rake to the depth of four inches. More thorough coverage may be achieved by dividing the recommended dosage into three applications and mixing the grain between applications. 2) DIPEL DUST for a top dressing at the rate of 4 lbs/500 sq. ft. Mix thoroughly to a depth of 2-4 inches. (See Table 5).

For the protection of bagged grain, apply the dosage to the entire grain mass and mix thoroughly prior to bagging.

Treatments can be applied to the stored grain at any time, but for best results, make application immediately after harvest before moth activity occurs.

In areas where late fall harvested grain is not subject to infestation because of low temperatures, application can be delayed until late winter or early spring before moth activity begins. Control for a full storage season should normally be expected; however, repeat application if infestation occurs.

Table 5. Dipel Surface Treatment for Stored Grains

PEST	RATE
Indian Meal Moth	1 lb WP/10 gal water 500 sq. ft.* 4 lbs D/500 sq. ft.*

*Grain surface area; mix into top 4 inches.

Aerate to Cool Grain

Insect activity is greatly reduced and some insects die at temperatures below 50°F. So using aeration to cool grain to 40 to 45°F in fall helps control insects. Also, aerating grain prevents moisture migration, which produces wet pockets of grain that can be invaded by insects. (Note: grain bins smaller than about 1500 bu generally cool fast enough naturally that aeration is not needed.)

Inspect Stored Grain Frequently

It is very important that stored grain be inspected often to determine its condition and extent of pest damage. Early problems can be detected and eliminated to prevent losses. Inspect grain every week or two, especially during the summer and autumn months, to determine if treatment is needed. Check for insects by measuring grain temperature and by looking for insects themselves. To measure grain temperature, fasten a thermometer to a stick. Then in the center of the bin, push the thermometer 2 feet below the grain surface. If insects or fungi are active, the temperature will be more than 65°F, and may range as high as 100°F. To inspect for insects, insert a grain probe in the center of the bin 2 feet below the grain surface. Sift the grain samples through a 10 to 12 mesh per inch screen to separate out insects. Grain insect probe traps may also be used as a method of insect detection in grain bins.

Fumigation Practices and Precautions

FUMIGANTS SHOULD BE APPLIED ONLY BY TRAINED, EXPERIENCED OPERATORS WORKING IN PAIRS.

If you find one granary weevil, rice weevil, or lesser grain borer per quart sample, fumigation is needed at once. Fumigation destroys the present infestation, but it must not be considered a permanent control. Repeat fumigations may be necessary. Grains exposed to fumigants can usually be fed within a week if they are aerated or spread thinly and stirred to allow fumes to evaporate. Be sure to follow all label directions including general information and safety precautions. These chemicals are very hazardous. Seed temperatures should be between 65°F. and 85°F. during exposure. Do not expose to fumigants for more than 24 hours and remove fumigants immediately after 24 hours by aeration. Do not fumigate low viability seed, as germination may be further reduced.

Use Malathion Surface Treatment Along with a Fumigant for deep Storage

- A. Level the grain. Remove or break up any crust in the grain.
- B. Seal all cracks making the bin as air-tight as possible.
- C. Fumigate on a still day, preferably when the temperature is above 70°F. Wind causes rapid leakage of the gas and results are poor.
- D. Apply the correct amount of fumigant as a coarse spray evenly over the surface of the grain. Cover the grain with a tarpaulin if there is a large airspace above the grain. **THE OPERATOR SHOULD STAY OUT OF THE BIN. DO NOT BREATHE VAPOR OR FUMES. ALWAYS WORK IN PAIRS.** Self-contained or life-line gas mask units only should be used when entering a bin containing a fumigant. Canister types are for exterior bin use only.
- E. **DO NOT ENTER** the bin during or after fumigation until gases have been thoroughly removed by aeration.
- F. When under fumigation, the storage bins should be locked and identified with a sign "DANGER - KEEP OUT" to prevent entry and avoid accidents.
- G. Increase rates by 1 gallon/1000 bu for wooden bins.

PHOSTOXIN is a fumigant found to be effective against all stages of insect development, including Indian meal moth. PHOSTOXIN in pellet or tablet formulation can be used on stored grains (barley, corn, rye, soybean and wheat) in bins. The dosage rate and exposure time of fumigation depend on size and airtightness of the bin. PHOSTOXIN's mechanism of action is the release of gas (hydrogen phosphide) which makes air-tight bins important. Structures made of wood or loosely constructed metal should be covered with polyethylene permitting the dosage to be considerably reduced. Uncovered structures that are not air-tight, require twice the recommended dosages. All obvious cracks, seams, or openings around doors or elsewhere must be sealed with masking or duct tape. The surface of stored grain in a bin should be covered with 4 mil polyethylene. This covering should overlap at least 8" if more than one piece is required to cover the surface. Tape overlapping joints to prevent leaks. The polyethylene surface covering must also be pushed down into the grain where it meets the walls of the bin. (Remove polyethylene cover when bin is being aerated.)

PHOSTOXIN fumigation will not provide residual control. Once the bin is opened for ventilation or inspection it may be re-infested with insects.

The manufacturer of PHOSTOXIN requires all first users to be trained through their representatives. READ THE LABEL CAREFULLY AND FOLLOW THE DIRECTIONS -- this is a RESTRICTED PESTICIDE AND POISONOUS.

Weed Control in Field Crops

F.J. Webb, University of Delaware
R.L. Ritter, The University of Maryland
E.S. Hagood, VA Tech
J.W. Wilcut, VA Tech
H.P. Wilson, VA Tech

Chemical Weed Control in Field Crops

Herbicides are useful tools in most weed management programs. They should be used to supplement and not supplant other methods or tools available. These other tools include good cultural practices such as proper fertilization and liming to give the crop a "head start", and crop rotation and proper cultivation, which are essential for a total weed management program.

The following are definitions of terms you will find in this and similar publications on herbicides:

Preplowing. The herbicide is applied to a growing weed before the land is plowed.

Preplant incorporated (PPI). The herbicide is applied to the soil after plowing but before planting, and mixed with the top few inches of soil with different incorporation implements.

Preemergence (PRE). the herbicide is applied after the crop is planted but before it emerges from the ground. Soil moisture, light rainfall or shallow cultivation may be necessary to obtain good weed control with many preemergences herbicides.

Postemergence (Post). The herbicide is applied to the foliage of weeds after the crop has emerged.

Surfactant. This is a surface-active agent that reduces the surface tension, thus permitting a more uniform application, and spreads the herbicide solution evenly on the plant foliage or ground.

Many terms designate particular surface activities such as adjuvant, detergent, emulsifier, spreader, sticker, and wetting agent.

Most of the herbicides recommended in this publication are selective. That is, at the recommended rate of application, they will selectively control or injure weeds but will not seriously damage the crop in which these weeds are growing. In using most selective herbicides, you should carefully follow the recommended rate of application because higher rates may severely injure or kill the crop. You, the user, must accept the responsibility if you use a herbicide other than as directed on the label. Read the label on the container and follow the directions carefully.

The precision required for the application of herbicides is greater than for many other farm tasks. Three factors governing the rate of application are pressure, nozzle size, and ground speed. Contact your county Extension office for related publications.

Band Application

Some of the preemergence and postemergence herbicides are expensive; band spraying is one way to economize. Band spraying consists of applying a herbicide in a 14- to 16-inch band immediately over the crop row, leaving the middles unsprayed. Often it is more economical to mechanically cultivate the area between the rows than to treat them chemically.

Use Rate

The recommended use rates of herbicides generally vary with soil texture and organic matter content. The herbicides rates given in this section will refer only to three soil texture groups: coarse, medium, and fine. The following is a listing of soil textures included of these three soil texture groups:

Soil texture group	Soil texture
Coarse	Sand, loamy sand, sandy loam
Medium	Loam, silt loam, silt, sandy clay loam
Fine	Silty clay loam, clay loam, sandy clay, silty clay, clay

Please refer to this table to determine the soil texture group for the soil you want to treat. Low rates of herbicides generally are used on coarse soils low in organic matter while high rates generally are used on fine soils high in organic matter. Consult the label for the proper herbicide rate for your soils.

Guide to Prepackaged Mixes

Product Name	Prepackaged Mixes Ingredients	Formulation Ratio	Manufacturer
Bicep (6L)	Dual + AAtrex	3.33 + 2.67 lbs/gal	Ciba Geigy
Brominal 3 + 3	Brominal + MCPA	3 + 3 lbs/gal	Union Carbide
Bronco	Lasso + Roundup	2.6 + 1.4 lbs/gal	Monsanto
Buctril-Atrazine**	Buctril + atrazine	1.0 + 2.0 lbs/gal	Rhone Poulenc
Canopy	Lexone + Classic	6 to 1 ratio	DuPont
Colonel	Paraquat + Atrazine	0.4 + 2.0	ICI
Commence	Treflan + Command	3.0 + 2.25 lbs/gal	FMC
Conquest**	Bladex + Atrazine	3 to 1 ratio	DuPont
Extrazine	Bladex + Atrazine	2.5 + 1.5 lbs/gal	DuPont
Gemini	Lorox + Classic	12 to 1 ratio	DuPont
Laddok	Basagran + atrazine	1.66 + 1.66 lbs/gal	BASF
Lasso/Atrazine	Lasso + Atrazine	2.5 + 1.5 lbs/gal	Monsanto
Lorox Plus**	Lorox + Classic	16 to 1 ratio	DuPont
Marksman	Banvel + Atrazine	1.1 + 2.1 lbs/gal	Sandoz
Prelude	paraquat + metolachlor + linuron	0.5 + 2.0 + 0.25	ICI
Preview**	Lexone + Classic	10 to 1 ratio	DuPont
Prozine	Prowl + Atrazine	1.5 + 1.5	American Cyanamid
Rescue	Alanap + 2,4-DB	2 + 0.06 lbs/gal	Uniroyal
Rhino	Butylate + atrazine	4.3 + 1.7 lbs/gal	PPG
Salute	Treflan + Sencor	1.55 + 2.4 lbs/gal	Mobay
Squadron	Scepter + Prowl	0.33 + 2.0 lbs/gal	American Cyanamid
Storm	Basagran + Blazer	2.67 + 1.33 lbs/gal	BASF
Surefire	Paraquat + Diuron	2.0 + 1.0	ICI
Sutazine +	Sutan + + Atrazine	4.8 + 1.2 lbs/gal	Stauffer
Top Gun	Paraquat + Simazine	0.8 + 3.2	ICI
Torch**	Brominal + Atrazine	1.875 lbs/gal + 2.5 lbs/gal***	Union Carbide
Turbo	Dual + Sencor	6.55 + 1.45 lbs/gal	Mobay

** Products not targeted for major distribution in Delaware, Maryland and Virginia.

*** Packaged together in separate containers.

Weed Control in Forage Crops

Legume seedlings are relatively slow growing, whereas weeds often have a rapid initial growth period. Thus, in new seedlings, weeds compete strongly with the legume seedlings for light, moisture, and nutrients. Severe reduction or loss of stands may result. Several preplant incorporated treatments are available that offer good annual grass control and some broadleaf weed control at establishment. In addition, postemergence treatments, available for use on new stands, give good broadleaf weed control. Once a stand is established, weeds may continue to reduce yields and impair quality of the forage. Both residual type herbicides and postemergence herbicides are available for use in established forage stands. Most are recommended for fall or spring dormant application. Pick the treatment that best suits the specific weed infestation, and carefully follow label directions in terms of timing and rates of application.

Spray volumes for forage areas should be 20 to 30 gal/A. Lower volumes will also work, but increase risk of spray drift.

The following table illustrates the susceptibility of common alfalfa weeds to recommended herbicides. Herbicide application timings include establishment, seedling stands, fall/spring dormant, and postcutting. Note that four treatments may be used either in seedling stands or as fall or spring treatments in established stands.

ALFALFA - Treatment and application timing^a

Species	Establishment				Seedling stand and fall/ spring dormant			Post-
	EPTC (Eptam)	Benifin (Balan)	2 x paraquat (Paraquat) (Gramoxone)b	Glyphosate (Roundup)	Chlor- propham (Furloe)	2,4-DB (Butyrac Butoxone)	Pronamide (Kerb)	Sethoxydim (Poast)
Grasses								
Barnyardgrass	G	G	G	G	P	N	F	G
Bermudagrass	F	P	P-F	G	P	N	P	G
Cheat	G	G	G	G	G	N	G	P-F
Crabgrass spp.	G	G	G	G	P	N	F	G
Fescue, tall (EST)	N	N	G	G	P	N	G	P
Foxtail spp.	G	G	G	G	P	N	F	G
Goosegrass	G	G	G	G	P	N	F	G
Johnsongrass (seed)	G	F	G	G	P	N	P	G
Nutsedge, yellow	G	P	P	F-G	P	N	N	N
Orchardgrass (EST)	N	N	G	G	P	N	G	P
Panicum, fall	G	G	G	G	P	N	F	G
Quackgrass	F	P	F	G	P	N	G	F-G
Broadleaf weeds								
Chickweed, common	F	F	G	G	G	N	G	N
Dandelion (EST)	N	N	P	G	N	P-F	P	N
Dock spp. (EST)	N	N	P	F-G	P	P	F	N
Dock spp. seedling	N	N	G	G	F	G	F	N
Dogbane, hemp	N	N	P	G	N	N	N	N
Henbit	G	P-F	G	G	N	N	F	N
Horseweed	P	P	P	G	N	F-G	P	N
Knawel (German moss)	P	P-F	F-G	F-G	F	N	P	N
Lambsquarters common	G	G	G	G	N	G	P	N
Lettuce, prickly	N	N	F	G	N	F	P	N
Milkweed spp.	N	N	P	F-G	N	N	N	N
Mustard spp.	G	P	G	G	N	G	P	N
Nightshade, black	P	P-F	G	G	N	G	P	N
Pennycress spp.	P	P	G	G	N	G	F	N
Pepperweed spp.	P	P	G	G	N	G	P	N
Pigweed spp.	G	G	G	G	N	G	N	N
Plantain spp.	N	N	P	F-G	N	F-G	F	N
Ragweed, common	P	N	G	G	N	F	N	N
Shepherdspurse	P	P	G	G	F-G	G	F	N
Smartweed spp.	P	P	F-G	G	F-G	P	P	N
Speedwell	P	P	G	G	P	P	P	N
Thistle, bull	N	N	F	G	N	F-G	P	N
Thistle, plumeless	N	N	F	G	N	F-G	P	N
Thistle, musk	N	N	F	G	B	F-G	P	N
Yellowrocket	P	P	F	G	N	G	P-F	N

ALFALFA (continued) - Treatment and application timing^a

Species	Fall/spring dormant						Postcutting		
	Diuron (Kar mex)	MCPA (MCPA)	Simazine (Princep)	Metribuzin (Sencor Lexone)	Paraquat (Paraquat) (Gramoxone)	Terbacil (Sinbar)	Hexa- zinone (Velpar)	Paraquat (Paraquat) (Gramoxone)	Terbacil (Sinbar)
Grasses									
Barnyardgrass	F	N	P-F	P-F	N	P-F	P-F	G	G
Bermudagrass	P	N	P	P	P	P-F	P-F	P-F	P-F
Cheat	P-F	N	G	G	G	G	F-G	G	G
Crabgrass spp.	F	N	P-F	P-F	N	P-F	P-F	G	G
Fescue, tall (EST)	F	N	F	P-F	F	F	F	F	F
Foxtail spp.	F	N	P-F	P-F	N	P-F	P-F	G	G
Goosegrass	F	N	P-F	P-F	N	P-F	P-F	G	G
Johnsongrass (seed.)	P-F	N	P	P	N	P	P	G	G
Nutsedge, yellow	N	N	N	N	P	P	P	P-F	P-F
Orchardgrass (EST)	F	N	F	P	F	F	F-G	F	F
Panicum, fall	P-F	N	P-F	P-F	N	P-F	P-F	G	G
Quackgrass	P-F	N	F	P	F	F	F	F	F
Broadleaf weeds									
Chickweed, common	G	N	G	G	G	G	G	G	G
Dandelion (EST)	P	F-G	P-F	F-G	P	F	F-G	P-F	F
Dock spp. (EST)	P-F	P-F	P	F	P-F	P-F	P-F	P-F	F
Dock spp. (Seedling)	F	G	P	F	G	F	F	G	G
Dogbane, hemp	N	N	N	N	N	P	P	P	P
Henbit	F	N	G	G	G	G	F-G	G	G
Horseweed	F	F-G	P	P	P	F	F	P	F-G
Knawel (German moss)	F-G	N	G	F	F-G	F	F	F	F
Lambsquarters, common	F-G	P	P	P	N	F-G	F-G	G	G
Lettuce, prickly	F	F	F	F	F	F	F-G	F	F
Milkweed spp.	N	N	N	N	N	P	P	P	P
Mustard spp.	G	G	G	G	F	G	G	G	G
Nightshade spp.	P-F	P	P	P	P	F	F	G	G
Pennycress spp.	G	G	G	G	F	G	G	G	G
Pepperweed spp.	G	G	G	G	F	G	G	G	G
Pigweed spp.	F-G	P	P	P	N	F-G	F-G	G	G
Plantain spp.	P-F	G	G	G	P-F	F-G	F-G	G	G
Ragweed, common	F-G	P	P	P	N	F-G	F-G	G	G
Shepherdspurse	G	G	G	G	F	G	G	G	G
Smartweed spp.	F	P	P	P	N	F-G	F-G	G	G
Speedwell	F-G	P	G	F-G	G	G	G	G	G
Thistle, bull	P-F	G	P	F	F	P-F	P-F	F	F
Thistle, plumeless	P-F	G	P	F	F	P-F	P-F	F	F
Thistle, musk	P-F	G	P	F	F	P-F	P-F	F	F
Yellowrocket	G	G	F-G	G	P-F	G	G	F	F-G

^aThe susceptibility ratings listed in this table assume correct rates and timings of herbicide application for the normal growth habit of each species. In some instances, ratings are lower than might be obtained if the recommended time of herbicide application and the time of weed presence or optimum susceptibility coincided. The rating scale is as follows: G(good) = 80-100 percent control, F(fair) = 60-80 percent control, P(poor) = 20-60 percent control, and N(none) = < 20 percent control.

^b2 x paraquat refers to susceptibility of weeds when sequential (two) applications of paraquat are used.

Alfalfa, red clover, ladino clover

Weed problem	Chemical rate per acre	Product per acre	Remarks
Preplant Annual grasses and broadleaf weeds, including barnyardgrass, annual bluegrass, carpetweed, chickweed, crabgrass, Florida pusley, panicum, foxtails, (giant, green, yellow), goosegrass, johnsongrass from seed, lambsquarters, pigweed, purslane (common), sandbur and annual ryegrass	Benefin 1.12-1.5 lb	Balan EC 3.0-4.0 qt	Apply to clean, dry soil surface no later than 10 weeks before planting. Incorporate within 8 hours with a disc set to cut 4-6 in and fall operated in two different directions at 4-6 mph, or with power takeoff driven equipment set to cut 2-3 in deep once over. See label, and adjust rate to soil texture.
Above weeds; also bermudagrass, Brachiaria sp., corn spurry, fall panicum, henbit, nightshade, nutsedge, quackgrass, ryegrass, volunteer small grains, sandbur and shattercane	EPTC 3.0-4.0 lb	Eptam 7E 3.5-4.5 pt Genep EPTC 7E 3.5-4.5 pt	Spray on surface of freshly prepared soil. Incorporate into the soil to a depth of 2-3 in immediately after application. Follow label suggestion for proper incorporation procedures. Plant alfalfa seed immediately after incorporation. Perennial grass rhizomes must be chopped up thoroughly (2-in sections or less) before treatment. Temporary stunting and sealing of first leaves may occur. Do not use if more than 1.2 lb active ingredient of atrazine was applied within the previous 12 months.
Bluegrass (annual), downy-brome crabgrass, fleabane, foxtail, kochia, common lambsquarters, prickly lettuce, panicums, redroot pigweed, smooth pigweed, common giant ragweed, sandbur, shattercane, Pennsylvania smartweed, spanish needles, Russian thistle, velvetleaf, volunteer wheat, bahiagrass, bermudagrass, field bindweed, Kentucky bluegrass, cattail dallisgrass, curly dock, hemp dogbane, fescues, guineagrass, johnsongrass, milkweed, wirestem muhly, common mullein, napiergrass, silverleaf nightshade, orchardgrass, paragrass, quackgrass, reed canarygrass, swamp smartweed, Texas blueweed, Canada thistle, torpedograss, vaseygrass	Glyphosate 1.0-5.0 lb	Roundup 1.0-5.0 qt	For control of emerged vegetation before the establishment of alfalfa in conventional systems, or when overseeded into a cover crop. When overseeding alfalfa, glyphosate must be applied before planting a labeled cover crop. Avoid contact of spray with foliage, green stems or fruit of desirable crops, plants, trees or other vegetation since severe damage or destruction may result. Repeated treatments may be necessary to control weeds regenerating from underground parts or seed. Repeat treatments must be made before the crop emerges. Do not exceed 8 qt/A per year. Do not feed or forage treated crops within 8 weeks after application.

Alfalfa, red clover, ladino clover (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Orchardgrass and fescue sods, control of annual weeds, alfalfa establishment, and suppression of perennial broadleaf weeds	Paraquat 0.47 lb plus surfactant	Gramoxone Super 2.5 pt plus surfactant as specified by label	For no-till establishment of alfalfa into perennial grass sods. Two applications 10-14 days apart generally will be required for complete sod kill. Additional herbicide treatments or alternate methods of establishment may be required if perennial broadleaf weeds are present.
Postemergence Chickweed, downy brome, and suppression of some other winter annuals	Chlorpropham 2.0-4.0 lb	Furloe 4EC 2.0-4.0 qt	Spray in the late fall or winter when alfalfa is dormant. May be used year of seeding after alfalfa reaches trifoliate stage and clover reaches 4-leaf stage. Do not apply to grass/alfalfa mixtures since the grass may be injured. Slow acting.
Thistle (bull, curled, and musk), cocklebur, common ragweed, curly dock seedlings, fanweed, filaree, lambsquarters, morningglory, mustards, nightshade, pennycress, prickly lettuce, pigweed, shepherdspurse and smartweed	2,4-DB 0.5-1.5 lb	Butoxone 2.2-6.5 qt Butyrac 200 2.0-6.0 pt	Apply when weeds are actively growing, and no more than 3 in high, or rosettes less than 3 in across. May be applied either to seedling legumes (when seedling plants have 2-4 trifoliate leaves) or to established stands (in late fall or early winter for best control). Fields should not be grazed or harvested for forage within 30 days on established stands after application. Do not apply if temperature expected above 90° F or to fall below 40° F during or shortly after treatment.
Bluegrass (annual and perennial), cheat, chickweed, orchardgrass, quackgrass, ryegrass, red sorrel, volunteer grains and wild oats	Pronamide 0.5-1.5 lb	Kerb 50W 1.0-3.0 lb	Use on established plantings or on new plantings after legume has reached trifoliate stage. Apply during fall or early winter and before winter freeze-up. Apply when soil temperature is 50 F or less. Remove or disperse trash or crop residue before treatment. Rainfall necessary to move it into the root zone where it is absorbed. Avoid drift to nontarget areas. Do not graze or harvest for forage within 120 days of treatment.

Alfalfa (established)

Postemergence

Chickweed, corn
gromwell, corn spurry
Knawel (German moss),
pennycress,
shepherdspurse,
prickly lettuce,
dog fennel and wild
mustards (including
Calepina sp.)

Diuron 1.2-1.6 lb

Karmex 80W 1.5-2.0 lb

Apply in March or early April when alfalfa is dormant, and before it begins growth in the spring. Treat only stands established for 1 year or more. Do not apply to alfalfa/grass mixtures, or to alfalfa with unusually shallow root penetration (such as shallow hard pans) or on sandy soils with less than 1 percent organic matter content. Do not replant treated areas to any crop within 2 years, unless otherwise directed.

Many broadleaf weeds including burdock, Calepina sp., dandelion, goatsbeard, mustards, pennycress, pepperweed, plantain, shepherdspurse, thistles (curled and musk), and yellow rocket

MCPA 0.5 lb

MCPA 1.0 pt

Apply after frost when alfalfa is defoliated and dormant. Stand losses may result if sprayed when not completely dormant. Temperatures at the time of spraying should be above 40°F. May be used on mixtures with orchardgrass if established 1 year.

Cheat, downy brome, chickweed, fanweed, henbit, knawel (German moss), pepperweed, seedlings of shepherdspurse, speedwell, wild oats, wild mustards

Simazine 0.8-1.2 lb

Princep 80W 1.0-1.5 lb
and/or
90W 0.9-1.3 lb

Apply only to alfalfa alfalfa/orchardgrass mixtures established one full growing season. Use after last cutting and through December, but before permanently frozen soil conditions. Alfalfa may be growing, semidormant or dormant. Do not use on sands or loamy sands, nor apply excessive rates, as injury may occur. Allow 30 days between applications and grazing to beef and dairy cattle and sheep, and 60 days for cutting hay. Rotations should be followed only by corn the following growing season.

Alternate method:
residual control of
weeds listed above
plus contact
control of weeds
emerging before
simazine
application.

Simazine 0.8-1.2 lb
plus
paraquat 0.47-0.75 lb
plus
surfactant

Princep 80W 1.0-1.5 lb
or 90W 0.9-1.3 lb
plus
Gramoxone Super
2.5-4.0 pt
plus
surfactant as
specified by label

For late fall dormant use on established alfalfa observe on instructions and precautions on both labels. Apply before frozen ground conditions.

Cheat, smoothbrome, wild oats, chickweed, henbit, pepperweed, shepherdspurse, white cockle, bluegrass, dandelion and suppression of dock

Metribuzin 0.375-1.0
lb

Lexone 50W 0.75-2.0
lb, 4L 0.375-1.0 qt,
DF 0.5-1.3 lb

Sencor 50W 0.75-2.0
lb, 4F 0.375-1.0 qt,
or 0.5-1.3 lb

Make a single application in the fall after alfalfa becomes dormant or in the spring before new growth starts. Do not apply during first growing season after seeding. Do not graze or harvest within 28 days after application.

Alfalfa (established) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Bluegrass, chickweed, henbit, downy brome and suppression of perennial grasses including orchardgrass, timothy and smooth brome	Paraquat 0.47-0.75 lb plus surfactant	Gramoxone Super 2.5-4.0 pt plus surfactant as specified by label	Apply as a broadcast application in 20-60 gal of water per acre using ground equipment. Use higher rate for kill or suppression of harder to control weeds and grasses, such as the perennial species. Do not apply if fall regrowth following the last fall cutting is more than 6 in high. Apply to well-established stands (at least 1 year old) after the last fall cutting when the crop is dormant or before spring growth reached 1 in. Alfalfa foliage present at the time of application will be burned, which may reduce the yield of the first cutting. Weeds and grasses should be succulent and growing at the time of application. Do not graze, cut or harvest within 60 days of application. Do not apply more than once per season.
Annual grasses and broadleaf weeds and suppression of perennial plants	Paraquat 0.28 lb plus surfactant	Gramoxone Super 1.5 pt plus surfactant as specified by label	Alternate method: postharvest application. Apply 20-60 gal of water by ground equipment immediately after alfalfa has been harvested. Do not treat more than 5 days after cutting. Foliage present at application will be burned. Do not graze, cut, or harvest within 30 days of application. Make 1-3 applications per year as required.
Chickweed, henbit, lambsquarters, horseweed, mustard, pepperweed, prickly lettuce, shepherds-purse, yellow rocket, crabgrass, downy brome, fox-tail, ryegrass and wild barley	Terbacil 0.4-1.2 lb	Sinbar 80W 0.5-1.5 lb	Treat only stands established 1 year or more. Make a single application in the fall after plants become dormant or in the spring before new growth exceeds 2 in or after cutting following hay removal. For semidormant and nondormant varieties, apply in the fall after last cutting or in the spring before new growth exceeds 2 in in height. Do not use on seedling alfalfa or on alfalfa grass mixtures or other mixed stands. Do not apply on snow-covered or frozen ground as injury to the crop may result. Do not replant to any crop within 2 years after last application.

Alfalfa (established) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Annual bluegrass common chickweed, common dandelion, groundsel, lambsquarters, crabgrass, fiddleneck, mustard spp., pennycress, fleabane, foxtail, pigweed spp., shepherdspurse, speedwell, yellow rocket, broadleaf plantain, prickly lettuce, sweet clover Corn may be planted 12 months after application. Do not graze or feed treated forage to livestock within 30 days following application.	Hexazinone 0.45-1.35 lb	Velpar 90W 0.5-1.5 lb	Apply as a postemergence treatment to established stands of alfalfa in the fall or winter after alfalfa becomes dormant or in the spring before new growth begins. Use the lower rate on coarse textured soils and the higher rate on fine textured soils. Apply in a minimum of 20 gal/A when weeds are 2 in high or less for best results.
Barnyardgrass, fox- tails, fall panicum, johnsongrass, witchgrass, annual ryegrass, crab- grass, shattercane, volunteer small grains and corn, bermuda- grass, and quackgrass	sethoxydim 0.19-0.47 lb plus crop oil concentrate	Poast 1.0-2.5 plus crop oil concentrate 2.0 pt	Apply to actively growing grasses at the size and rate indicated on the label for the individual grass species. Always add crop oil concen- trate to the spray solution. A second application is required for complete control of perennial grass species. Do not apply sethoxydim within 7 days of feeding, grazing, or harvesting forage, or within 20 days of feeding or harvesting hay.

Pasture

Spray volumes for pasture areas should be 20-30 gal/A per acre with ground sprayers. Lower volumes also will work, but risk of spray drift increases. Aerial application of lower volumes also may be used.

Musk and curled thistles are major problems in Western Virginia and Maryland and continue to spread eastward. These plants are considered biennials but some plants actually may germinate in spring and flower in the late summer. Such plants would be annuals. In the spring, susceptible crop and ornamental plants are actively growing and will be damaged if spray drift reaches them.

The 2,4-D used for thistle control has little residual activity in the soil. Thus, we are experiencing reinfestation of areas where the thistles were killed in the fall. This results in plants that bloom and produce seed the next summer. Based on this experience, we can conclude that spring is a more effective time to control thistles, but also considerably more hazardous in terms of damage to desirable plants.

Rates of application are stated in pounds acid equivalent (AE) per acre. Amine, low volatile ester (LVE), and oil soluble amine (OSA) formulations for various weed situations are suggested. Various formulations containing from 2-6 lb acid equivalent per gallon are available. Usually, higher acid equivalents per gallon are more economical. The following table will aid in converting pounds per acre to liquid volumes necessary to supply the amount of the weed killer suggested. It is important to have the correct amount of herbicide.

AE (lb/gal on label)	Pints of given formulation necessary to supply following rates per acre					
	1/4 lb	1/2 lb	1 lb	2 lb	3 lb	4 lb
2	1	2	4	8	12	16
3	2/3	1 1/3	2 2/3	5 1/3	8	10 2/3
4	1/2	1	2	4	6	8
6	1/3	2/3	1 1/3	2 2/3	4	5 1/3

Susceptibility of pasture weeds to recommended herbicide treatments^a

Species	Treatment and rate (lb active ingredient per acre)						
	2,4-D		Dicamba (Banvel)				2,4-D plus dicamba 0.75-1.5 plus 0.25-0.50
	1.0-1.5	2.0	0.25	0.50	1.0	2.0	
Aster spp.	G	G	F	F-G	G	G	G
Bedstraw spp.	P	P	N	N	P	P-F	P
Bindweed, field	F	F	P	P-F	F-G	G	F
Bindweed, hedge	G	G	F	F-G	G	G	G
Blackberry spp.	P	P	N	N	P	P-F	P
Brackenfern	P	P	N	N	P	P-F	P
Burdock spp.	G	G	P-F	F	F	G	G
Buttercup spp.	G	G	P	F	F-G	G	G
Campion, bladder	P	P	F	F-G	G	G	G
Carrot, wild	G	G	P-F	F	G	G	G
Chamomile, mayweed	P	P	F	F-G	G	G	G
Chicory	G	G	P	P	G	F-G	G
Chickweed, common	P	P	P	F-G	F-G	G	G
Chickweed, mouseear	P	P	P	P-F	F-G	G	G
Clover spp.	P	P	P-F	F-G	G	G	G
Clover, hop	P	P	N	N	P	P	P
Cockle, corn	F	F	G	G	G	G	G
Cocklebur, common	G	G	G	G	G	G	G
Cowcockle	G	G	G	G	G	G	G
Daisy spp.	G	G	F	F-G	G	G	G
Dandelion	G	G	N	F	F-G	G	G
Dewberry sp.	P	P	N	N	P	P-F	P
Dock spp.	F	F	P-F	P-F	F	F	F
Dogbane, hemp	G	G	P-F	P-F	G	G	G
Dogfennel	G	G	P	F	F-G	G	G
Eveningprimrose	G	G	P-F	F	G	G	G
Fleabane spp.	G	G	F	F-G	G	G	G
Garlic or onion, wild	F-G	G	F	F	G	G	G
Goldenrod spp.	G	G	P	P	P	P	P
Hawkweed spp.	G	G	P	P	F	F	F
Honeysuckle spp.	P	P	N	N	P	P-F	P
Horsenettle	P	P	P-F	P-F	G	G	G
Horseweed or marestalk	G	G	F	F-G	G	G	G
Jimsonweed	G	G	G	G	G	G	G
Knapweed, spotted	P	F-G	P-F	F	G	G	G
Knawel (German moss)	P	P	G	G	G	G	G
Knotweed prostrate	F	F	N	N	P	P	P
Kudzu	P	P	G	G	G	G	G
Lambsquarters, common	G	G	G	G	G	G	G
Lettuce, wild	G	G	F	F-G	G	G	G
Mallow, common	F	F	F	F-G	G	G	G
Milkweed spp.	P	P	P-F	P-F	G	G	G
Mustard spp.	G	G	F	F-G	G	G	G
Nightshade, black	P-F	P-F	F	F-G	G	G	G
Pennycress spp.	G	G	F	F-G	G	G	G
Pepperweed spp.	G	G	F	F-G	G	G	G
Persimmon, common	P	P	P	P	P-F	P-F	P
Pigweed spp.	F-G	G	F-G	G	G	G	G
Plantain spp.	G	G	P	P	F-G	G	G
Poison-hemlock	F	G	N	N	P	P-F	P
Poison-ivy, oak	P	P	N	N	P	P-F	P
Pokeweed, common	P	P	N	N	P	P-F	P
Ragweed, common	F-G	G	F-G	G	G	G	G
Ragweed, giant	F	F	F-G	G	G	G	G
Multiflora rose	P	P	N	N	P	P	P
Shepherdspurse	F-G	F-G	F	F-G	G	G	G
Sneezeweed, bitter	F-G	G	F	F-G	G	G	G
Sorrel spp.	P	P	F	F-G	G	G	G
Spurge, prostrate	P	P	F	F-G	G	G	G
Sumac spp.	P	P	N	N	P	P-F	P
Sunflower spp.	F-G	F-G	G	G	G	G	G
Teasel spp.	P-F	P-F	P-F	P-F	G	G	G
Thistle, bull	F-G	G	P-F	F	G	G	G
Thistle, plumeless	F-G	G	P-F	F	G	G	G
Thistle, musk	G	G	P-F	F	G	G	G
Trumpet creeper	P	P	P	P	F	F	F
Velvetleaf	F-G	F-G	P	P	G	G	G
Waterhemlock, spotted	F	G	N	N	P	P-F	P
Woodsorrel spp.	P	P	P	P	P-F	G	P
Yellowrocket	G	G	F	F-G	G	G	G

^aG(good) = 80-100 percent control, F(fair) = 60-80 percent control, P(poor) = 20-60 percent control, and N(none) = <20 percent control.

^bBetter control of these species may be obtained by using higher rates of 2,4-D plus dicamba. Consult the label for use rates and precautions.

Permanent pasture

Weed problem	Chemical rate per acre	Product per acre	Remarks
Annual and perennial weeds including aster, buttercup, burdock, chicory, crane's bill, daisy, dandelion, dog fennel, elderberry, eveningprimrose, fleabane, goatsbeard, goldenrod, hawkweed, horseweed, wild lettuce, dock seedlings, musk thistle, mustards, pepperweed, pennycress, plantains spotted knapweed, wild carrot and wild parsnip	2,4-D ^a 1.0-1.5 lb	LVE, OSA or amine	Apply when weeds are actively growing. Use lower rates on annuals and biennials and higher rates for perennials.
Bitterweed	2,4-D ^a 1.5 lb	LVE, OSA or amine	Apply when bitterweed reaches about 3 in high.
Thistle (bull and curled)	2,4-D ^a 1.5 lb	LVE, OSA or amine	Spray thistles when in rosette stage and actively growing, either in late fall or early spring.
Pigweed (spiny) ragweed	2,4-D 1 ^a .0-1.5 lb	LVE, OSA, or amine	Apply in early summer when weeds first reach 2-4 in in height. Usually one application is sufficient. Occasionally more seed will germinate. Repeat treatment if necessary.
Horsenettle (sandbriar), curly dock, dewberry, persimmon, poison ivy, and many other weeds listed above for 2,4-D	Dicamba 0.25-0.5 lb plus 2,4-D 0.75-1.5 lb	Weedmaster 1.0-2.0 qt	Spray about time horsenettle blooming begins. All legumes will be killed. Repeat treatment on regrowth 2nd year. Do not graze dairy animals on treated areas within 7 days after application. Do not graze meat animals on treated areas within 30 days of slaughter. Do not harvest for dry hay within 37 days of treatment. Make ground application only, 10-20 gal of water per acre.
Multiflora rose, hawthorne, juniper kudzu, sumac, and other woody species	Picloram 2.0-4.0 lb	Tordon 10K 20.0-40.0 lb	Apply picloram pellets to individual plants at 0.75-1.5 oz of pellets per 100 sq ft. For multiflora rose, the lower rate has been effective. May injure or suppress grasses in the immediate treated area. Limit coverage to no more than 25% of an applicator's acreage found in any particular watershed. Read and follow all use precautions. Avoid use near desirable plants, movement of treated soil, transfer of livestock or manure, and water contaminations.
	Dicamba 1.0-2.0 lb	Banvel 4WS 1.0-2.0 qt	
	Dicamba 1.0 lb plus 2,4-D 2.0 lb	Banvel 4WS 1.0 qt plus 2,4-D 2.0 qt	

Permanent pasture (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Coralberry (devil's shoestring)	2,4-D ^a 2.0 lb	LVE or OSA	Clip in winter. Spray when weed is about 1 in high (early May) and actively growing. Be prepared to spot-treat the 2nd year.
Dwarfflarkspur, water hemlock	2,4-D ^a 2.0lb	LVE, OSA or amine	Apply in the bud to early bloom stage. See 2,4-D above.
Wild garlic or onion	2,4-D ^a 1.5-2.0 lb	LVE	Spray late in fall and during February or early March with midday temperature of 60° F or above. Repeat twice annually for 3 to 4 years. Do not graze dicamba treated areas for 21 days after treatment.
	Dicamba 1.0 lb	Banvel 1.0 qt	
Cowcockle, corn cockle, corn chamomile, German moss (knapweed), knotweed, mayweed, ragweed, sheepsorrel (red sorrel), prostrate spurge and sunflower	Dicamba 0.25 lb	Banvel 0.5 pt	Post emergence application. Apply when weeds are actively growing. Clovers will be killed. Do not apply near desirable trees or plants, or in location where chemicals may be washed or moved into contact with their roots. Do not graze meat animals in treated fields within 30 days before slaughter.
Bladder campion, chickweed, curly dock, giant ragweed, ragwort, shepherdspurse, wornwood, croton, sesbania and velvetleaf	Dicamba 0.5 lb	Banvel 1.0 pt	Do not graze dairy animals on treated areas within 7 days if 0.5 lb/A applied; 21 days if 1.0 lb/A is applied; 40 days if 2.0 lb/A is applied; or 60 days if 8.0 lb/A is applied.
Aster, clover, spotted knapweed, goldenrod, wild garlic, wild onion, sow thistle, mallow, spotted knapweed and teasel	Dicamba 1.0 lb	Banvel 1.0 qt	Observe dosage rates and days of delay between treatment and harvesting for hay: 37 days if 0.5 lb/A is applied; 51 days if 2.0 lb/A is applied; 70 days if 2.0 lb/A is applied; 90 days if 9.0 lb/A is applied.
Blueweed (viper's bugloss), buckbrush (coralberry), chicory, cottonwood (seedlings), evening-primrose, groundsel, musk thistle, nightshade, poison ivy, spotted knapweed, stinging nettle, trumpet creeper, wild carrot, wood sorrel, yarrow and tansy ragwort	Dicamba 2.0 lb	Banvel 2.0 qt	Postemergence application. Apply when weeds are actively growing. Clovers will be killed. Do not apply near desirable trees or plants, or in locations where chemicals may be washed or moved into contact with their roots. Do not graze meat animals in treated fields within 30 days before slaughter.
Bedstraw, bindweed, blackberry, bluebell, bracken fern, Canada thistle, Carolina geranium, dewberry, hop clover, horsemint, kudzu, poison oak or ivy, pokeweed, sumac, water hemlock, wild honeysuckle, yucca and persimmon treatment	Dicamba 4.0-8.0 lb	Banvel 1.0-2.0 gal	Do not graze dairy animals on treated areas within: 7 days if 0.5 lb/A is applied; 21 days if 1.0 lb/A is applied; 40 days if 2.0 lb/A is applied; 60 days if 8.0/A is applied.

Permanent pasture (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Multiflora rose	Dicamba 4.0 lb	Banvel 1.0 gal to 100 gal water (use a wetting spray)	Observe dosage rates and days of delay between treatment and harvesting for hay: 37 days if 0.5 lb/A is applied; 51 days if 1.0 lb/A is applied; 70 days if 1.0 lb/A is applied or 90 days if 9.0 lb/A is applied.
Spot treatment of undesirable woody vegetation including pine, cherry, sumac, locust, elm, maple, alder, spruce, oak species, multiflora rose and many others	Tebuthiron 1.0-4.0 lb	Spike 5G 20.0-80.0 lb or Spike 80W 1.25-5.0 lb or Spike 20P 5.0-20.0 lb or Spike 40P 2.5-10.0 lb	For nonselective soil sterilant activity as a spot treatment on individual woody plants. Consult label for rates for individual species, and for application procedures for individual formulations. Do not use spike in any area where desirable species are in the vicinity of plants to be eliminated. Both grasses and broadleaf plants in treated spots will be killed. Grazing is allowed in areas treated with 4 lb active ingredient tebuthiron or less. In areas treated with 4 lb or less, grass may be cut for hay 1 year after application.
Burdock, Canada thistle, cocklebur, dandelion, goldenrod, lambsquarters, marshelder, oxalis, plantains, wild carrots, ragweed, ironweed, sunflower, vetch and others	2,4-D plus triclopyr (prepackage mix) 0.75-1.5 lbs	Crossbow 1.0-2.0 qts	Apply when weeds and brush are actively growing. Apply in a manner to avoid drift or other contact with nearby susceptible vegetation. Use lower rates for general weed control and control of more susceptible woody species. Withdraw animals from treated areas 3 days prior to slaughter. Do not graze lactating dairy animals for 1 year following treatment. Do not harvest treated grasses for hay for 1 year following treatment. Do not graze any area treated with more than 1 1/2 gallon of product for 1 year.
Alder, ash, aspen, birch, blackberry, blackgum, cherry, elderberry, hawthorne, hazel, maples, Multiflora rose, oak, pine, salmonberry, sumac, sweetgum, tamarack, willow, and others	2,4-D plus triclopyr (prepackage mix)	Crossbow 2.0-6.0 qts	Apply when weeds and brush are actively growing. Apply in a manner to avoid drift or other contact with nearby susceptible vegetation. Use lower rates for general weed control and control of more susceptible woody species. Withdraw animals from treated areas 3 days prior to slaughter. Do not graze lactating dairy animals for 1 year following treatment. Do not harvest treated grasses for hay for 1 year following treatment. Do not graze any area treated with more than 1 1/2 gallon of product for 1 year.

^a Do not graze dairy animals on 2,4-D sprayed areas for 7 days after spraying. Observe grazing restrictions specific to the gate of Banvel applied. If poisonous plants are present, keep animals out until plants turn brown. Spray when temperature is predicted to be 60 °F or above during the day. Do not use on newly seeded areas until the grass is well-established.

Pasture renovation

Weed problem	Chemical rate per acre	Product per acre	Remarks
Suppression of competition by existing sod and undesirable emerged broadleaf weeds and grasses	Paraquat 0.47-0.75 lb plus surfactant	Gramoxone Super 2.0-4.0 pt plus surfactant as specified by label	Graze area close, apply in spring or early summer after growth begins, before or at time of seeding grasses, alfalfa, clover or birdsfoot trefoil. Do not graze in treated areas until newly planted seedlings are 3-6 in high for seedling grasses and forage legumes, 18 in for sudangrass, and 24 in high for sorghum-sudan. Do not pasture or mow bermudagrass for hay until 40 days after treatment.

Weed Control in Corn

Uncontrolled weeds continue to be a major limiting factor in Delmarva corn production. To be successful in controlling weeds in corn, the weed control program must be both well planned and well executed. Consideration should be given to cultural, mechanical and chemical methods of weed control with reference to specific weed infestations. The major elements of a successful weed control program in corn are summarized below.

Weed Control Program

Weed identification. The first step in an effective weed control program is proper weed identification. Only by knowing the exact identities and relative infestations of weeds on a field by field basis can the proper weed control strategy be developed. Continued use of the same program, or use of reduced tillage practices, can result in changes in weed infestations. Keep an accurate field record of the weeds in each field on a yearly basis and use this record to plan your weed control program.

Cultural control. Several aspects of cultural weed control should be considered in planning a corn weed control program. These include weed free seed, cover crops and crop rotation. Crop rotation is a valuable tool in our corn/soybean rotations because perennial broadleaf weeds that cannot be controlled in soybeans can be effectively controlled in corn. Take advantage of this opportunity to control these tough weeds with mechanical methods and herbicides.

Mechanical control. Mechanical weed control is still one of our most useful weed control tools. Both primary tillage and cultivation should be considered for specific weed problems. Perennial broadleaf weeds are an increasing problem in no-till corn production. In some cases, these weeds cannot be controlled without tillage to disrupt underground perennial parts. The use of the moldboard plow when these weeds become a problem is an effective method of control, and for some weeds represents the only practical method of control.

Herbicidal control. Many options are available in terms of herbicidal control of weeds in corn. Both preplant incorporated and preemergence combinations are available that offer broad spectrum weed control. Preplant incorporated treatments ensure activation of the herbicide and minimize the risk of crop injury. Preemergence treatments require rainfall for activation, but offer good weed control when rainfall occurs within the first 2 weeks after application. Consider postemergence and directed postemergence applications. These are some of our strongest options in corn weed control. Identify the weed and select the herbicide program that best fits your specific weed infestation.

The following table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type, and application method. Under nonoptimal conditions, activity may be less than indicated.

Relative effectiveness of "burndown" for no-till corn establishment^{a,b,c}

	Grasses and broadleaf weeds in crop stubble (0-3 in)	Grasses and broadleaf weeds in crop stubble (>3 in)	Rye cover and annual weeds	Orchardgrass sod and annual weeds	Volunteer small grains and annual weeds
Paraquat	G	F-G	G	P-F	F
Paraquat and then paraquat (10-14 days later)	G	G	G	G	G
Paraquat + 2,4-D	G	G	G	P-F	F
Paraquat + Banvel	G	G	G	P-F	F
2,4-D and then paraquat (10-14 days later)	G	G	G	P-F	F
Banvel and then paraquat (10-14 days later)	G	G	G	P-F	F
Bladex	G	NR	F	P-F	P-F
Bladex + 2,4-D	G	NR	F	P-F	P-F
Bladex + Banvel	G	NR	F	P-F	P-F
Roundup (1.0 qt)	G	F-G	F-G	P	F
Roundup (2.0-3.0 qt)	G	G	G	F-G	F
Roundup (1.0 qt) + 2,4-D	G	G	F-G	P	F
Roundup (1.0 qt) + Banvel	G	G	F-G	P	F
Atrazine (3.0 lb) + paraquat	G	G	G	G	G
Atrazine (2.0 lb) + Bladex (1.0 lb) + paraquat	G	G	G	G	G
Atrazine (1.0-2.0 lb) + paraquat	G	F-G	G	F	G
Atrazine (1.0-2.0 lb) + Bladex	G	F-G	F-G	F	G

^aG = 80 to 100 percent control; F = 60 to 80, P = 20 to 60, N = less than 20, NR = not recommended.

^bThese treatments are rated only for control of vegetation existing at the time of no-till corn establishment. Add residual herbicides as required for the specific infestation.

^cUse Banvel only on soil types for which the preemergence use of this product is permitted by label.

The following table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type and application method. Under nonoptimal conditions, activity may be less than indicated.

	Fescue sod and annual weeds	Clover and annual weeds	Alfalfa and annual weeds	Horseweed and other annual weeds	Perennial broadleaf weeds and annuals
Paraquat	F	F	P-F	F	P-F
Paraquat and then paraquat (10-14 days later)	G	F-G	F	F-G	F
Paraquat + 2,4-D	P-F	F-G	F	F-G	F
Paraquat + Banvel	P-F	F-G	F-G	F-G	F
2,4-D and then paraquat (10-14 days later)	P-F	G	F	G	F-G
Banvel and then paraquat (10-14 days later)	P-F	G	G	G	F-G
Bladex	P-F	F	F	G	P-F
Bladex + 2,4-D	P-F	G	F	G	F
Bladex + Banvel	P-F	G	G	G	F
Roundup (1.0 qt)	P	F	P-F	F-G	F
Roundup (2.0-3.0 qt)	G	G	G	G	F-G
Roundup (1.0 qt) + 2,4-D	P	G	F	G	F-G
Roundup (1.0 qt) + Banvel	P	G	G	G	F-G
Atrazine (3.0 lb) + paraquat	G	F	P-F	F-G	F
Atrazine (2.0 lb) + Bladex (1.0 lb) + paraquat	G	F	P-F	F-G	F
Atrazine (1.0-2.0 lb) + paraquat	F	F	P	F	P-F
Atrazine (1.0-2.0 lb) + Bladex	F	F	P	F-G	P-F

^aG = 80 to 100 percent control; F = 60 to 80, P = 20 to 60, N = less than 20, NR = not recommended.

^bThese treatments are rated only for control of vegetation existing at the time of no-till corn establishment. Add residual herbicides as required for the specific infestation.

^cUse Banvel only on soil types for which the preemergence use of this product is permitted by label.

The following table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type and application method. Under nonoptimal conditions, activity may be less than indicated.

Corn (no-till and conventional)
Relative effectiveness of residual herbicides for corn^a

	Barnyard-grass	Crab-grass	Fall panicum	Foxtails	Johnson-grass (seedling)	Johnson-grass (rhizome)	Yellow Nutsedge	Shatter-cane
Preplant incorporated								
Dual	G	G	G	G	P	N	F-G	P
Dual + Atrazine	G	G	G	G	P	N	F-G	P
Dual + Bladex	G	G	G	G	P	N	F-G	P
Dual + Princep	G	G	G	G	P	N	F-G	P
Dual + Atrazine + Princep	G	G	G	G	P	N	F-G	P
Eradicane Extra	G	G	G	G	G	F	G	G
Eradicane Extra + Atrazine	G	G	G	G	G	F	G	G
Eradicane Extra + Bladex	G	G	G	G	G	F	G	G
Sutan + or Genate Plus	G	G	G	G	G	P-F	G	G
Sutan + or Genate Plus + Atrazine	G	G	G	G	G	P-F	G	G
Sutan + or Genate Plus + Bladex	G	G	G	G	G	P-F	G	G
Sutan + or Genate Plus + Atrazine + Bladex	G	G	G	G	G	P-F	G	G
Preemergence								
Atrazine	F	P-F	P	F	N	N	P	P
Bladex	F-G	F-G	F	F-G	P	N	P	P
Princep	F-G	F-G	F	F-G	P	N	P	P
Atrazine + Bladex	F-G	F-G	F	F-G	P	N	P	P
Atrazine + Princep	F-G	F-G	F	F-G	P	N	P	P
Dual	G	G	G	G	P-F	N	F	P
Dual + Atrazine	G	G	G	G	P-F	N	F	P
Dual + Bladex	G	G	G	G	P-F	N	F	P
Dual + Princep	G	G	G	G	P-F	N	F	P
Dual + Atrazine + Princep	G	G	G	G	P-F	N	F	P
Lasso	G	F-G	G	G	P-F	N	P-F	P
Lasso + Atrazine	G	F-G	G	G	P-F	N	P-F	P
Lasso + Bladex	G	F-G	G	G	P-F	N	P-F	P
Lasso + Princep	G	F-G	G	G	P-F	N	P-F	P
Postemergence								
Atrazine + Oil	F	P-F	P	F	P	N	P-F	P
Banvel	N	N	N	N	N	N	N	N
Basagran	N	N	N	N	N	N	F	N
Bladex	N	F	P-F	F	P	N	P	P
Brominal or Buctril	N	N	N	N	N	N	N	N
2,4-D	N	N	N	N	N	N	N	N
2,4-D + Banvel	N	N	N	N	N	N	N	N
Evik	F-G	F-G	F-G	F-G	P-F	N	P	F
Laddock	F	P-F	P	F	P	N	P-F	P
Lorox	F	F	F	F	P-F	N	P	P-F
Paraquat	G	G	G	G	G	N	F	G
Prowl + Atrazine	F-G	F-G	F	F-G	P-F	N	F	P
Prowl + Bladex	F-G	F-G	F	F-G	P-F	N	P	P
Tandem + Atrazine	F-G	G	G	G	F	N	P-F	F-G

^aG = 80 to 100 percent control : F = 60 to 80, P = 20 to 60, N = less than 20.

^bTriazine resistant.

Corn (no-till and conventional) (continued)
Relative effectiveness of herbicides for corn^a (continued)

	Cockle- bur	Jimson- weed	Lambs- quarters	Morning- glory (annual spp.)	Pig- weed	Pig- weed ^b	Common rag- weed	Smart weed	Prickly sida or teaweed	Velvet leaf
Preplant incorporated										
Dual	N	N	P-F	N	G	G	P	P	P	N
Dual + Atrazine	F-G	G	G	G	G	G	G	G	G	F-G
Dual + Bladex	F	G	G	F-G	G	G	G	G	G	F
Dual + Princep	F	G	G	F-G	G	G	G	G	G	F
Dual + Atrazine + Princep	F-G	G	G	G	G	G	G	G	G	G
Eradicane Extra	P	N	P-F	P	F	F-G	P	P	P	P-F
Eradicane Extra + Atrazine	F-G	G	G	G	G	F-G	G	G	G	F-G
Eradicane Extra + Bladex	F	G	G	F-G	G	F-G	G	G	G	F
Sutan + or Genate Plus	P	N	P-F	P	F	F-G	P	P	P	P-F
Sutan + or Genate Plus + Atrazine	F-G	G	G	G	G	F-G	G	G	G	F-G
Sutan + or Genate Plus + Bladex	F	G	G	F-G	G	F-G	G	G	G	F
Sutan + or Genate Plus + Atrazine + Bladex	F-G	G	G	G	G	F-G	G	G	G	G
Preemergence										
Atrazine	F-G	G	G	G	G	N	G	G	G	F-G
Bladex	F	G	G	F-G	P-F	N	G	G	G	F
Princep	F	G	G	F-G	G	N	G	G	G	F
Atrazine + Bladex	F-G	G	G	G	G	N	G	G	G	G
Atrazine + Princep	F-G	G	G	G	F-G	N	G	G	G	G
Dual	N	N	P-F	N	F-G	F-G	P	P	P	N
Dual + Atrazine	F-G	G	G	G	G	F-G	G	G	G	F-G
Dual + Bladex	F	G	G	F-G	G	F-G	G	G	G	F
Dual + Princep	F	G	G	F-G	G	F-G	G	G	G	F
Dual + Atrazine + Princep	F-G	G	G	G	G	F	G	G	G	G
Lasso	N	N	P-F	N	F-G	F	P	P	P	N
Lasso + Atrazine	F-G	G	G	G	G	F	G	G	G	F-G
Lasso + Bladex	F	G	G	F-G	G	F	G	G	G	F
Lasso + Princep	F	G	G	F-G	G	F	G	G	G	F
Postemergence										
Atrazine + Oil	G	G	G	G	G	N	G	G	G	F-G
Banvel	G	G	G	G	G	P	F	F	F	G
Basagran	G	G	P-F	P	P	P	F	F-G	F-G	F-G
Bladex	F-G	F-G	G	F-G	F	N	G	F-G	G	F-G
Brominal or Buctril	F-G	F-G	F	F	N	N	F-G	F-G	P	F-G
2,4-D	G	G	G	G	G	F-G	G	F-G	G	F-G
2,4-D + Banvel	G	G	G	G	G	G	G	G	G	G
Evik	G	G	G	F-G	G	G	G	F-G	G	F-G
Laddock	G	G	F-G	P-F	F	P	F-G	F-G	F-G	F-G
Lorox	G	G	G	F-G	G	G	G	F-G	G	F-G
Prowl + Atrazine	G	G	G	G	G	N	G	G	G	G
Prowl + Bladex	F-G	F-G	G	F-G	F	N	G	F-G	G	G
Tandem + Atrazine	G	G	G	G	G	N	G	G	G	G

^aG = 80 to 100 percent control; F = 60 to 80, P = 20 - 60, N = less than 20.
^bTriazine resistant

Corn (no-till)
Perennial sod: bluegrass, fescue, orchardgrass, timothy and ryegrass

Weed problem	Chemical rate per acre	Product per acre	Remarks
Perennial covers including bluegrass, fescue, orchardgrass, and timothy, and annuals including barnyardgrass, foxtails (giant, green, yellow), lambsquarters, morningglory (annual), mustard, nightshade, redroot pigweed, purslane (common) ragweed, velvetleaf, witchgrass, and large crabgrass	Paraquat 0.47 lb + surfactant + atrazine 3.0 lb	Gramoxone Super 2.5 pt + surfactant as labeled + Atrazine 80Wa 3.75 lb, 4L 3.0 qt, or 90W 3.3 lb	Apply 2-3 weeks before corn planting. Paraquat gives contact kill of cover. Atrazine is needed for complete root kill and for control of annual weeds developing from seed. Use 35-45 gal of solution per acre. Paraquat efficacy may be reduced if certain phosphorus-containing soluble fertilizers are used as carriers. Do not allow animals to graze paraquat treated areas. Paraquat is toxic. Follow label for proper mixing procedures.
Alternate method 1: for reduced triazine carryover in controlling fescue and orchardgrass sods and control of annual weeds listed above	Paraquat 0.47 lb + surfactant + atrazine 1.5 lb + cyanazine 1.5 lb	Gramoxone Super 2.5 pt + surfactant as labeled + Atrazine 80Wa 1.9 lb, 4L 1.5 qt, or 90W 1.7 lb + Bladex 80W 1.9 lb or 4L 1.5 qt	Follow precautions listed above. Cyanazine will give shorter triazine residual and increased burndown of existing vegetation. This combination may not provide late-season control of annual grasses.
Alternate method 2: for reduced triazine carryover and optimum control of vigorous orchardgrass sods	Paraquat 0.47 lb + surfactant + paraquat 0.28-0.47 lb + surfactant 10-14 days later + residual herbicide treatment as required for specific infestations	Gramoxone Super 2.5 pt + surfactant as labeled + Gramoxone Super 1.5-2.5 pt + surfactant as labeled 10-14 days later + residual herbicide	Use double paraquat 2.5 pt application for vigorous orchardgrass stands where single applications have not been effective. Observe paraquat use instructions and precautions as above. Tank mix with residual herbicides as listed below for the specific weed infestation. High triazine rates are not required for orchardgrass control where the double paraquat application is used.
Contact kill of rye, wheat and barley cover crops, and annuals including barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, lambsquarters, morningglory (annual), mustard, nightshade, redroot pigweed, purslane, ragweed, smartweed, spanishneedles, velvetleaf and witchgrass	Paraquat 0.28-0.47 lb + surfactant ----- Glyphosate 1.0-2.0 lb + the approved tank mix atrazine 1.0-2.0 lb + simazine 1.0-2.0 lb	Gramaxone Super 1.5-2.5 pt + surfactant as labeled ----- Roundup 1.0-2.0 qt + Atrazine 80Wa 1.25-2.50 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb + Princep 80Wa 1.25-2.50 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb	Apply 10-14 days before planting in 35-45 gal/A. Use paraquat 0.5 lb active ingredient on barley. Use 1:2 atrazine to simazine ratio on heavily infested fall panicum fields. Do not plant to any crop, except those specified on the label the following year. Do not allow animals to graze treated forage. See precaution above on use of paraquat. Follow label for proper mixing procedures and adjust rate to soil texture, organic matter content of soil and weed problem.

Weed problem	Chemical rate per acre	Product per acre	Remarks
(continued)	Paraquat 0.28-0.47 lb + surfactant + atrazine 0.75-2.0 lb + cyanazine 0.75-2.0 lb	Gramoxone Super 1.5-2.5 pt + surfactant as labeled + Atrazine 80Wa 0.94-2.5 lb, 4L 0.75-2.0 qt, or 90W 0.66-2.2 lb + Bladex 80W 0.94-2.5 lb, 4L 0.75-2.0 qt	The combination of atrazine plus cyanazine can be used in late plantings of no-till corn in place of atrazine plus simazine for shorter triazine residues plus increased burndown of existing vegetation. Adjust ratios of atrazine/cyanazine to fit weed and grass infestation and soil type. This combination may not provide late-season control of annual grasses. Atrazine plus cyanazine also sold as package mix called Extrazine.
Contact kill of rye, wheat and barley cover crops, and annuals barnyardgrass, carpetweed, cocklebur, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, jimsonweed, lambsquarters, nightshade (black), pigweed spp., purslane, ragweed, (common), signalgrass, smartweed, velvetleaf and witchgrass	Paraquat 0.28-0.47 lb + surfactant Glyphosate 1.0-2.0 lb + the approved tank mix alachlor 2.5-3.0 lb + atrazine 1.0-2.0 lb Simazine 1.0-2.2 lb	Gramoxone Super 1.5-2.5 pt + surfactant as labeled Roundup 1.0-2.0 qt + Lasso 2.5-3.0 qt + Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb or Bronco 3.2-5.0 qt + Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb Princep 80Wa 1.25-2.8 lb, 4L 1.0-2.2 qt, or 90W 1.1-2.4 lb	Apply 10-14 days before and up to day of planting. Use paraquat at 0.47 lb active including ingredient on barley. See precaution above on use of paraquat. Follow label for proper mixing procedures and adjust rate to soil texture, organic matter content of soil, and weed problem. This combination may be weak on crabgrass species and may not provide season long control of other annual grasses. Alachlor plus atrazine may also be applied as Lasso/Atrazine prepackage mix.
Annual cover: rye, barley, wheat or no-till into existing crop stubble.			
Contact kill of rye, wheat and barley cover crops, and annuals including barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, signalgrass, yellow nutsedge, carpetweed, cocklebur, common purslane, Florida pusley, lambsquarters morningglory, pigweed spp., ragweed smartweed and velvetleaf	Paraquat 0.28-0.47 lb + surfactant or Glyphosate 1.0-2.0 lb + the approved tank mix metolachlor 1.5-2.5 lb + atrazine 1.2-2.0 lb	Gramoxone Super 1.5-2.5 pt + surfactant as labeled or Roundup 1.0-2.0 qt + Dual 8E 1.5-2.5 pt + Atrazine 80Wa 1.5-2.5 lb, 4L 1.2-2.0 qt, or 90W 1.3-2.2 lb or Bicep 6.0 lb/gal 1.8-3.0 qt	Apply before, during, or after planting, but before the corn emerges. Adjust rates to soil texture and organic matter. Use lower rate of glyphosate for annual weeds and higher rate for perennial weeds. Do not graze or feed forage to livestock or use for silage. Small grains may be seeded 4.5 months after metolachlor use. Do not graze or feed forage or fodder from small grains to livestock.

Annual cover: rye, barley, wheat or no-till into existing crop stubble. (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Contact kill of rye, wheat and barley cover crops, and annuals including barnyard-grass, crabgrass, fall panicum, foxtail millet, giant foxtail, goosegrass, green foxtail, signalgrass southwestern cupgrass, witchgrass, yellow foxtail, yellow nutsedge, carpetweed, cocklebur, common purslane, Florida pusley, lambsquarters, morningglory, pigweed spp., ragweed, smartweed, velvetleaf and sandbur	Paraquat 0.28-0.47 lb + surfactant	Gramoxone Super 1.5-2.5 pt + surfactant as labeled	Apply in 10-40 gal of water or fluid fertilizer with ground equipment in minimum tillage or no-tillage systems where corn is planted directly into a cover crop, stale seedbed, established sod, or previous crop residues. Use lower rate of glyphosate for annual weeds and higher rate for perennial weeds. Adjust rates of metolachlor atrazine and simazine to soil texture, organic matter content of soil and weed problem. Check labels for restrictions regarding planting of rotational cover crops. Note: metolachlor plus atrazine plus simazine may also be applied as Bicep (atrazine plus metolachlor) plus Princep (simazine). Consult label for specific
	Glyphosate 1.0-2.0 lb + either of the following approved tank mixes: Metolachlor 1.5-2.5 lb + simazine 1,2-2.0 lb	Roundup 1.0-2.0 qt Dual 8E 1.5-2.5 pt + Princep 80Wa 1.5-2.5 lb, 4L 1.2-2.0 qt, or 90W 1.3-2.2 ob	
	Metolachlor 1.5-2.5 lb + atrazine 0.6-1.0 lb + simazine 0.6-1.0 lb	Dual 8E 1.5-2.5 pt + Atrazine 80Wa 0.75-1.25 lb, 4L 0.6-1.0 qt, or 90W 0.66-1.1 lb + Princep 80Wa 0.75-1.25 lb 4L 0.6-1.0 qt, or 90W 0.66-1.1 lb	
Triazine resistant pigweed	Use either the paraquat or glyphosate plus atrazine and metolachlor pigweed treatment or the paraquat or glyphosate plus atrazine and simazine and metolachlor treatment listed above. Use the latter where heavy fall panicum or other annual grass infestation exists. Metolachlor will suppress or control initial triazine resistant pigweed flushes. In most years, an early postemergence application of dicamba (Banvel) will be required for satisfactory season-long control (see dicamba below under postemergence herbicides).		
Contact kill of rye, wheat and barley cover crops and annuals as listed above	Paraquat 0.28-0.47 lb + surfactant + atrazine 1.0-2.0 lb + metolachlor 1.5-2.5 lb + cyanazine 1.0-2.0 lb	Gramoxone Super 1.5-2.5 pt + surfactant as labeled + Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb + Dual 8E 1.5-2.5 pt + Bladex 80W 1.25-2.5 lb or 4L 1.0-2.0 qt	Apply as directed above for atrazine, metolachlor and simazine combination. For use where weed control similar to this combination with shorter triazine residual activity is desired. Adjust rates of atrazine, cyanazine plus metolachlor to soil texture, organic matter and weed problems. Check labels for restrictions on use of Bladex on light, sandy soils and for restrictions regarding rotational crops. Note: metolachlor plus atrazine may be applied as Bicep. Consult label for specific rates.

Annual cover: rye, barley, wheat or no-till into existing crop stubble. (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Burndown of small annual grasses and broadleaf weeds in existing crop stubble and residual control of weeds listed for Atrazine plus Princep or Atrazine plus Dual or Atrazine plus Lasso (Bladex for burndown is not for use in any living cover crop or sod)	Cyanazine 1.0-2.0 lb + surfactant + any of the follow tank mixes:	Bladex 4L 1.0-2.0 qt + nonionic surfactant 1.0-2.0 qt/100 gal +	Cyanazine (Bladex 4L) can be used for burndown in place of paraquat or glyphosate only if broadleaf weeds and grasses are 3 in high or less and only in existing crop residue. Not for use in living covers such as rye, orchardgrass, fescue or alfalfa. Use only the 4L Bladex formulation in a minimum of 25 gal/A of carrier. Burndown generally is better when cyanazine is applied in nitrogen solutions or liquid fertilizers than when applied in water. Add a nonionic surfactant at the rate of 1-2 qt/100 gal of spray solution for all applications. Cyanazine burndown activity relies on both foliar and root uptake, and will be reduced if activation rainfall does not occur shortly after application. Can be weak on volunteer small grains.
	Atrazine 1.0-2.0 lb + simazine 1.0-2.0 lb	Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt or 90W 1.1-2.2 lb + Princep 80Wa + 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb	
	Atrazine 1.0-2.0 lb + metolachlor 1.5-2.5 lb	Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 + Dual 8E 1.5-2.5 pt	
	Atrazine 1.0-1.0 lb + alachlor 2.5-3.0	Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb + Lasso 4E 2.5-3.0 qt	
Early preplant control of annual grasses	Simazine 1.0-1.5 lb	Princepa 80W 1.25-1.9 lb or 4L 1.0-5.0 qt or 90W 1.1-1.7 lb	Apply 2-4 weeks prior to corn planting. Rainfall is necessary for satisfactory control. Apply additional burndown and residual herbicides at planting as required.
Supplement to paraquat, glyphosate (Roundup), cyanazine (Bladex 4L), or simazine early preplant, burndown treatments. For added control of hard to control annual broadleaf weeds present at no-till corn establishment, suppression of some perennial broadleaf species, and control of alfalfa and clovers	2,4-D 0.25-0.50	2,4-D 0.50-1.0 pt	Add 2,4-D or dicamba to paraquat or cyanazine (Bladex 4L) for added burndown of hard to control broadleaf weeds. Use the lower rate of 2,4-D on light, sandy soils and the higher rate only on heavy soils. Do not apply dicamba on light, sandy coastal plain soils as a preemergence treatment. Adjust dicamba rate to soil texture and organic matter content as labeled. Use 2,4-D for added control or suppression of mustard spp., plantains, horseweed, dandelion and 2,4-D susceptible annual broadleaf weeds. Use dicamba for control or suppression of dock, clovers, alfalfa, and dicamba susceptible annual broadleaf weeds.
	Dicamba 0.25-0.375 lb	Banvel 0.50-0.75 qt	
CORN (Conventional Tillage)			
Preplant Quackgrass, Canada thistle, nutsedge and annuals including barnyardgrass crabgrass, foxtails lambsquarters, morningglory (annual), mustard, nightshade, redroot pigweed, purslane (common), ragweed, velvetleaf and witchgrass	Atrazine 4.0 lb	Atrazine 80Wa 5.0 lb, 4L 4.0 qt, or 90W 4.4 lb	Use 2 lb active ingredient of atrazine per acre in the fall or spring and plow 1-3 weeks later. Before, during or after planting of corn and before annual weeds are 1.5 in high, use second application of 2 lb active ingredient of atrazine per acre. Cultivate at least once.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Yellow and purple nutsedge suppression and annuals including barnyardgrass, carpetweed, cocklebur, crabgrass, fall panicum, field sandbur, Florida pusley, foxtails (giant, green and yellow), goosegrass, jimsonweed, johnsongrass and bermudagrass from seed, lambsquarters, morningglory (annual), mustards, nightshade (black), redroot pigweed, purslane (common), ragweed, ryegrass (annual), smartweed, witchgrass, and velvetleaf	Butylate + safener 3.1-4.2 lb	Sutan + 3.75-4.75 pt	All weed growth and crop residue should be chopped thoroughly into the soil before applying. Soil should be dry enough to permit thorough mixing. Mix well into soil 2-4 in immediately after application. Follow label instructions for proper rate for weeds and soil texture, tank mixing and incorporation. Has been effective for late season grass control. Combination gives better annual broadleaf control than butylate alone. Do not seed deeper than 2 in. Do not use on corn seed stock, milo or sorghum. Cultivation suggested especially for sandbur, nutsedge and wildcane control. Follow atrazine label instructions regarding rotational crops.
	+ atrazine 1.0-1.6 lb	Genate Plus 3.75-4.75 pt + Atrazine 80Wa 1.25-2.0 lb, 4L 1.0-1.6 pt, or 90W 1.1-1.8 lb	
	Cyanazine 1.0-2.0 lb	Sutazine + 5.27-7.0 pt Bladex 80W 1.25-2.5 lb or 4L 1.0-2.0 qt	
	Butylate + safener 3.1-4.0 lb	Rhino 6.0-7.8 pt	
		Sutan 3.75-4.75 pt	
		Genate Plus 3.75-4.75 pt	
	+ atrazine 0.75-2.0 lb	+ Atrazine 80Wa 0.94-2.50 lb, 4L 0.75-2.0 qt or 90W 0.83-2.2 lb	
	+ cyanazine 0.75-2.0 lb	+ Bladex 80W 0.94-2.50 lb or 4L 0.75-2.0 qt	
Johnsongrass suppression, nutsedge suppression and annual grasses including barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, sandbur, seedling johnsongrass and bermudagrass, volunteer sorghum and wild cane (suppression)	Butylate + safener 4.0-6.0 lb	Sutan + 4.75-7.3 pt	Perennial weeds must be chopped up thoroughly (four or fewer nodes per strand) before treatment. The soil should be well worked and dry enough for good soil mixing. The heavier rate required for johnsongrass rhizome suppression. See previous remarks for addition of atrazine or cyanazine for residual broadleaf weed control.
		Genate Plus 4.75-7.3 pt	
Annual grasses: annual ryegrass, barnyardgrass, crabgrass, foxtails, goosegrass, fall panicum, johnsongrass seedlings, sandbur, shattercane and volunteer small grains Annual broadleaf weeds: carpetweed, cocklebur, Florida pusley, lambsquarters, nightshade (black, hairy) morningglory, mustard, purslane, pigweed spp., ragweed, shepherdspurse, sicklepod, smartweed, prickly sida and velvetleaf Perennials: bermudagrass, nutsedge (purple and yellow)	EPTC + safener 3.1-4.0 lb	Eradicane 6.7E 3.75-4.75 pt	Perennial weeds must be chopped up thoroughly (four or fewer nodes per strand) before treatment. The soil should be well worked and dry enough for good soil mixing. Incorporate immediately after application to prevent loss from surface. Follow label instructions for proper rate for weeds and soil texture, tank mixing and incorporation procedures. Do not seed small grains after corn harvest until September. Shallow cultivation suggested especially for sandburg and nutsedge control. Observe all precautions and limitations on cyanazine and atrazine labels.
	+ atrazine 1.0-1.5 lb	Eradicane Extra 6E 4.0-5.33 pt + Atrazine 80Wa 1.25-1.9 lb, 4L 2.0-3.0 pt, or 90W 1.1-1.65 lb	
	cyanazine 1.0-2.0 lb	Bladex 80W 1.25-2.5 lb, 4L 1.0-2.0 qt	
	EPTC + safener 3.1-4.0 lb	Eradicane 6.7E 3.75-4.75 pts	
	+ atrazine 0.75-2.0 lb	Eradicane Extra 6E 4.0-5.33 pt + Atrazine 80Wa 0.94-2.50 lb, 4L 0.75-2.0 qt, or 90W 0.83-2.2 lb	
+ cyanazine 0.75-2.0 lb	+ Bladex 80W 0.94-2.5 lb or 4L 0.75-2.0 qt		

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Johnsongrass rhizome and bermudagrass suppression, heavy infestations of nutsedge and wild cane (shattercane), and annuals listed above	EPTC + safener 6.0 lb	Eradicane 6.7E 7.33 pts Eradicane Extra 6E 8.0 pt	Fall plow soils that cannot be adequately worked in the spring. Disc thoroughly 6-8 in deep so that rhizomes are cut into 3- to 4-in pieces. Work the soil so that it is in good tilth before applying. Plant corn varieties that are resistant to maize dwarf mosaic and maize chlorotic virus. Plant midseason or full season corn varieties tolerant to EPTC plus safener. Additional broadleaf weed control may be obtained by tank mix of atrazine or cyanazine or a sequential treatment with atrazine or 2,4-D. See above remarks.
Barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, signalgrass, witchgrass, yellow nutsedge, carpetweed, Florida pusley and pigweed	Metolachlor 1.5-3.0 lb	Dual 8E 1.5-3.0 pt	Apply to the soil and incorporate into the top 2 in within 14 days before planting using a disk, harrow, rolling cultivator or similar implement. Small grains may be planted 4.5 months following treatment. Do not graze or feed forage or fodder from small grains to livestock.
Above weeds and cocklebur, common purslane, lambsquarters, pigweed spp., morningglory, ragweed, smartweed and velvetleaf	Metolachlor 1.25-2.5 lb + atrazine 1.0-2.0 lb	Dual 8E 1.25-2.5 pt + Atrazine 80Wa 1.25-2.5 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb or use Bicep 6.0 lb/gal 1.8-3.0 qt	Apply tank mixture to the soil and incorporate into the top 2 in before planting using a disk, harrow, rolling cultivator or similar implement. Read the label and adjust rate to soil texture and organic matter content. See metolachlor restrictions above.
	Metolachlor 1.25-2.5 lb + cyanazine 0.8-2.5 lb	Dual 8E 1.25-2.5 pt + Bladex 80W 1.0-3.1 lb or 4L 0.8-2.5 qt	
Barnyardgrass, crabgrass, fall panicum, foxtail, millet, giant foxtail, goosegrass, green foxtail, signalgrass, southwestern cupgrass, witchgrass, yellow foxtail, yellow nutsedge, carpetweed, cocklebur, common purslane, Florida pusley, lambsquarters, morningglory, pigweed spp., ragweed, smartweed, velvetleaf, sandbur, seedling johnsongrass and volunteer sorghum	Metolachlor 1.25-2.5 lb + atrazine 1.0-2.0 lb + simazine 0.5-2.0 lb	Dual 8E 1.25-2.5 pt + Atrazine 80Wa 1.25-2.50 lb, 4L 1.0-2.0 qt, or 90W 1.1-2.2 lb + Princep 80Wa 0.62-2.5 lb, 4L 0.5-2.0 qt, or 90W 0.55-2.2 lb	Apply the tank mixture to the soil and incorporate into the top 2 in of soil within 14 days before planting using a finishing disk, harrow, rolling cultivator or similar implement capable of providing uniform 2-in incorporation. If corn is to be planted on beds, apply and incorporate the tank mixture after bed formation. Read the label and adjust rate to soil texture and organic matter content. Note: metolachlor plus atrazine plus simazine may also be applied as Bicep (atrazine plus metolachlor) plus Princep (simazine). Consult label for specific ratios.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
PREEMERGENCE			
Barnyardgrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails (giant, green and yellow), goosegrass, purslane (common), signalgrass, witchgrass and pigweed spp.	Alachlor 2.0-4.0 lb	Lasso 2.0-4.0 qt	Apply after planting and before crop or weeds emerge. Read label and adjust rate to soil texture and organic matter content. Most effective on grasses; higher rate improves control of many broadleaf weeds.
Above weeds and black nightshade jimsonweed, lambsquarters, morningglory, mustards, pigweed spp., ragweed, smartweed and velvetleaf	Alachlor 1.5-3.0 lb + atrazine 1.0-1.6 lb	Lasso 1.5-3.0 qt + Atrazine 80Wa 1.25-2.0 lb, 4L 1.0-1.6 qt, or 90W 1.1-1.8 lb Lasso and atrazine (prepackage mix) 3.0-4.0 qt	Read label and adjust rate to soil texture and organic matter content. See other remarks and precautions to the use of alachlor and atrazine separately. Alachlor and atrazine may be applied as a tank mix and incorporated into the top 2 in of soil within 7 days before planting. May also be applied as an early postemergence treatment up to the time when weeds reach the 2-leaf stage and corn is not more than 5 in high. Do not apply as an early postemergence treatment in fluid fertilizer.
Many annuals: Florida pusley, lambsquarters, morningglory, nightshade, mustards, redroot pigweed, velvetleaf and witchgrass Broadleaf weeds listed above for atrazine plus barnyardgrass, Brachiaria sp., crabgrass, foxtails, fall panicum, Florida pusley, goosegrass lambsquarters, morningglory, mustards, nightshade, redroot pigweed, ragweed, smartweed, spanishneedles and witchgrass	Atrazine 1.5-3.0 lb Atrazine 1.0-1.5 lb + simazine 1.0-1.5 lb	Atrazine 80Wa 1.88-3.75 lb, 4L 1.5-3.0 qt, or 90W 1.66-3.3 lb Atrazine 80Wa 1.25-1.8 lb, 4L 1.0-1.5 qt, or 90W 1.1-1.6 lb + Simazine 80Wa 1.25-1.8 lb, 4L 1.0-1.5 qt, or 90W 1.1-1.6 lb	Spray immediately after planting. Use lower rate on light soils. Shallow cultivation usually will improve weed control. Do not plant any crop except those specified on the label the following year. Do not apply more than 4 lb of atrazine or simazine in any one year. Use 1:2 ratio of atrazine to simazine on more severe annual grass problem areas
Annual ryegrass, barnyardgrass, carpetweed, cocklebur, crabgrass, corn spurry, curly dock (seedlings), fall panicum, Florida pusley, foxtails, galinsoga, goosegrass, ground cherry, lambsquarters, morningglory, redroot pigweed, purslane, poorjoe, ragweed, smartweed, prickly sida, velvetleaf, witchgrass, jimsonweed and mustards	Cyanazine 1.2-2.5 lb	Bladex 80W 1.5-3.1 lb, 4L 1.2-2.5 qt	Read label and adjust rate to soil texture and organic matter. Apply at planting or before corn and weeds emerge. Cyanazine has shorter soil residual life than atrazine. Do not use on peat or muck soil or sandy, loamy sands with less than 1 percent organic matter.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
PREEMERGENCE (continued)			
Most annual weeds see list for cyanazine)	Cyanazine 0.75-2.0 lb + atrazine 0.75-2.0 lb	Bladex 80W 0.94-2.5 lb, 4L 0.75-2.0 qt + Atrazine 80Wa 0.94-2.5 lb, 4L 0.75-2.0 qt, or 90W 0.83-2.2lb	Read label and adjust rate to soil texture and organic matter. Apply before planting, at planting, or after planting. The combination may give shorter residual weed control and less residual problems than with atrazine alone. Follow label for tank mixing procedures. Cyanazine plus atrazine also sold as package mix called Extrazine.
	Cyanazine 0.75-2.0 lb + alachlor 2.0-3.0 lb	Bladex 80W 0.94-2.5 lb or 4L 0.75-2.0 qt + Lasso 2.0-3.0 qt	See cyanazine above.
Broad spectrum control of weeds listed for respective chemicals	Cyanazine 0.75-1.5 lb + atrazine 0.75-1.5 lb + alachlor 1.5-2.5 lb	Bladex 80W 0.94-1.8 lb or 4L 0.75-2.0 qt + Atrazine 80Wa 0.94-1.5 lb, 4L 0.75-1.5 qt, or 90W 0.83-1.6 lb + Lasso 1.5-2.5 qt	The three way combination will give shorter triazine residual levels than alachlor plus atrazine alone and better broadleaf control than alachlor plus cyanazine alone. Observe all instructions and precautions on individual labels.
Barnyardgrass, crabgrass, fall panicum, foxtails, pigweed spp., signalgrass, witchgrass, yellow nutsedge, goosegrass, carpetweed and Florida pusley	Metolachlor 1.5-3.0 lb	Dual 8E 1.5-3.0 pt	Apply after planting and before corn emerges. Small grains may be seeded 4.5 months after treatment. Do not graze or feed forage or fodder from small grains to livestock. Adjust rate to soil texture. Under high moisture conditions, while
Above weeds and cocklebur, lambsquarters, ragweed, smartweed and velvetleaf	Metolachlor 1.25-2.5 lb + atrazine 1.0-1.6 lb	Dual 8E 1.25-2.5 pt + Atrazine 80Wa 1.25-2.0 lb, 4L 1.0-1.6 qt, 90W 1.1-1.8 lb, or use Bicep 6.0 lb/gal 1.8-3.0 qt	See above for respective herbicides. Metolachlor plus atrazine (or Bicep) also may be applied as an early postemergence treatment up to the time when weeds reach the 2-leaf stage and corn is no more than 5 in high. Do not apply as an early postemergence treatment in fluid fertilizer.
	Cyanazine 0.75-2.0 lb	Bladex 80W 0.94-2.5 lb or Bladex 4L 0.75-2.0 qt	
Barnyardgrass, crabgrass, fall panicum, foxtail millet, giant foxtail signalgrass, southwestern cupgrass witchgrass, yellow foxtail, yellow nutsedge, carpetweed, cocklebur, common purslane, Florida pusley, lambsquarters, mornningglory, pigweed spp., ragweed, smartweed, velvetleaf, sandbur, seedling johnsongrass and volunteer sorghum	Metolachlor 1.25-2.5 lb + atrazine 0.5-1.0 lb + simazine 0.5-1.0 lb	Dual 8E 1,25-2.5 pt + Atrazine 80Wa 0.62- 1.25 lb, 4l 1.0-2.0 pt, or 90W 0.55 1.1 lb + Princep 80W 0.6-1.25 lb or 4L 1.0-2.0 pt or 90W 0.55-1.1 lb	Apply the tank mixture during planting (behind the planter) or after planting but before weeds or corn emerge. Read the label and adjust rates to soil texture and organic matter content. Check labels for instructions regarding planting of rotational crops. Note: metolachlor plus atrazine plus simazine may also be applied as Bicep (atrazine plus metolachlor) plus Princep (simazine). Consult labels for specific ratios.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
POSTEMERGENCE			
Cocklebur, nightshade (black), morningglory, jimsonweed, mustards, ragweed, velvetleaf, barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, johnsongrass from seed, lambsquarters pigweed spp., and signalgrass	Pendimethalin 0.75-1.5 lb + atrazine 1.0-1.6 lb	Prowl 0.75-1.5 qt + atrazine 80Wa 1.25-2.0 lb, 4L 1.0-1.6 qt, or 90W 1.1-1.8 lb	Refer to label for rate of application for different soil types and organic matter content and for mixing procedures. Some injury can occur if seed is not well covered with soil. Apply as early postemergence treatments in water only up until corn reaches the 2-leaf stage and weeds are no more than 1 in high. These combinations are particularly effective as early postemergence treatments for velvetleaf control. Pendimethalin plus atrazine may also be applied as Prozine.
	Cyanazine 1.0-2.4 lb	Bladex 80W 1.25-3.0 lb, 4L 1.0-2.4 qt	
Barnyardgrass, crabgrass, foxtails, lambsquarters, morningglory, nightshade, pigweed, purslane, ragweed, cocklebur, mustards and smartweed	Atrazine 2.0-3.0 lb + crop oil	Atrazine 80Wa 2.5-3.75 lb, 4L 2.0-3.0 qt, or 90W 2.2-3.3 lb + emulsifiable crop oil 1.0 gal	Use in a single broadcast spray before weeds exceed 1.5 in in height. Use oil/atrazine in 20 gal/A. Do not include oil in atrazine sprays when corn is under stress from prolonged cold, wet weather, poor fertility or other factors, or when corn is wet and succulent from recent rainfall as crop injury may occur. Do not use oil in sprays when treating inbred lines or other breeding stock. Adding other pesticides, fertilizers, or other material to the oil/water emulsions may cause compatibility problems or crop injury. Follow instructions on the container for proper mixing and maintaining the emulsion in the spray tank.
		crop oil concentrate 1.0 qt	
Above weeds and nutsedge control	Atrazine 4.0 lb	Atrazine 80Wa 5.0, 90W 4.4 lb, or 4L 4.0 qt + emulsifiable crop oil 1.0 gal Crop oil concentrate 1.0 qt	Apply atrazine with 1 gal of crop oil or 1 qt oil concentrate in a minimum of 10 gal of water per acre, after crop emergence and before nutsedge is 3 in high. For best results, use atrazine at 2.0 lb followed with a second application at the same rate 10-20 days later but before layby stage (corn 20-30 in). See precautions above concerning use of atrazine/oil mixtures.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Barnyardgrass carpetweed, crabgrass, fall panicum, Florida pusley, foxtails (giant, green, yellow), galinsoga, goosegrass, lambsquarters, pigweed spp., morningglory, purslane (common), ragweed (common), smartweed, prickly sida, cocklebur, morningglory, sicklepod, sesbania, prickly sida and velvetleaf	Linuron 0.63-1.5 lb + surfactant	Lorox 50W 1.25-3.0 lb or 4L 1.25-3.0 pt + surfactant as labeled	Apply as a single directed spray in 25 gal of water after corn is at least 15 in high and weeds up to 5 in high. Thoroughly cover weed foliage without contacting upper leaves or whorl of corn as such contact causes crop injury. Use wetting agent suggested by manufacturer. Do not plant to other crops not on the label within 4 months after treatment. Gauge wheels and/or leaf lifter equipment should be used to prevent corn leaf contact with spray. Provide continuous agitation in tank.
Above weeds and nutsedge, shattercane and signalgrass	Ametryn 1.6-2.0 lb + surfactant	Evik 80W 2.0-2.5 lb + surfactant as labeled	Same as above. Apply in a minimum of 20 gal of water or nonpressure nitrogen solution. Do not harvest, graze or feed forage to livestock until 30 days after application. Do not apply if temperatures are low. Do not plant any rotational crop other than small grains until the following year. Do not apply within 3 weeks of tasseling.
See weeds listed for preemergence use of cyanazine	Cyanazine 1.2-2.0 lb	Bladex 80W 1.5-2.5 lb	Apply from crop emergence through the 4-leaf stage of growth, but before weeds exceed 1.5 in in height. Do not apply to corn if the fifth leaf is visible. Do not exceed the dosage rate specified by soil texture for preemergence use. Follow label for proper mixing and spraying directions. Can be weak against pigweed. Under drought conditions, add a nonionic surfactant for improved performance.
Canada thistle, beggars ticks, cocklebur, dayflower, jimsonweed, prickly sida, ragweed, smartweed, spurred anoda, velvetleaf, wild mustard, wild sunflower and yellow nutsedge	Bentazon 0.75-1.0 lb + crop oil concentrate	Basagran 0.75-1.0 qt + crop oil concentrate 1.0 qt	Refer to label as the rate of application is dependent on leaf stage and height of weeds to be controlled. For Canada thistle and yellow nutsedge, follow with a second application if needed in 7-10 days. Cultivation within 10-14 days after application will improve control. For some species (jimsonweed and cocklebur) the addition of a crop oil concentrate is not required for adequate control.
Cocklebur, lambsquarter, common ragweed, giant, ragweed, redroot pigweed, velvetleaf, smartweed	Bentazon plus atrazine prepackage mix 1.0-1.5 lb + crop oil concentrate	Laddock 2.4-3.6 pt + crop oil concentrate 2.0 pt	Apply in a minimum of 20 gallons of water and a minimum at 40 psi using hollow core or flat fan nozzles only. Crop oil concentrate should always be added to the spray solution. Apply when weeds are small and when the crop is in the 1-5 leaf stage. Carefully observe maximum weed growth stages on the label.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Beggar ticks, bindweed, burdock, cocklebur, coffeeweed, carpetweed, Florida pusley, galinsoga, horseweed, jimsonweed, lambsquarters, morningglory (annual), mustards, nightshade (black), purslane (common), ragweed (common), smartweed, spanishneedles, sunflower, velvetleaf, pigweed spp., and sicklepod	2,4-D 0.25-0.5 lb	2,4-D amine or LVE 0.5-1.0 pt of a 4.0 lb/gal formulation	Use from time corn emerges until layby. Do not cultivate for 10 days, or corn may break off. Small weeds are easier to kill; use higher rate for larger weeds. Grasses are not controlled. After corn is more than 10 in high, direct the spray below top of corn plant (use drop nozzles).
Clovers, cocklebur, jimsonweed, lambsquarters, morningglory, mustards, black nightshade, pepperweed, pigweed spp., prickly sida (teaweed), purslane, ragweed, smartweed, prostrate spurge, velvetleaf, burcucumber and giant ragweed	Dicamba 0.25-0.5 lb	Banvel 0.50-1.0 pt	Use the early postemergence rate as labeled for the specific soil type for corn up to the fifth leaf. For corn past the 5-leaf state, use only the 0.25 lb (0.50 pt Banvel) rate. Apply after weeds have emerged but before corn is 26 in high or 15 days before tassel emergence. Best performance occurs when weeds are small. Drop nozzles may be used to increase coverage where corn leaves cover weeds. Do not graze or harvest for dairy or beef feed before ensilage (milk) stage. Observe precautions to avoid drift to adjacent crops. Also may be applied as a dicamba plus atrazine prepackage mix as Marksman.
Nightshade spp., cocklebur, lambsquarters, common ragweed, giant ragweed, morningglory spp., jimsonweed, smartweed spp., velvetleaf, wild buckwheat and wild mustard	Bromoxynil 0.25-0.375 lb	Buctril 2E 1.0-1.5 pt Brominal 4E 0.5-0.75 pt	Apply as an early postemergence treatment to small weeds in corn from the 4- to 8-leaf stage. Adjust rate to weed size as specified by label. This treatment is nonvolatile and is appropriate to situations where the proximity of susceptible crops prohibits the use of 2,4-D or dicamba. May also be applied, as Buctril/Atrazine prepackage mix.
Contact kill of emerged annual weeds in corn	Paraquat 0.28 lb + surfactant	Gramoxone Super 1.5 pt + surfactant as labeled	Apply as a directed spray when corn plants are at least 10 in high. Do not allow spray to contact more than the lower 3 in of the corn plant. Paraquat is toxic. Follow label for proper mixing procedures.
Weeds listed above for respective chemicals plus suppression of alfalfa, jerusalem artichoke, bindweeds curly dock, hemp dogbane, horsenettle, or milkweed (common and honeyvine), broad-leaf plantain, red sorrel, and Canada thistle	2,4-D 0.25-0.5 lb + dicamba 0.25 lb	2,4-D amine 0.5-1.0 pt of a 4.0 lb/gal formulation + Banvel 0.5 pt	Observe all precautions listed for respective chemicals. When corn is greater than 8 in, direct spray beneath corn leaves and onto weeds. Use higher 2,4-D rate on larger weeds.

CORN (Conventional Tillage) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Small escape fall panicum, crabgrass, and foxtail spp.	Tridiphane 0.5 lb + atrazine 4L 1.5 lb + crop oil concentrate 2.0 pt	Tandem 1.0 pt + Atrazine 4La 3.0 pt + crop oil concentrate 2.0 pt	For use when preemergence herbicides do not provide satisfactory annual grass control and when escape grasses are in the 1- to 4-leaf stage. Grasses must be small for effective control. Observe rotational crop restrictions that apply when the additional 1.5 lb atrazine is used as a component of the postemergence treatment. Apply in 20-30 gal at 30-40 psi.
Johnsongrass	Glyphosate 1.0-3.0 lb	Roundup 1.0-3.0 qt	Use an effective johnsongrass seedling control herbicide on corn and soybeans. Treated corn will be killed. Treatment must be made before silking the corn. The 1.0 qt rate of glyphosate may be used for johnsongrass control in 5-10 gal of water with fan tips and added surfactant. Use the 2.0-3.0 qt rate in noncrop areas or where annual tillage is not preferred. After corn harvest, permit new growth of johnsongrass to reach 12 in or more in height and approaching the boot stage of growth. Apply in 10-40 gal of water at least 7 days before frost or before tillage. Rainfall within 6 hours may reduce effectiveness; within 2 hours retreatment is necessary. Do not plant subsequent crops, other than those on the label, for 1 year following application. Do not feed or graze treated crops within 8 weeks after treatment.
Harvest aid Morningglory and other broadleaf weeds	2,4-D 0.5-1.0 lb	2,4-D amine 1.0-2.0 pt of a 4.0 lb/gal formulation	Apply after hard dough or denting stage. Do not forage or feed corn fodder for 7 days following application.

^aAtrazine and Simazine precautions: 1) do not apply more than 4 lb active ingredient of atrazine to corn in any one year. 2) Land treated with atrazine should not be planted to any crop except corn or sorghum until the following year, or injury may occur. 3) Do not plant tobacco, vegetables or spring-seeded legumes and grasses following atrazine treatment, or injury may occur. 4) Do not graze treated area or feed treated forage to livestock for 21 days following application of atrazine. For simazine, do not graze treated area. 5) If more than 3 lb active ingredient is used per acre, a crop of untreated corn should precede the next rotational crop. 6) Atrazine and simazine are available with various trade names in addition to AAtrex and Princep, respectively. AAtrex Nine-O, a 90-percent water dispersible granule, is available as well as Princep Caliber 90, a 90-percent water dispersible granule of simazine.

Weed Control in Soybeans

Table 1 - Relative effectiveness of herbicides for soybeans^a

	Barnyard-grass	Crab-grass	Fall panicum	Foxtails	Johnson-grass (seedling)	Johnson-grass (rhizome) ^b	Yellow nutsedge	Shatter-cane
Preplant incorporated								
Canopy	F	F	F	F	P	N	P	P
Canopy + Dual	G	G	G	G	P	N	F-G	P
Canopy + Treflan	G	G	G	G	P	N	P	P
Canopy + Lasso	G	F-G	G	G	P	N	F	P
Command	F-G	F-G	G	G	P	N	N	P
Command + Lexone or Sencor	F-G	F-G	G	G	P	N	N	P
Dual	G	G	G	G	P	N	F-G	P
Dual + Lexone or Sencor	G	G	G	G	P	N	F-G	P
Lasso	G	F-G	G	G	P	N	F	P
Lasso + Lexone or Sencor	G	F-G	G	G	P	N	F	P
Lexone or Sencor	P-F	P-F	P-F	P-F	P	N	N	P
Prowl	G	G	G	G	G	P	N	G
Prowl + Lexone or Sencor	G	G	G	G	G	P	N	G
Scepter	P	P	P	F	F	P	N	G
Scepter + Lasso	G	G	G	G	F	N	F-G	P
Scepter + Dual	G	G	G	G	N	N	G	P
Scepter + Prowl	G	G	G	G	G	P	P	G
Scepter + Treflan	G	G	G	G	G	P	P	G
Treflan	G	G	G	G	G	P	N	G
Treflan + Lexone or Sencor	G	G	G	G	G	P	N	G
Vernam	G	G	G	G	F-G	P	F-G	G
Vernam + Treflan	G	G	G	G	G	P-F	F-G	G
Preemergence								
Canopy	F	F	F	F	P	N	P	P
Canopy + Lasso	G	F-G	G	G	P	N	F	P
Canopy + Dual	G	G	G	G	P	N	F-G	P
Canopy + Prowl	G	G	G	G	P	N	P	P
Dual	G	G	G	G	P	N	F	P
Dual + Lexone or Sencor	G	G	G	G	P	N	F	P
Dual + Lorox or Linex	G	G	G	G	P	N	F	P
Gemini	F	F	F	F	P	N	F	P
Gemini + Lasso	G	F-G	G	G	P	N	F	P
Gemini + Dual	G	G	G	G	P	N	F-G	P
Gemini + Prowl	G	G	G	G	P	N	P	P
Lasso	G	F-G	G	G	P	N	F	P
Lasso + Lexone or Sencor	G	F-G	G	G	P	N	F	P
Lasso + Lorox or Linex	G	F-G	G	G	P	N	F	P
Lexone or Sencor	P-F	P-F	P-F	P-F	P	N	N	P
Lorox or Linex	F	F	F	F	P	N	N	P
Prowl	G	G	G	G	F	N	N	F
Prowl + Lexone or Sencor	G	G	G	G	F	N	N	F
Prowl + Lorox or Linex	G	G	G	G	F	N	N	F
Scepter	P	P	P	P-F	P-F	N	N	F
Scepter + Lasso	G	G	G	G	P	N	F	P
Scepter + Dual	G	G	G	G	P	N	F-G	P
Scepter + Prowl	G	G	G	G	P	N	P	P
Surflan	G	G	G	G	F	N	N	F
Surflan + Lexone or Sencor	G	G	G	G	F	N	N	F
Surflan + Lorox or Linex	G	G	G	G	F	N	N	F

(continues)

	Barnyard-grass	Crab-grass	Fall panicum	Foxtails	Johnson-grass (seedling)	Johnson-grass (rhizome) ^b	Yellow nutsedge	Shatter-cane
(continued)								
Postemergence								
Basagran	N	N	N	N	N	N	F	N
Blazer or Tackle	NN	NN	PP	PP	PP	NN	NN	PP
Classic	P	P	P	P	P	N	P-F	P
Cobra	N	N	N	N	N	N	N	N
Fusilade								
or Fusilade 2000	G	F-G	G	G	G	G	N	G
Hoelon	GG	F	F-G	GG	NN	NN	NN	PP
Poast	GG	G	GG	GG	GG	GG	NN	GG
Reflex	NN	NN	NN	NN	NN	NN	NN	NN
Rescue	NN	NN	NN	NN	NN	NN	NN	NN
Scepter	P	P	P	P	P	N	P-F	P
Whip	G	G	G	G	G	F-G	N	G
Postemergence directed spray								
Lexone or Sencor	F-G	F-G	F-G	F-G	P	N	P	P
Lorox	F	F	F	F	P	N	P	P
Lorox + Buxoxone or Butyrac	F	F	F	F	P	N	P	P

Table 1 (continued)

	Cockle-bur	Jimson-weed	Lambs-quarters	Morning-glory (annual spp.)	Pigweed	Common rag-weed	Smart-weed	Prickly sida or teasweed	Velvet-leaf
Preplant incorporated									
Canopy	G	G	G	F	G	G	G	G	F-G
Canopy + Dual	GG	GG	GG	F	GG	GG	GG	GG	F-G
Canopy + Treflan	GG	GG	GG	F	GG	GG	GG	GG	F-G
Canopy + Lasso	G	G	G	F	G	G	G	G	F-G
Command	P	F-G	G	N	P-F	F	F-G	F-G	G
Command + Lexone or Sencor	F	F-G	G	P-F	G	G	G	G	G
Dual	N	N	P-F	N	G	P	P	P	N
Dual + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Lasso	N	N	P-F	N	G	P	P	P	N
Lasso + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Lexone or Sencor	F	F	GG	P-F	GG	GG	GG	GG	F-G
Prowl	N	N	G	P	G	N	P	N	F
Prowl + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F
Scepter	GG	F-G	GG	F	GG	GG	F-G	GG	F-G
Scepter + Lasso	GG	F-G	GG	F	GG	GG	F-G	GG	F-G
Scepter + Dual	GG	F-G	GG	F	GG	GG	F-G	GG	F-G
Scepter + Prowl	GG	F-G	GG	F	GG	GG	F-G	GG	F-G
Scepter + Treflan	GG	F-G	GG	F	GG	GG	F-G	GG	F-G
Treflan	N	N	G	P	G	N	P	N	N
Treflan + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F
Vernam	N	P	F	P	GG	P	P	P	P
Vernam + Treflan	P	P	G	P	G	P	P	P	P
Preemergence									
Canopy	F-G	F-G	G	F	G	G	G	G	F
Canopy + Lasso	F-G	F-G	GG	F	GG	GG	GG	GG	F
Canopy + Dual	F-G	F-G	GG	F	GG	GG	GG	GG	F
Canopy + Prowl	F-G	F-G	G	F	GG	GG	GG	GG	F
Dual	N	N	P-F	N	G	P	P	P	N
Dual + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Dual + Lorox or Linex	P-F	P-F	G	P-F	G	G	G	F-G	F
Gemini	F-G	F-G	GG	F	GG	GG	GG	G	F
Gemini + Lasso	F-G	F-G	GG	F	GG	GG	GG	GG	F
Gemini + Dual	F-G	F-G	G	F	GG	GG	GG	GG	F
Gemini + Prowl	F-G	F-G	G	F	GG	GG	GG	GG	F
Lasso	N	N	P-F	N	G	P	P	P	N
Lasso + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Lasso + Lorox or Linex	P-F	P-F	G	P-F	G	G	G	F-G	F

(continues)

Table 1 (continued)

	Cockle- bur	Jimson- weed	Lambs- quarters	Morning- glory (annual spp.)	Pigweed	Common rag- weed	Smart- weed	Prickly sida or teaweed	Velvet- leaf
Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Lorox or Linex	P-F	P-F	G	P-F	G	G	G	F-G	F
Prowl	N	N	F-G	P	G	P	P	P	F
Prowl + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Prowl + Lorox or Linex	P-F	P-F	G	P-F	G	G	G	F-G	F
Scepter	F-G	F-G	F-G	P-F	G	F-G	F-G	F-G	P-F
Scepter + Lasso	F-G	F-G	F-G	P	G	F-G	F-G	F-G	P-F
Scepter + Dual	F-G	F-G	F-G	P	G	F-G	F-G	F-G	P-F
Scepter + Prowl	F-G	F-G	F-G	P	G	F-G	F-G	F-G	P-F
Surflan	N	N	F-G	P	G	P	P	P	P
Surflan + Lexone or Sencor	F	F	G	P-F	G	G	G	G	F-G
Surflan + Lorox or Linex	P-F	P-F	G	P-F	G	G	G	F-G	F
Postemergence									
Basagran	G	G	P	P	P	F-G	G	G	G
Blazer or Tackle	F-G	G	P-F	G	G	G	F-G	N	P
Classic	G	G	P	P-F	G	F-G	F-G	P	P-F
Corba	F	G	P	P-F	G	G	P	P-F	F-G
Fusilade 2000	N	N	N	N	N	N	N	N	N
Hoelon	N	N	N	N	N	N	N	N	N
Poast	N	N	N	N	N	N	N	N	N
Reflex	F	G	P-F	F-G	G	G	F	N	P
Rescue	F-G	F	P-F	F	P-F	F	P-F	P-F	P-F
Scepter	G	F	N	P	G	P	P	P	P
Whip	N	N	N	N	N	N	N	N	N
Postemergence directed spray									
Lexone or Sencor	G	G	G	F-G	G	G	G	G	F-G
Lorox	G	G	G	F-G	G	G	F-G	G	F-G
Lorox + Butoxone or Butyrac	G	G	G	F-G	G	G	F-G	G	F-G

^aG = 80 to 100% control, F = 60 to 80, P = 20 to 60, N = less than 20. This table gives general ratings of relative herbicidal activity. Activity varies with weather conditions, soil type and application method. Under nonoptimal conditions, activity may be less than indicated.

^bRatings on rhizome johnsongrass are for standard use rates of each herbicide. Suppression and partial control of rhizome johnsongrass can be obtained with higher rates of Treflan. Consult the label for johnsongrass rates of these herbicides.

Rotational Restrictions

The herbicides listed below when used in soybeans may influence one's ability to rotate crops in a normal fashion. Labeled rotational intervals are as follows but may be influenced by many factors such as the addition of other residual herbicides, soil type, soil pH, etc. Do not use these herbicides unless all rotational restrictions are understood.

	Corn	Small grains (months ^a)	Vegetables
Canopy	10 ^b	4	18
Classic	9 ^b	3	9 + bioassay ^c
Command	9	12	9
Gemini	10	4	12 - 18 + bioassay ^c
Reflex	10	4	18
Scepter	11	4	11 - 18

^aNumbers indicate the number of months you must wait from last application to planting of rotational crop. For soil type, rainfall, and soil pH differences, follow individual product labels.

^bIf Classic is applied after August 1, extend recrop interval on corn by 2 months.

^cA successful field bioassay must be completed the season **before** planting the intended crop. A successful field bioassay means growing to maturity a test strip of the crop(s) intended for production the **following** year. The test strip should cross the **whole field including knolls and low areas**.

Soybeans

Weed problem	Chemical rate per acre	Product per acre	Remarks
PREPLANT			
Johnsongrass (rhizomes)	Glyphosate 2.0-3.0 lb	Roundup 2.0-3.0 qt	Use in 10-40 gal of water per acre. Spray when johnsongrass is 24-30 in high and in boot to head stage. Rainfall within 6 hours may reduce effectiveness, within 2 hours retreatment is necessary.
Johnsongrass (rhizomes) (continued)			Allow at least 7 days before plowing. Use one of the pre-plant incorporated herbicides for johnsongrass seedling control before planting. Do not feed or forage treated crops within 8 weeks after application.
Alternate method	Glyphosate 1.0 lb + surfactant	Roundup 1.0 qt + 0.5% nonionic	Use 1.0 qt rate with low water volume (5-10 g/A) and with additional surfactant and fan surfactant type nozzles on annually cropped areas. Use the 2.0-3.0 qt rate described above on noncrop areas or where annual tillage is not performed.
Barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, broadleaf signalgrass, yellow nutsedge, carpetweed, pigweed and galinsoga	Metolachlor 1.5-3.0 lb	Dual 8E 1.5-3.0 pt	If used preplant incorporated, incorporate not over 2 in deep within 14 days before planting. Apply before weeds or crop emerges.
	Approved combinations: metribuzin-tank mix or preemergence; linuron-preemergence; chlorimuron + metribuzin (Canopy)-tank mix or preemergence; chlorimuron + linuron (Gemini)-preemergence; imazaquin-tank mix or preemergence	Refer to label for rates, application and complete weed lists. The metolachlor plus metribuzin combination may be applied as the prepackage mix Turbo.	
Barnyardgrass, carpetweed, crabgrass, fall panicum, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, pigweed, signalgrass, smartweed, spurge and shattercane	Pendimethalin 0.5-1.5 lb	Prowl 1.0-3.0 pt	Adjust rate of soil texture. Apply and incorporate 1-2 in deep within 7 days after application. Soybeans may be planted immediately.
	Approved combinations: metribuzin-tank mix or preemergence; linuron-preemergence; chlorimuron + metribuzin (Canopy)-preemergence; chlorimuron + linuron (Gemini)-preemergence; imazaquin-tank mix or preemergence		Observe all precautions, rates of application, and weeds controlled on the respective labels.
Barnyardgrass, Brachiaria sp., bromegrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, pigweed, purslane, sandbur, stinkgrass, Texas panicum wild cane, or shattercane	Trifluralin 0.5-1.0 lb	Treflan EC 1.0-2.0 pt	Incorporate with tandem disk set to cut 4-6 in immediately or within 24 hours after application. Use lower rates on sandy and sandy loam soils and heavier rates on loam and silt loam soils. Plant soybeans after early season adverse weather has passed. Do not plant deeper than 2 in. Follow label for proper soil incorporation procedures.

Soybeans (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
	Approved combinations: metribuzin-tank mix or preemergence; linuron-preemergence; chlorimuron + metribuzin (Canopy)-tank mix or preemergence; chlorimuron + linuron (Gemini)-preemergence; imazaquin-tank mix or preemergence		Observe all precaution, rates of application, and weeds controlled on the respective labels.
Johnsongrass control and above annual weeds for respective chemicals	Trifluralin 1.0-2.0 lb	Treflan EC 2.0-4.0 pt	In the fall (preferable) or early spring, bring johnson- grass rhizomes to soil surface by moldboard plow, spring hoarow, or chisel plow. Tooth Thoroughly disc soil before treatment to cut johnsongrass rhizomes into 2-3 in pieces. Apply herbicide to well worked, dry surfaced soil. Apply in spring at the rate suggested for your solid and thoroughly incorporate with a tandem disc set to cut 4-6 in deep and operated at 4-6 mph and cross disc. Soybeans can be planted immediately. Cultivate at least once during growing season. Usually re- quires two annual applica- tions for effective control. Follow label as to rotational crops that may be safely grown. Use a johnsongrass seedling control herbicide the succeeding year.
	Pendimethalin 1.0-2.0 lb	Prowl 2.0-4.0 pt	
Wild cane or shattercane control and above annual weeds for respective chemicals	Trifluralin 0.5-1.25 lb	Treflan EC 1.0-2.5 pt	Follow soil preparation, mix- ing, application, and incorpo- ration instructions listed above.
Nutsedge suppres- sion and above annuals: barnyard- grass, carpetweed, crabgrass, foxtails, Florida, pusley, German millet, goosegrass, johnsongrass seedlings, lambquarters, mornningglory, pigweed, purslane, sicklepod, velvetleaf, and wild cane or shattercane	Vernolate 2.0-2.6 lb	Vernam 7E 2.3-3.0 pt	All weed growth and crop stubble should be thoroughly worked into the soil before treatment. Use lower rates on sandy soils and heavier rates on silt and clay loam soils. Apply to soil surface that is dry enough to permit good incorporation with Tandem disk set to cut 4-6 inches and incorporate immediately. Follow label for proper soil incorporation procedures. Do not plant deeper than 2 in. Mal-formation of primary leaves usually is not detrimental.
	Approved combinations: linuron-preemergence		Observe all precautions, rates of application, and weeds controlled on the respective labels.
Above weeds and Brachiaria sp., sandbur, stink- grass, and johnsongrass suppression	Vernolate 2.0-3.0 lb + Trifluralin 0.5-1.0 lb	Vernam 7E 2.3-3.5 pt + Treflan 1.0-2.0 pt	See above. Use as a tank mix Use heavier rates of vernolate for nutsedge, wild can and velvetleaf control. This also has been effective for johnsongrass suppression at the 2.6 lb rate of vernolate. Cultivate at least once. The use of this combination allows rotation to corn in the year following application.
	Approved combinations: vernolate + pendimethalin		

Soybeans (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Cocklebur, jimsonweed, lambsquarters, pigweed, common ragweed, smartweed, prickly sida or teaweed, velvetleaf, and suppression of annual morningglory species, burcucumber and giant ragweed	Chlorimuron + metribuzin 0.25-0.38 lb	Canopy 75DG 6.0-10.0 oz	Incorporate uniformly into the top 1-2 in of soil before planting soybeans. If tank mixed with grass herbicide, follow incorporation instructions for the grass herbicide. Use lower rates on sandy soils of low organic matter content. Do not use on sand or loamy sand or any soil of less than 0.5% organic matter content. Do not use on soils of pH 7.0 or higher. Observe labeled rotational crop restrictions.
	Approved combinations: alachlor, metolachlor, trifluralin		Observe all precautions, rates of application, and weeds controlled on respective labels.
Cocklebur, jimsonweed, lambsquarters, pigweed, spp., common ragweed, smartweed, prickly sida on teaweed, velvet leaf, foxtail spp., seedling johnsongrass and suppression of giant ragweed	Imazaquin 0.125 lb	Scepter 1.5E 0.66 pt	Apply before planting and incorporate uniformly into the top 1-2 in of soil. Observe labeled rotational crop restrictions. Do not graze or feed treated soybean forage, hay or straw to livestock.
	Approved combinations: alachlor, metolachlor, pendimethalin, trifluralin		Observe all precautions, rates of application, and weeds controlled on respective labels.
Barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, seedling johnsongrass, purslane, common ragweed, jimsonweed, lambsquarter, smartweed, velvetleaf	Dimethazone 0.75-1.0 lb	Command 1.5-2.0 pts	Apply in a spray volume of 10-40 gallons per acre. An agriculturally approved spray drift reducing agent is required for spray volumes of 10-15 gallons. Use coarse sprays to reduce drift. Incorporate on dry soil within 3 hours. Application to wet soils increase risk of offsite movement and improper incorporation. Carefully follow labeled incorporation's instructions. DO NOT APPLY COMMAND within 1000 feet of areas listed on label including towns, subdivisions, commercial fruit and vegetable production, and etc. Carefully note species susceptible to injury from offsite movement of this herbicide as listed on the label. Observe labeled rotational crop registrations.
	Approved combinations: metribuzin		
PREEMERGENCE			
Barnyardgrass, crabgrass, carpetweed, Florida pusley, foxtails, galinsoga, goosegrass, fall panicum, nightshade (black), pigweed, signalgrass and witchgrass	Alachlor 1.5-4.0 lb	Lasso EC 1.5-4.0 qt	Apply immediately after planting and before crop and weeds emerge. Use lower rates on sandy and sandy loam soils, higher rates on silt loam soils. Also may be used as a preplant incorporated treatment. Shallow incorporation or surface blend generally is most effective, particularly on light, sandy soils. Lasso is not recommended for incorporation on coarse soils in the Southeast.

Soybeans (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
	Approved combinations: linuron-tank mix; metribuzin-tank mix; chlorimuron + metribuzin (Canopy)-tank mix; chlorimuron + linuron (Gemini)-tank mix; imazaquin-tank mix		Observe all precautions, rates of application, and weeds controlled on respective labels.
Barnyardgrass, carpetweed, crabgrass, foxtails, Florida pusley, goosegrass, fall panicum, galinsoga, lambsquarters, mustard, pigweed, purslane, ragweed and smartweed Will not control cocklebur, jimsonweed, morningglory or velvetleaf	Linuron 0.5-1.33 lb	Lorox 50W 1.0-2.67 lb or 4L or Linex 4L 0.5-1.33 qt	Apply after planting and before beans germinate. Provide good agitation in tank before and during application. Follow labeled directions regarding soybean planting depth. Do not use on light sandy soils with low organic matter as injury may occur. Do not plant of any crop not on label within 4 months of application. Often provides short-term grass control.
	Approved combinations: alachlor-tank mix; metolachlor-tank mix; oryzalin-tank mix; trifluralin-preplant incorporated, pendimethalin-preplant incorporated or tank mix		Observe all precautions, rates of application, and weeds controlled on the respective labels. When used in combinations, linuron rates generally should be reduced.
Barnyardgrass, beggarweed, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, galinsoga, goosegrass, pigweed, signalgrass, witchgrass and yellow nutsedge	Metolachlor 1.25-3.0 lb	Dual 8E 1.25-3.0 pt	Apply before, during or after planting but before weeds or crop emerges. May be incorporated into the top 2 in of soil within 14 days before planting. Small grains may be planted 4.5 months after treatment. Do not graze or feed forage of fodder from small grains or soybeans.
	Approved combinations: linuron-tank mix; metribuzin-tank mix or preplant incorporated; trifluralin-preplant incorporated; chlorimuron + metribuzin (Canopy)-tank mix or preplant incorporated; chlorimuron + linuron (Gemini)-tank mix; imazaquin-tank mix or preplant incorporated		Observe all precautions, rates of application, and weeds controlled on the respective labels. Do not use metribuzin on coarse textured, coastal plain soils. The metolachlor plus metribuzin combination may be applied as the prepackage mix Turbo.

Soybeans (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Barnyardgrass, beggarweed, carpet weed, coffeeweed, pusley, fall panicum, jimsonweed, lambs-quarters, mustard spp., pigweed spp., purslane, ragweed, signalgrass, sicklepod, smartweed, spurred anoda, prickly sida and velvetleaf	Metribuzin 0.25-0.375 lb	Lexone or Sencor 50W 0.50-0.75 lb or 4L 0.50-0.75 pt or DF 0.33-0.50 lb	Apply immediately after planting. Plant at least 1.5 in deep. Do not use on sands or sandy loam soils or soils with less than 0.5% organic matter. If used on coarser textured soils with less than 2% organic matter or if heavy rain-fall follows soon after application, severe stand losses can occur. Certain organic phosphates soil insecticides placed in contact with seed also may result in increased soybean injury from metribuzin. Do not use on Altona, Coker 102 and 156, Gervin, Semmes, Tracy or Varsoy varieties. The lowest rates have not effectively controlled cocklebur, jimsonweed or morningglory. Rain-fall (0.25-0.5 in) within 2 weeks after application is necessary to activate herbicide. Do not use treated vines for feed or forage. Do not replant treated areas to any crop other than soybeans within 4 months after treatment. Read and follow the label for such use.
	Approved combinations: alachlor-tank mix; metolachlor-tank mix or preplant incorporated; cryzalin-tank mix; pendimethalin-tank mix or preplant incorporated; trifluralin-preplant incorporated		Observe all precaution, rates of application, and weeds controlled on respective labels.
Barnyardgrass, Brachiaria sp, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, johnsongrass seedlings, lambsquarters, redroot pigweed spp. and purslane	Oryzalin 0.75-1.5 lb	Surflan 75W 1.0-2.0 lb or 4AS 1.5-3.0 pt	Apply at planting or within 2 days. Requires moisture for good activity. If adequate rainfall for activation is not received, shallow cultivate (1-2 in) to destroy existing weeds and place the herbicide in zone of weed seed germination. Do not use on soils with more than 5% organic matter. Do not feed forage from treated fields to livestock.
	Approved combinations: linuron-tank mix; metribuzin-tank mix		Observe all precautions, rates of application, and weed controlled on respective labels.
Barnyardgrass, carpetweed, crabgrass, fall panicum, Florida pusley, foxtails, goosegrass, lambsquarters, pigweed, signalgrass, smartweed, sparges, and velvetleaf suppression	Pendimethalin 0.5-1.25 lb	Prowl 1.0-2.5 pt	Apply to a seedbed that is firm and free of trash. Rainfall is necessary for activation and treatment is most effective when adequate rainfall or overhead irrigation is received within 7 days after application. If rainfall is not adequate for activation a shallow cultivation should be made to control existing weeds and place herbicide in zone of weed seed germination. Under certain environmental conditions, soybeans may become brittle at soil surface.

Soybeans (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
	Approved combinations: metribuzin-tank mix or preplant incorporated; linuron-tank mix; chlorimuron + metribuzin (Canopy)-tank mix; imazaquin-tank mix or preplant incorporated		Observe all precautions, rates of application, and weeds controlled on specific labels.
Cocklebur, jimson- weed, lambsquarters, pigweed, common ragweed, smartweed, prickly sida or teaweed, and suppression of annual morningglory species, burcucumber and giant ragweed	Chlorimuron + metribuzin 0.28-0.47 lb	Canopy 75DG 6.0-10.0 oz	Apply uniformly to soil sur- face after planting but before soybeans emerge. Do not use on sand or loamy sand or any soil of less than 0.5% organic matter content. Can be tank mixed with a residual grass herbicide for improved annual grass control. Do not apply on soils at pH 7.0 or greater. Observe labeled rotational crop restrictions.
	Approved combinations: alachlor or pendimethalin- tank mix; metolachlor-tank mix or preplant incorporated; trifluralin- preplant incorporated or as an overlay to trifluralin		Observe all precaution, rates of application, and weed con- trolled on respective labels.
Cocklebur, jimson- weed, lambsquarters, pigweed, common ragweed, smartweed, prickly sida or teaweed, and suppression of annual morningglory species, burcucumber and giant ragweed	Chlorimuron + linuron	Gemini 60DG 12.0- 16.0 oz	Apply uniformly to soil surface after planting but before soybeans emerge. Do not use on sand or loamy sand or any soil of less than 0.5% organic matter content. Can be tank mixed with a residual grass herbicide for improved annual grass control. Do not apply on soils at pH 7.0 or greater. Observe labeled rota- tional crop restrictions.
	Approved combinations: alachlor or metolachlor- tank mix; pendimethalin or trifluralin-preplant incorporated with Gemini applied preemergence		Observe all precautions, rates of application, and weed controlled on respective labels.
Cocklebur, jimson- weed, lambsquarters, pigweed spp., common ragweed, smartweed, prickly sida or teaweed, and foxtail spp.	Imazaquin 0.125 lb	Scepter 1.5E 0.66 pt	Apply during or after planting but before crop emergence. If sufficient rainfall for activ- ation is not received within 7 days of application, a shallow tillage or cultivation is recommended. May be tank mixed with a residual her- bicide for improved annual grass control. Observe labeled rotation crop restrictions.
	Approved combinations: tank mix with pendimethalin alachlor or metolachlor; preplant incorporated with pendimethalin, trifluralin or metolachlor	of	Observe precautions, rates application, and weed con- trolled on respective labels.

Soybeans (Full season no-till)

For control of vegetation existing at planting use one of the three following options:

Contact kill of most annual weeds and annual cover crops	Paraquat 0.28-0.47 lb + surfactant	Gramoxone Super 1.5-2.5 pt + surfactant as specified by label	Apply in 20-60 gal/A. May not control weeds higher than 6 in. Increase gallonage as density of stubble, crop residue and/or weeds increase.
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Soybeans (full season no-till) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Alternate method for increased activity on harder to control annual weeds such as horseweed (maretail), annual vetch and lambsquarters	Paraquat 0.28 lb + surfactant + paraquat 0.28 lb + surfactant 10 days later + residual herbicide	Gramoxone Super 1.5 pt + surfactant as labeled + Gramoxone Super 1.5 pt + surfactant as labeled 10 days later + residual herbicide as needed	Apply as directed above.
Control of annual weeds and annual cover crops and suppression or control of perennial weeds or covers	Glyphosate 1.0-3.0 lb	Roundup 1.0-3.0 qt	Effective in heavy annual weed infestations and with large weeds where thorough coverage with paraquat is not possible. Higher rates will control perennial species, but those species often are not present or susceptible at the time of planting. Use 1.0 qt for annual weeds up to 6 in and 1.5 qt for weeds greater than 6 in. Use a minimum of 1.5 qt for horseweed (maretail) control. Horseweed taller than 6 in may not be controlled. Applications with fan type nozzles generally have been more effective than with flood nozzles. Use 15-30 gal/A (lower volumes usually are most effective).

For residual weed control use one of the following herbicides or herbicide combinations along with a herbicide for control of vegetation existing at planting from above.

Control of annual weeds and grasses as listed for specific herbicides in previous tables.

For annual grass control in full season no-till, use either alachlor (Lasso), metolachlor (Dual), oryzalin (Surflan), or pendimethalin (Prowl). Where split paraquat applications are used, a portion of the residual grass herbicide may be applied with the initial paraquat application for improved early season grass control. Stem brittleness and lodging can be associated with applications of oryzalin or pendimethalin when soil conditions are cool and wet. Because these conditions occur frequently early in the growing season, especially under no-till conditions, the use of alachlor or metolachlor for early full season no-till plantings is recommended. Late-season grass control will tend to be better with the longer residual herbicides Dual and Surflan than with the somewhat shorter residual herbicides Lasso and Prowl. Supplement the grass control herbicide with linuron (Lorox or Linex), metribuzin (Sencor/Lexone), chlorimuron + metribuzin (Canopy), chlorimuron + linuron (Gemini), or imazaquin (Scepter) for broadleaf weed control. Carefully monitor weed development and supplement the preemergence herbicide program with appropriate postemergence or postdirected herbicides.

For perennial weed control in full season no-till soybeans

Perennial broadleaf weeds

No selective herbicides are available to control perennial broadleaf weeds in soybeans, and these weeds may become prevalent under continuous no-till culture. Spot treatment with glyphosate (Roundup) may be used. Other alternatives include rotation to corn or another grass crop in which 2,4-D and dicamba (Banvel) may be used, tillage or treatment before the soybean crop is established or after harvest.

Perennial grass weeds (johnsongrass, wiregrass, bermudagrass)

In general, soil applied herbicides to control perennial grasses must be incorporated and cannot be used in no-till culture. Perennial grasses, therefore, must be controlled in non-till with spot treatment with glyphosate (Roundup), glyphosate treatment via selective application equipment (rope wick, recirculating sprayer), or with sethoxydim (Poast) or fluazifop-P (Fusilade 2000). See directions under postemergence treatments listed below. Carefully consider these options before establishing no-till soybeans in areas containing a perennial grass infestation.

Soybeans (no-till, small grain stubble)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Contact kill of most annual weeds and weeds listed in previous tables for specific residual herbicides	Paraquat 0.28-0.47 lb + surfactant + alachlor metolachlor oryzalin pendimethalin (residual grass control) + imazaquin linuron metribuzin linuron + chlorimuron metribuzin + chlorimuron (residual broadleaf control)	Gramoxone Super 1.5-2.5 pt + surfactant as specified by label + Lasso or Lasso MT Dual Surflan Prowl + Scepter Lorox or Linex Sencor or Lexone Gemini Canopy	Apply to small grain stubble after planting and before emergence of soybeans. Use 20-60 gal of diluted spray acre. As the density of the stubble or crop residue increases, the spray gallonage should increase to ensure complete coverage and kill. Do not graze or feed treated forage to livestock. Observe all precautions, rates or application and weeds controlled on respective labels.
Kill of most annuals and some perennials and weeds listed in previous tables for specific residual herbicides	Glyphosate 1.0-3.0 lb	Roundup 1.0-3.0 qt	Refer to previous table. At the normal time of planting of soybeans, johnsongrass and bermudagrass will not be the proper stage of growth for effective control. Do not feed or forage glyphosate treated crops within 8 weeks after application. See label for specific weeds controlled. Use 1.0 qt/A for control of annual broadleaf weeds and grasses up to 6 in high and 1.5 qt/A for annual broadleaf weeds and grasses more than 6 in high. Applications with fan type nozzles generally have been more effective than flood jet type nozzles. Use 3-10 gallons of water per acre and low rate technology instructions for most economical glyphosate use rates or 10-40 gallons of water using high volume instructions and corresponding glyphosate rates.
	Approved combinations: alachlor or metolachlor + linuron; alachlor or metolachlor + metribuzin, alachlor or metolachlor + imazaquin; alachlor or metolachlor + Canopy (chlorimuron + metribuzin); alachlor or metolachlor + Gemini (chlorimuron + linuron)	Bronco (prepackage mix of glyphosate + alachlor) is approved for use with linuron, metribuzin, imazaquin, chlorimuron + metribuzin + linuron (Gemini)	Observe all precautions, rates of application, and weeds controlled on respective labels.

Soybeans (no-till, small grain stubble) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
POSTEMERGENCE			
Common cocklebur (2-leaf only), morning-glory, pigweed, jimsonweed, common ragweed, small melon, buffalobur, wild mustard, carpetweed, common purslane, Pennsylvania smartweed, giant ragweed, Florida pusley, black nightshade, ironweed, tropic croton, lanceleaf groundcherry, prostrate spurge and burcucumber	Acifluorfen 0.375-0.5 lb	Blazer 2L or Tackle 2L 1.5-2.0 pt	Apply when weeds are 2-4 inches high and actively growing and when soybeans are in the 1-to 2-trifoliate leaf stage. Use standard herbicide sprayers equipped with hollow cone or flat fan nozzles. (Best results have been obtained with fan type nozzles.) use 40-60 psi at the nozzle tips and a minimum of 20 gallons spray volume per acre. Add a nonionic surfactant at the rate of 1 pt per 100 gal to Blazer 2L. Do not apply when crop and weeds are under stress such as from drought, flooding, excessive fertilizer or soil salts, wind injury, frost damage unseasonable cold night and day temperatures, or injury from previous herbicides. Application with 30 gal of spray volume per acre, a minimum of 50 psi, and the addition of surfactant to the 2L formulation may improve control on drought stressed or slightly oversized weeds, but applications made under these conditions generally will be less satisfactory than those made under optimum conditions. Do not apply if rain is threatening (6-hour rainfree period is required for best results). Do not apply within 50 days of harvest and do not use treated plants for feed or forage.
	Approved combinations: bentazon-tank mix		Observe all precautions, rates of application, and weeds controlled on respective labels.
Beggar tick, cocklebur, Pennsylvania smartweed, wild mustard, velvetleaf, common ragweed, galinsoga, jimsonweed, giant ragweed, prickly sida (tea-weed), purslane, spurred anoda, yellow nutsedge and suppression of Canada thistle	Bentazon 0.75-1.0 lb + Crop oil concentrate	Basagran 0.75-1.0 qt + Crop oil concentrate 1.0 qt/A	Apply to thoroughly cover weeds when they are small and actively growing. Add oil concentrate to the spray solution according to label instructions. Weed growth stages generally correspond to soybean growth stages or 1- to 2-trifoliate leaves. For best results, treat before weeds reach the size limits listed on the label. Control has generally been most effective using fan tips and pressures of 40-50 psi. Yellow nutsedge may be controlled best when application is followed in 7-10 days with a repeated applications or by cultivation in 10-14 days. Soybeans may exhibit a slight yellowing, bronzing or speckled appearance, which generally is soon outgrown. Do not apply to soybeans growing under unfavorable conditions and exhibiting stress symptoms. Rainfall within 8 hours of application may reduce effectiveness. Do not apply within 65 days of harvest. Do not feed forage to livestock.

Soybeans (no-till, small grain stubble) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
	Approved combinations: acifluorfen-tank mix		Observe all precautions, rates of application and weeds controlled on respective labels.
Improved spectrum of control for weeds listed above for both bentazon and acifluorfen	Acifluorfen 0.25-0.50 lb + bentazon 0.5-1.0	Blazer 2L or Tackle 2L 1.0-2.0 pt + Basagran 1.0-2.0	See labels for specific ratios of bentazon/acifluorfen depending on weed species and size. Always use spray additives (nonionic surfactant or crop oil concentrate) in accordance with specific label instructions.
Improved control of larger weeds for either bentazon or acifluorfen, especially improved control of ivyleaf morningglory and cocklebur	Acifluorfen 0.25-0.50 lb + 2,4-DB 0.03 lb	Blazer 2L or Tackle 2L 1.0-2.0 pt + Butyrac or Butoxone 2.0 fl oz	Observe all instructions and precautions as described above for acifluorfen.
	Bentazon 0.75-1.0 lb + surfactant + 2,4-DB 0.03 lb	Basagran 1.5-2.0 pt + surfactant as recommended + Butyrac or Butoxone 2.0 fl oz	Observe use instructions and precautions as described above for bentazon.
Cocklebur, jimsonweed, pigweed, common ragweed, smartweed, velvetleaf and suppression of morningglory species and sicklepod, giant ragweed and burcucumber	Chlorimuron 0.008-0.12 lb + surfactant 0.25%	Classic 0.5-0.75 oz + surfactant 0.25%	Apply to young actively growing weeds within labeled weed growth stage ranges. Apply at 25-40 psi with a minimum of 10 gal/A. Always add 0.25% surfactant. Do not use crop oil, crop oil concentrate, or vegetable oil spray additives. Flood type low pressure nozzles are not recommended. Observe labeled rotational crop restrictions.
Cocklebur, pigweed, and suppression of sicklepod	Imazaquin 0.125 lb + surfactant 0.25%	Scepter 1.5E 0.66 pt + surfactant 0.25%	Apply after crop emerges but before weeds are 12 in high. Do not apply when weeds and soybeans have been subjected to temperature or moisture stress. Allow 90 days between application and harvest. Observe labeled rotation crop restrictions.
Cocklebur, morningglory, and suppression of jimsonweed, lambsquarters, pigweed, ragweed, and velvetleaf	2,4-DB 0.175-0.22 lb	Butoxone 1.0 pt Butyrac 100 0.7-0.9 pt	Apply as directed spray into the row when soybeans are 8-12 in and cocklebur, morningglory, jimsonweed and redroot pigweed have not exceeded 3 in high. Top of weed seedling must be sprayed. Use precision directed spray application equipment. Apply with sprayer nozzles mounted on skids or gauge wheels. Do not spray over one-third the base of soybean as severe injury may occur. Do not harvest within 60 days after application.
	Approved combinations: linuron-tank mix (for directed spray method only)		Observe all precautions, rates of application, and weeds controlled on respective labels

Soybeans (no-till, small grain stubble) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Burcucumber, carpetweed, cocklebur, groundcherry, galinsoga, jimsonweed, morningglory, nightshades, pigweed, prickly sida (teaweed), purslane, ragweeds, spurred, velvetleaf	lactofen 0.16-0.20 lb	Cobra 0.63-0.98 pt	The addition of surfactant or crop oil concentrate when weeds are near maximum labeled growth stages is generally beneficial. Apply in 15-30 gallons of water using flat fan or hollow cone nozzles. Apply to small, actively growing weeds not larger than indicated on the label, generally when soybeans are in the 1-2 trifoliate leaf stage. Do not apply within 90 days of harvest.
Morningglories, nightshade, cocklebur, common ragweed, jimsonweed, smartweed, pigweed and others	fomesafen 0.19-0.31 lb + surfactant crop oil concentrate	Reflex 0.75-1.25 pt + surfactant crop oil concentrate	Apply in a minimum of 10 gallons of water and 40-60 psi when weeds are small and before weeds reach maximum growth stages described on the label. Apply in combination with 0.25-0.5% nonionic surfactant or 1% crop oil concentrate. Do not apply Reflex more than once every 2 years. Carefully observe labeled rotational crop restrictions.
Cocklebur, giant ragweed	Naptalam + 2,4-DB (prepackage mix) 1.55 lb	Rescue 3.0 qt	Salvage treatment for emergency use only where cocklebur has canopied over soybeans and where some injury to the crop will be acceptable. Apply when soybeans are 14 inches or taller and after 1st bloom. Do not graze or feed forage from treated fields to livestock. Make application 10-25 gallons of water per acre.
Barnyardgrass, carpetweed, cocklebur, crabgrass, dog fennel, foxtail, Florida pusley, goosegrass, fall panicum, lambsquarters, morningglory, pigweed, prickly sida (teaweed), purslane, ragweed, sicklepod, smartweed, and velvetleaf	Linuron 0.25-1.0 lb	Lorox 50W 0.50-2.0 lb 4L Linex 4L 0.50-2.0 pt	Apply only as a directed spray to cover weed foliage with minimum contact of soybean plant. Do not spray higher than 3 in on soybean stem. For soybeans at least 8 in high and weeds less than 2 in, apply 0.5-1.0 lb 50W or 0.5-1.0 pt 4L. Make a second application if new flush of weeds occurs. For soybeans at least 12 in high and weeds less than 4 in, apply a single application of 1-2 lb 50W or 1-2 pt 4L or split applications of 1 lb 50W or 1 pt 4L. Add 1 pt Surfactant WK for each 25 gal spray mixture.
	Approve combinations: 2,4-DB-tank mix, directed		Observe all precautions, rates of application, and weeds controlled on respective labels.
Carpetweed, cocklebur, pigweed, purslane, sicklepod, prickly sida (teaweed), velvetleaf, crabgrass, common ragweed and partial control of morningglory, horsenettle, Florida pusley, and spotted spurge	Metribuzin 0.25-0.50 lb	Lexone 50W 0.50-1.0 lb 4L 0.50-1.0 pt DF 0.33-0.66 lb Sencor 50W 0.50-1.0 lb 4L 0.50-1.0 pt	Apply only to a directed spray when soybeans are at least 12 inches tall and weeds do not exceed 3 inches and grasses and common ragweed do not exceed 1 in. Direct spray to cover weeds with minimal or no contact to soybean plant. Crop injury may result if spray is higher than 2 in on soybean stem. Do not use on sand or on soils with less than 0.5% organic matter. Add a nonionic surfactant to the spray mixture to obtain better wetting. If needed, a second application may be made after 7 days.

Soybeans (no-till, small grain stubble) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Barnyardgrass, fall panicum, foxtails, johnsongrass seedlings, goosegrass, crabgrass, shattercane, volunteer corn and volunteer cereal grains	Sethoxydim 0.19-0.38 lb + crop oil concentrate	Poast 1.0-2.0 pt + crop oil concentrate 2.0 pt	Apply to actively growing grasses at the rate and size range indicated on the label for the individual grass species with 10-20 gal of water per acre and 40 psi. Do not use flood type nozzles. Always add 2 pt/A of crop oil concentrate. Rainfall within 1 hour of application will decrease effectiveness.
Barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, seedling johnsongrass, volunteer corn, shattercane and others	fenoxaprop-ethyl 0.10-0.20 lb + crop oil concentrate (optional for some species)	Whip 0.8-1.6 pts + crop oil concentrate 1.0 qt	Apply in a minimum of 10 gallons of water and 30-60 psi using flat fan or hollow cone nozzles. Carefully follow label instructions regarding grass growth stages. Add crop oil concentrate for weeds on which its use is optional when timing of application is non-optimum or when weeds are under drought stress. Do not graze or use treated forage, hay or straw.
Rhizome johnsongrass, bermudagrass (wiregrass)	Sethoxydim 0.29 lb + crop oil concentrate + (sequential treatment on regrowth) Sethoxydim 0.19 lb + crop oil concentrate	Poast 1.5 pt + crop oil concentrate 2.0 pt + Poast 1.0 pt + crop oil concentrate 2.0 pt	Apply to actively growing grasses in the manner described above. Apply first application to johnsongrass 15-20 in high or bermudagrass plants less than 6 in in diameter. Apply regrowth treatments to 6- to 10-in johnsongrass or 1- to 4-in diameter bermudagrass plants. Rainfall within 1 hour of application will decrease effectiveness.
Quackgrass	Sethoxydim 0.47 lb + crop oil concentrate + (sequential treatment on regrowth) Sethoxydim 0.29 lb + crop oil concentrate	Poast 2.5 pt + crop oil concentrate 2.0 pt + Poast 1.5 pt + crop oil concentrate 2.0 pt	Apply to actively growing quackgrass 6-8 in high and to regrowth 6-8 in high with 2 pt/A crop oil concentrate in the manner described above. Rainfall within 1 hour of application will decrease effectiveness.
Barnyardgrass, fall panicum, crabgrass, foxtails, johnsongrass seedlings, goosegrass, shattercane and volunteer corn	Fluazifop-P 0.19 lb + crop oil concentrate	Fusilade 2000 1.5 pt + crop oil concentrate 2.0 pt	Apply to actively growing grasses at the rate and growth stage indicated on the label for the individual grass species with a minimum of 10 gal of water per acre and 30-60 psi. So not use flood nozzles. Add 1% crop oil concentrate or 0.25% nonionic surfactant to the spray mixture. Rainfall within 1 hour of application will decrease effectiveness.
Rhizome johnsongrass	Fluazifop-P 0.19 lb + crop oil concentrate + (sequential treatment on regrowth) fluazifop-P 0.125 lb + crop oil concentrate	Fusilade 2000 1.5 pt + crop oil concentrate 2.0 pt + Fusilade 20000 1.0 pt + crop oil concentrate 2 pt	Apply in the manner described above to johnsongrass 12-18 in high and before boot stage and if necessary, to regrowth 6-12 in high.

Soybeans (no-till, small grain stubble) (continued)

Weed problem	Chemical rate per acre	Product per acre	Remarks
Bermudagrass (wiregrass), quackgrass	Fluazifop-P 0.19 lb + crop oil concentrate + (sequential treatment on regrowth) Fluazifop-P 0.125 lb + crop oil concentrate	Fusilade 2000 1.5 pt + crop oil concentrate 2 pt + Fusilade 2000 1.0 pt + crop oil concentrate 2 pt	Apply in the manner described above to bermudagrass 6-12 in in runner length or quackgrass less than 10 in high. Make sequential treatments when bermudagrass regrowth shows 6- to 12-in runners or quackgrass regrowth shows 3- to 5-in leaves.
Rhizome johnsongrass	fenoxaprop-ethyl 0.15 lb + (sequential treatment on regrowth) fenoxaprop-ethyl 0.10 lb	Whip 1.2 pts + Whip 0.8 pts	Apply in a minimum of 10 gallons of water and 30-60 psi using flat fan hollow cone nozzles when johnsongrass is 10-15 inches tall. The sequential application may be needed on regrowth of rhizome johnsongrass. Do not add crop oil concentrate to fenoxaprop-ethyl when treating johnsongrass. Do not graze or use treated forage, hay or straw.
Barnyardgrass, crabgrass, goosegrass, pigweed, johnsongrass and seedlings	Paraquat 0.063 lb + surfactant	Gramoxone Paraquat 0.33 pt + surfactant as recommended	Apply in 20-40 gal of water per acre when soybeans are at least 8 in tall and weeds 2-4 inches. Use as a precision directed spray, hitting no more than the lower 3 in of the soybeans. Follow label for necessary application equipment and procedures. Do not treat more than twice. Do not graze or feed treated forage to livestock.
Johnsongrass and other perennial weeds, cocklebur, pigweed, volunteer corn and shattercane	Glyphosate 1.0-3.0 lb	Roundup 1.0-3.0 qt	Use as spot treatment when johnsongrass is 24-36 in high and in the boot-seeding stage. See label for proper stage of treatment for other perennials. All soybeans hit with chemical will be killed. Applications of glyphosate may be made with a wick applicator or recirculating sprayer. Apply when there is 6-in or more differential in height. The 1.0 qt rate of Roundup may be used on johnsongrass if 5-10 gal of water is applied, fan tips are used, and additional surfactant is added to the spray mix. Use the 2.0-3.0 qt rate on noncrop land or where annual tillage is not performed. Do not harvest soybeans within 7 days after application.
Harvest aid	Paraquat 0.128-0.25 lb + surfactant	Gramoxone Super 0.7-1.3 pt + surfactant as recommended	Apply in 20-40 gal/A when soybeans are fully developed at least one-half of the leaves have dropped, and remaining leaves are yellow with aerial applications, observe caution and consider the addition of drift control agents. Do not pasture livestock within 15 days of treatment. Remove livestock from treated fields at least 30 days before slaughter.

Weed Control in Small Grains

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (wheat, barley, oats and rye)				
Contact kill of most annual weeds for no-till plantings	Paraquat 0.28-0.47 + surfactant	Gramoxone Super 1.5-2.5 pt + surfactant as labeled	No-till establishment	Apply after planting and before emergence of the small grain. Use 20-60 gal of diluted spray per acre. As the density of the crop residue increases, the spray gallonage should increase to ensure complete coverage and kill. Use the higher rate if existing vegetation is dense, cool temperatures exist, and/or drought conditions are prevalent.
Kill of most annual weeds for no-till plantings	Glyphosate 0.5-4.0 lb + surfactant 0.25-4.0%	Roundup 0.5-4.0 qt + surfactant as labeled	No-till establishment	See label for specific instructions for use. The low rate can be used when small winter annuals are present and less than 2 in high. Increase rate on larger weeds. Application with fan-type nozzles is preferred using 15-30 gal/A. The lower rate is more effective. The higher rates can be used in controlling certain perennials if their stage of growth and condition are correct according to Roundup's labeling.
Preplant for johnsongrass control	Glyphosate 2.0-3.0 lb	Roundup 2.0-3.0 qt	Preplant	Apply in 10-40 gal water per acre when johnsongrass is 18 in or more and approaching the early head stage of growth. Allow 7 or more days before plowing. Barley, oats and wheat can be planted immediately after tillage. Do not feed or forage treated crops within 8 weeks after treatment.

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (wheat, barley, oats and rye) (continued)				
Corn chamomile, corn gromwell, cowcockle, knawel (German moss), mayweed, field pennycress, pepperweed, sheperdspurse, wild mustard, wild radish, yellow rocket, weak in control of chickweed and henbit	Bromoxynil 0.375-0.5 lb in 10-20 gal water	Buctril 2E 1.5-2.0 pt or Brominal ME4 0.75-1.0 pt	Postemergence fall or spring	Destroy all weed seedlings before seeding small grains. Look for weeds as soon as small grains start to germinate. Apply after small grain is beyond 2-leaf stage and weed seedlings have not more than 3-4 leaves or rosettes 1.5 in across. Best results can be expected with flat fan nozzles using a minimum of 30 pounds per square inch (psi) and 10 gal/A. With flood nozzles, use a minimum of 20 gal/A and 30 psi. Use higher rate for cowcockle, henbit, chickweed and wild mustard control. Poor control has resulted when applied to larger weeds. Thorough weed coverage is necessary for effective control. Do not apply if small grains form a canopy, during or after boot stage, or when crop is under stress from lack of moisture. Do not contaminate streams, lakes and ponds with this material. Do not graze treated fields for 30 days after application. May be applied with fluid fertilizer.
Many annual broadleaf weeds, especially mustards	MCPA 0.25-0.5 lb in 5-20 gal water	Rhomene 0.5-1.0 pt	Postemergence fall or spring	Apply when grain is in the 3-to 5-leaf stage or up to early boot stage. For best results, apply when weeds are small. Use up to 3 pt for less susceptible weeds after crop has tillered but not later than early boot stage. Use lower rate on small grains underseeded to legumes. Do not apply during boot to dough stage.

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (wheat, barley, oats and rye not seeded to legumes)				
Black mustard, blessed thistle, bulbous buttercup, burdock, cornflower (bachelor buttons), meadow campion (ragged-robin), corn poppy, curly dock seedlings, fanweed, goats-beard, hairy vetch, pennycress, plantain, primrose, prickly lettuce, rock cress, shepherdspurse, purse, wild mustard, wild radish, wild turnip, fleabane, chicory, dandelion, henbit, vetch, smartweed, suppression of thistles, and wild onions and garlic	2,4-D amine 0.25-0.5 lb in 5-25 gal water	2,4-D amine 0.5-1.0 pt (various brands 4.0 lb/gal)	Postemergence spring	Spray, 2,4-D when grain is 4 to 8 in high or after tillering but before jointing. Spraying small grain too young or after jointing can result in reduced yields and uneven ripening. The higher rates of 2,4-D increase the risk of grain injury. Use production practices favorable to maximum crop competition. Do not graze dairy animals or feed forage within 14 days of treatment. Always premix 2,4-D amine with water before mixing with liquid fertilizer. Oats may be injured, use low rate.
Harvest aid-above weeds listed for 2,4-D amine	2,4-D amine 0.5-1.0 lb in 5-25 gal water	2,4-D amine 1.0-2.0 pt (various brands 4.0 lb/gal)	Postemergence spring	2,4-D amine can be applied from dough stage to harvest as a harvest aid when weeds threaten to interfere with harvest operations. Do not use treated straw for livestock feed.
Most winter annual weeds listed for 2,4-D amine and bromoxynil, especially good on knawel (German moss)	2,4-D amine or low volatile ester 0.25-0.5 lb + Bromoxynil 0.25-0.375 lb	2,4-D amine or low volatile ester 0.5-1.0 pt (various brands) 4.0 lb/gal + Buctril 2E 1.0-1.5 pt or Brominal ME4 0.5-0.75 pt	Postemergence spring	See remarks for 2,4-D and bromoxynil.
Most winter annual broadleaf weeds as listed for 2,4-D amine but better suppression of perennials, especially wild onion and garlic	2,4-D low volatile ester 0.25-0.5 in 4-25 gal water	2,4-D low volatile ester 0.5-1.0 pt (various brands 4.0 lb/gal)	Postemergence spring	Spray when grain is 4 to 8 in high and tillering but before jointing. <i>Caution:</i> vapors and drift drifts are injurious to tomato, tobacco and many ornamentals. Underseeded legumes usually are killed Use higher rates to prevent garlic aerial bulblet formation. Cannot control garlic in oats without injuring oats. Best results if daytime temperature is 50 F or for 5-7 days following treatment. For best results do not apply with liquid nitrogen solution, because the proper time of application of each differ. Uniform coverage is important.

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (wheat, barley)				
Over-the-top-spray (OTS) for weed control in wheat and barley only, followed by no-till soybeans. Fall panicum, crabgrass sp., foxtails, johnsongrass seedlings, control or suppression of many summer annual broadleaf weeds	Oryzalin 1.0-1.5 lb	Surflan 75W 1.3-2.0 lb or AS 1.0-1.5 qt or DF 1.2-1.8 lb	Postemergence spring	Do not apply Surflan to winter wheat or barley before the fully tillered stage because crop injury may result. The OTS weed control program is the most beneficial in moderate to heavy grass infested fields where the grain stand is not uniform or canopying the soil surface well. The primary benefit of OTS Surflan is to reduce grasses that are present when planting the double crop no-till soybeans. This treatment in combination with excessive nitrogen application may result in crop lodging.
Surflan OTS + 2,4-D above weeds listed for Surflan and 2,4-D	Oryzalin 1.0-1.5 + 2,4-D 0.25-0.5 lb	Surflan 75W 1.0-2.0 lb or AS 1.0-1.5 qt or DF 1.2-1.8 lb + 2,4-D low volatile ester or amine 0.5-1.0 pt (various brands 4.0 lb/gal)	Postemergence spring	When tank mixing, add Surflan to the tank first and agitate until completely dispersed. Maintain agitation and add the 2,4-D product. Application to wheat and barley with the tank mixture requires specific timing. The grain must be fully tillered early in the jointing stage. Generally grains will only be in this stage 1-3 days depending on variety and weather conditions. Be sure to follow all precautions listed for both materials.
Small grains (fall seeded wheat)				
Corn chamomile, cow cockle, corn-cockle, dandelion, dogfennel, (mayweed), goat-beard, knawel (German moss), smartweed, weak on chickweed	Dicamba 0.125 lb in 5-40 gal water	Banvel 0.25 pt	Postemergence spring	See label for grazing restrictions. Apply before jointing, but after grain is fully tillered.
Above weeds listed for dicamba and 2,4-D	Dicamba 0.06-0.125 lb + 2,4-D amine or ester 0.25-0.375 lb in 5-40 gal water	Banvel 0.13-0.25 pt + 2,4-D amine or ester 0.5-0.75 pt (various brands 4.0 lb/gal)	Postemergence spring	Good general treatment for broadleaf control. Controls wider spectrum of weeds than either herbicide alone. Apply before jointing, but after grain is fully tillered.

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (fall seeded wheat) (continued)				
Many winter annual broadleaf weeds	Dicamba 0.06-0.125 lb + Bromoxynil 0.25-0.375 5-40 gal water	Banvel 0.13-0.25 + Buctril 2E 1.0-1.5 pt or Brominal ME4 0.5-0.75 pt	Postemergence spring	Apply before jointing, but after grain is fully tillered. Observe label precautions.
Above weed listed for 2,4-D and dicamba and for improved performance against the following difficult-to-control weeds: fiddleneck, wild garlic, wild onion, gromwell henbit	Dicamba 0.125 lb + 2,4-D amine 0.5-1.0 lb in 5-40 gal water or Dicamba 0.125 lb + 2,4-D ester 0.5-0.75 lb in 5-40 pt gal water	Banvel 0.25 pt + 2,4-D amine 1.0-2.0 pt (4.0 lb/gal) or Banvel 0.25 pt + 2,4-D ester 1.0-1.5 pt ester (4.0 lb/gal)	Postemergence spring	Apply before jointing, but after grain is fully tillered. This combination gives better control of more weeds than either chemical alone. This is only labeled on fall seeded wheat, not barley, oats or rye. Do not use unless possible crop injury will be tolerated.
Annual ryegrass	Diclofopmethyl 0.5-1.2 lb in 10-40 gal water	Hoelon 1.3-3.3 pt	Postemergence	Hoelon will not control broadleaf weeds. It is slow acting on controlling ryegrass. Hoelon can be applied preemergence at 2-2.66 pt/A. For post-emergence control apply before jointing stage of wheat. Hoelon can be tank mixed with liquid nitrogen fertilizer.
Annual ryegrass and some winter annual weeds, but not chickweed	Diclofopmethyl 0.75-1.2 lb + Bromoxynil 0.375-0.5 lb in 10-40 gal water	Hoelon 2.0-3.3 pt + Buctril 2E 1.5-2.0 pt or Brominal ME4 0.75-1.0 pt	Postemergence	See comments above concerning Hoelon. Other broadleaf herbicides should not be applied within 1 week of a Hoelon application.
Small grains (fall seeded barley)				
Many winter annual broadleaf weeds, same as under <i>fall seeded wheat</i>	Dicamba 0.125 lb in 5-40 gal water	Banvel 0.25 pt	Postemergence	Apply before jointing, but after grain is fully tillered. Observe precautions on label.
Many winter annual broadleaf weeds, same as under <i>fall seeded wheat</i>	Dicamba 0.06-0.125 lb + 2,4-D amine or ester 0.25 lb in 5-40 gal water	Banvel 0.13-0.25 pt + 2,4-D amine 0.5 pt or ester (4.0 lb/gal)	Postemergence	Apply before jointing, but after grain is full tillered. Observe precautions on label.
Annual ryegrass	Diclofopmethyl 0.5-0.75 lb in 10-40 gal water	Hoelon 1.3-2.0 pt	Postemergence	Hoelon use in barley is restricted to the following varieties: Boone, Milton Henry and Sussex. Crop damage may result when applied to other varieties. Barley should be tillered before applying Hoelon. See other remarks under wheat section.

Weed problem	Chemical rate per acre	Product per acre	Treatment time	Remarks
Small grains (fall seeded barley) (continued)				
Annual ryegrass and some winter annual weeds, but not chickweed	Diclofopmethyl 0.5-0.75 lb in 10-40 gal water + Bromoxynil 0.375-0.5 lb in 10-40 gal water	Hoelon 1.3-2.0 pt + Buctril 2E 1.5-2.0 pt or Brominal ME4 0.75-1.0 pt	Postemergence	Refer to comments on Hoelon under <i>fall seeded wheat</i> and <i>fall seeded barley</i> .
Small grains (fall and spring seeded oats)				
Many winter annual broadleaf weeds, same as <i>fall seeded wheat</i>	Dicamba 0.125 lb in 5-40 gal water	Banvel 0.25 pt	Postemergence	Apply before jointing, but after grain is full tillered for fall seeded oats. Applications to spring seeded oats must be made before the oats exceed the 5-leaf stage. Observe precautions on label.

Virginia Regional Poison Control Centers

Provide 24 hour information and consultation services by Poison Information Specialists and board-certified Medical Toxicologists. Located in hospitals equipped for all toxicologic (poison) emergencies.

CHARLOTTESVILLE, VA
Blue Ridge Poison Center
Box 484, Medical Center
University of Virginia - 22908
Daniel Spyker, M.D.
(804) 924-5543
(call collect)

RICHMOND, VA
Central Virginia Poison Center
Virginia Commonwealth University
Box 522 - MCV Station - 23298
Lorne Garretson, M.D.
(804) 786-9123
(call collect)

WASHINGTON, DC
National Capital Poison Center
Georgetown University Hospital
3800 Reservoir Road, N.W. - 20007
Toby Litovitz, M.D.
(202) 625-3333

CHARLESTON, WV
West Virginia Poison System
3110 McCorkle Ave., S.E. - 25304
(304) 348-4211
(800) 642-3625 (WV only)

Maryland Poison Control Centers

For emergency assistance in case of pesticide spills or fires, county officials and fire departments should call:

CHEMTREC (800) 424-9300

Physicians seeking additional consultation on pesticide poisoning should call (800) 845-7633. This number is for physicians only.

STATE COORDINATOR
The University of Maryland
School of Pharmacy
Baltimore - 21201
(800) 492-2414

BALTIMORE
The University of Maryland
School of Pharmacy
636 West Lombard Street
Baltimore - 21201
(301) 528-7701
(800) 492-2414

CUMBERLAND
Sacred Heart Hospital
900 Seton Drive
Cumberland - 21502
(301) 722-6677

Delaware Poison Control Center

When telephoning a hospital concerning poisoning, ask for the Poison Control Center.

POISON INFORMATION CENTER
Wilmington Medical Center - Delaware Division
501 West 14 Street
Wilmington - 19899
(302) 655-3389

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