

2009 Weed Control Manual for Tennessee

Field Crops • Forage Crops • Pastures • Farm Ponds • Harvest Aids

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Available on-line at: weeds.utk.edu

Weed Control Manual (PB1580)

POISON CONTROL CENTERS

In case of a pesticide poisoning, the family physician should be called immediately. Advise the physician of the pesticide involved and, if possible, take the container with intact label to him or her. In the event the physician is not familiar with the pesticide, its antidote, and symptoms of poisoning, the nearest Poison Control Center should be contacted.

The numbers for the Tennessee Poison Control Centers are:

City	Address	Phone
NASHVILLE	Middle Tennessee Poison Center 1161 21 st Avenue, South 501 Oxford House Nashville, TN 37232-4632	Emergency Phone: (800) 222-1222 (national) (615) 936-0760 (Administrative Line)

2009 Weed Control Manual for Tennessee

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INTRODUCTION

This manual contains the 2009 University of Tennessee weed control recommendations for corn, grain sorghum, cotton, soybeans, burley and dark tobacco, wheat, forage crops, and farm ponds. These recommendations are based on results of research and demonstrations conducted by the Agricultural Experiment Station and the Agricultural Extension Service. Decisions regarding recommendations are made by the University of Tennessee Weed Control Committee and are based on three years of data at various locations in the state.

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

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EXPECTED WEED AND COVER CROP RESPONSE TO BURNDOWN HERBICIDES*

These are ratings for burndown materials alone, and also for some of the more widely used combinations in corn, cotton or soybeans. See appropriate crop section in this manual for the specific labeled and recommended burndown and residual herbicides.

	Glyphosate*	Ignite*	Gramoxone Inteon	2,4-D	Clarity	Glyphosate + 2,4-D	Glyphosate + Clarity	Ignite + 2,4-D	Ignite + Clarity	Gramoxone Inteon + 2,4-D	Gramoxone Inteon + Clarity	Ignite + diuron**	Ignite + Caparol**	Gramoxone Inteon + diuron**	Gramoxone Inteon + Caparol**	Gramoxone Inteon + Cotoran**	Gramoxone Inteon + Sencor**	Gramoxone Inteon + atrazine**	Glyphosate + atrazine**
Annual bluegrass	5	3	8	0	0	5	5	3	3	7	7	5	5	9	9	9	9	9	9
Carolina Geranium	1	8	8	7	8	9	9	9	9	9	8	9	9	9	9	9	9	9	9
Chickweed	5	9	9	7	9	7	8	9	9	9	8	9	9	9	9	9	9	9	9
Common lambsquarters	8	6	6	6	8	9	9	7	9	8	8	8	8	9	8	9	9	9	9
Curly dock	4	7	5	2	7	7	8	8	9	6	8	8	8	5	5	5	8	9	9
Cutleaf Eveningprimrose	4	7	5	7	8	8	8	8	9	7	8	8	8	8	8	8	8	9	9
Dandelion	3	6	2	8	8	9	9	8	9	9	8	8	8	8	8	8	8	8	8
Deadnettle/Henbit	5	7	7	4	5	7	8	8	8	8	9	8	8	8	8	8	8	9	9
Horseweed (mare's-tail) ^a	2	8 ^b	5 ^a	6	8	7	9	8	9	8	8	8	8	8 ^a	8 ^a	7 ^a	8 ^a	9	9
Ryegrass***	7	3	6	0	0	5	5	3	3	6	6	5	5	7	7	7	7	7	8
Smartweed	7	7	2	6	8	9	9	7	8	8	8	8	8	8	8	8	8	9	9
Vetch	5	8	7	8	9	9	9	9	9	8	8	9	9	7	7	7	8	9	9
Wheat	9	5	5	0	1	9	9	5	5	5	5	5	5	7	5	7	5	8	9
Plant back restrictions	(days)																		
Corn	0	0	0	7	0	7	0	7	0	7	0	NR ^c	NR	NR	NR	NR	NR	0	0
Cotton	0	0	0	30	21	30	21	30	21	30	21	0	0	0	0	0	NR	NR	NR
Soybean	0	0	0	30	21	30	21	30	21	30	21	NR	NR	NR	NR	NR	0	NR	NR

* Rates are the following: Glyphosate - 32 ozs./A of a 3 lb. ae/gal. formulation; Gramoxone Inteon -48 ozs./A (Gramoxone Inteon is a restricted use herbicide); Ignite 280 – 22 ozs./A.

** Ratings reflect burndown only, not residual control.

*** Two applications, or higher rates of glyphosate, are required for optimum control.

^a Glyphosate-resistant, smaller plants (<2 inches) are more consistently controlled.

^b Poor performance is possible with this product if day time temperatures are less than 60F.

GLYPHOSATE-RESISTANT HORSEWEED MANAGEMENT SYSTEMS

Management of glyphosate-resistant horseweed has become one of the biggest challenges for growers throughout West Tennessee. The glyphosate-resistant biotype of horseweed has now ended the era of glyphosate only weed control for the cotton and soybean fields. Moreover, recent research conducted by the University of Tennessee has found that horseweed will germinate from March through November. This information dictates that weed management programs must be constructed that utilize herbicides with different sites of action as well as herbicides that can provide residual and/or can be applied post or post-directed. While considerations should always be given to the entire weed spectrum, one or more of the following strategies are recommended to manage glyphosate-resistant horseweed in the following crops:

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
CORN			
Burndown			
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	22 - 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions. May be tank-mixed with atrazine and 2,4-D. Poor performance is possible with this product if day time temperatures are less than 75F.
Roundup PowerMax (glyphosate) + Banvel or Clarity (dicamba) or 2,4-D	0.75 - 1.5 lbs.(a.e.) + 0.25 lb. or 0.5 - 1.0 lb.	22 - 43 ozs.+ 0.5 pt. or 1.0-2.0 pt. of a 4 lb. /gal. formulation	Apply these products before, during or after corn planting (prior to corn emergence) for control of existing horseweed. Note: Make sure seed furrow is closed to avoid injury to corn seedlings. With 2,4-D apply 7-14 days prior to, or 3-5 days after corn planting, but prior to crop emergence. Do not use 2,4-D on light, sandy soils.
Preemergence			
Gramoxone Inteon +Atrazine (u)	0.47-0.75 lbs + 1.6 - 2.0 lbs.	30 - 48 ozs + 1.6 - 2.0 qts. 4L	Atrazine provides extended preemergence control of late emerging horseweed. Atrazine is a restricted use herbicide.
Postemergence			
Banvel or Clarity (dicamba) or Distinct (dicamba + diflufenzopyr)	0.25 lb. or 0.175 - 0.26 lb.	0.5 pt. or 4 -6 ozs.	The 0.5 pt. rate may be applied overtop corn up to 36" tall. For Distinct apply overtop to corn between 4" and 24" tall. For corn 4 to 10" tall, use 6 oz./A. For corn 10 to 24" tall, use 4 oz./A. Always add nonionic surfactant at 1 qt./100 gal. of spray mix. Do not use crop oil. Temporary corn injury (twisting, leaning) may be noted when applications are made during periods of rapid growth, or crop stress. Do not apply under conditions which favor drift onto nearby, sensitive crops. Do not tank-mix with Lorsban, Ambush or Warrior insecticides. Check labels of tank-mix partners for restrictions on corn size at application.

SOYBEAN			
Preplant Burndown			
Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	-22 – 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners. Poor performance is possible with this product if day time temperatures are less than 75F.
Roundup PowerMax (glyphosate) + Clarity (dicamba)	0.75 - 1.5 lbs. (a.e) + 0.25 lb.	22 - 43 ozs. + 8 ozs.	Apply as a tank-mix for control of winter weeds. A minimum of 1 inch of rainfall/irrigation and a 21 day waiting period after rainfall/irrigation is required before planting soybeans to avoid crop injury.
Roundup PowerMax (glyphosate) + 2,4-D	0.75 - 1.5 lbs.(a.e.) + 0.5 - 1.0 lb.	22 - 43 ozs.+ 1.0-2.0 pt. of a 4 lb. /gal. formulation	Apply 2,4-D before soybean planting for control of existing horseweed. With 2,4-D apply 30 days prior to soybean planting. Do not use 2,4-D on light, sandy soils. Higher 2,4-D rates (1.5 to 2 pts/A) have provided consistently better glyphosate-resistant horseweed control.
Valor 51% WDG (flumioxazin)	0.5 - 1 ozs.	1 - 2 ozs.	Apply as a fall treatment after November 15 in combination with labeled burndown herbicides to provide residual horseweed control the following year. 2 ozs. is recommended for fall application. Valor alone will not control emerged horseweed. Caution should be used with fall applied treatments on highly erodible land.
IN WHEAT PRIOR TO DOUBLECROP Harmony GT (Thifensulfuron) + Clarity (dicamba)	0.023-0.028 lbs. + 0.09 lbs.	0.5-0.6 ozs. + 3 ozs.	Apply in February. This herbicide treatment plus competition from a healthy wheat crop has reduced horseweed populations in subsequent double-crop soybeans. When wheat is combined, the tops of the horseweed plants are cut off, leaving a small amount of leaf surface for foliar herbicides to kill prior to double-crop planting.
Preemergence			
Gramoxone Inteon (u) (paraquat) + Sencor DF (metribuzin)	0.75 lb. + 0.19 lb.	48 ozs. + 4 ozs.	Apply to 6 inch or smaller horseweed and other weeds in a minimum of 20 gallons of water per acre as a preemergence burndown. Include a non-ionic surfactant at 2 pts. per 100 gals. of mix, or crop oil concentrate at 1 gal. per 100 gals. of spray mix. Weeds larger than 6 inches may not be controlled.
Valor 51% WDG (flumioxazin)	0.5 - 1 ozs.	1 - 2 ozs.	Do not apply more than 3 ozs/acre per growing season. Apply as a preplant or preemergence treatment to control spring germinating horseweed. Valor will not control existing horseweed.
Postemergence			
FirstRate 84 DG (cloransulam-methyl)	0.016 lb.	0.3 oz.	Postemergence in Roundup Ready soybeans: For tank-mix with Roundup WeatherMax, PowerMax, UltraMax or Glyphomax Plus, DO NOT add additional surfactant or crop oil. For tank-mix with other glyphosate products, add non-ionic surfactant at 2 pts. per 100 gals. of mix. Label recommends including ammonium sulfate at 8.5 to 17 lb/100 gals.

COTTON			
Preplant Burndown			
Herbicide	Active ingredient	Formulation	Remarks
Clarity 4AS (dicamba) + Roundup PowerMax (glyphosate)	0.25 lb. +0.75-1.5 ls.(a.e.)	0.5 pt. + 22 - 32 ozs.	Preplant for control of emerged annual weeds prior to planting cotton. Best results are obtained when weeds are small and actively growing and during warm weather. A minimum of 1 inch of rainfall/irrigation and a 21 day waiting period after rainfall/irrigation is required per 8 ounces, before planting cotton. May be tanked-mixed with Caparol, Cotoran, Gramoxone Inteon, and Roundup PowerMax for control of additional grasses and broadleaf weeds.
Envoke (Trifloxysulfuron)	0.0046 lbs.	0.10 oz	Must be planted back to cotton. Safe on wheat cover crop. Some plant residue should be on the field to reduce soil erosion on highly erodible soils.
Valor 51% WDG (flumioxazin) + broad spectrum herbicide	0.5 - 1 ozs.	1 - 2 ozs.	Use after November 15 in combination with labeled burndown herbicides to control emerged weeds and provide residual control the following year. A minimum of 30 days must pass, and 1 inch of rainfall/irrigation must occur, between Valor application and planting of cotton. Valor will not control existing horseweed.
Preemergence			
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	22 - 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. See label for further application instructions and tank-mix partners. Performance is enhanced by adding Caparol/Direx/Cotoran or delaying application until temperatures are greater than 75F.
Gramoxone Inteon (u) (paraquat) + Cotoran (fluometuron) or Direx (diuron) or Caparol (prometryn)	0.50 – 0.75 lb.	32 – 48 ozs.	Effective in suppressing glyphosate-resistant horseweed during the interval within 21 days before planting of cotton. Terminal regrowth can occur. Avoid drift to sensitive plants. See Preemergence Herbicides for Conventional or No-Till Cotton section of this manual for rates of Cotoran, Direx, or Caparol based on soil texture.
Postemergence			
Ignite 280 (Glufosinate) Liberty Tolerant Cotton Only	1.67-2.09 lbs.	22 – 29 ozs.	Apply over the top to Ignite (Liberty) tolerant cotton varieties. No more than 40 ozs./A may be applied per application and no more than 80 ozs./A may be applied per cotton growing season. Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed and crop canopies require 20 to 40 gallons per acre. See label for further application instructions.
Envoke (trifloxysulfuron)	0.0046 – 0.0069 lbs.	0.12 – 0.15 ozs.	Apply over the top of 5 leaf or greater cotton for suppression.
Post-directed			
Cotoran (fluometuron) + MSMA	1.0 lb.+ 2.0 lbs.	32 + 42 ozs.	May be applied to cotton at least 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.
Direx (diuron)+ MSMA	0.8 -1.2 lbs.+ 2.0 lbs.	1.6 - 2.4 pts. + 42 ozs.	May be applied after cotton reaches 12 in tall until bloom. May injure fall-seeded cover crops.
Suprend (prometryn + trifloxysulfuron)	1.25	1.56 lbs	May be applied to cotton at least 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.

(u)- *Restricted Use Herbicide*

GLYPHOSATE-RESISTANT PALMER AMARANTH MANAGEMENT SYSTEMS

Management of glyphosate-resistant Palmer amaranth (pigweed) is becoming an issue in West Tennessee. Control of Palmer amaranth will center around PRE applied herbicides. PRE applied herbicides require precipitation in order to provide good residual control of Palmer. As a result some kind of two pass approach (i.e. Valor EPP /fb Flexstar early Post in soybean) will provide the best chance of success managing this weed. While considerations should always be given to the entire weed spectrum, one or more of the following strategies are recommended to manage glyphosate-resistant Palmer amaranth in the following crops:

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
SOYBEAN			
Preplant Incorporated			
Treflan 4 EC and other trade names (Trifluralin)	0.5 lb. ^a 0.75 lb. ^b 1.0 lb. ^c	1.0 pt. ^a 1.5 pts. ^b 2.0 pts. ^c	
Preemergence			
Dual Magnum or Cinch (S-metolachlor)	sandy loam:0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam:1.27-1.59 lbs.	1-1.33 pts. 1.33-1.67 pts. 1.33-1.67 pts.	Requires rainfall or irrigation to be activated provides good small seeded broadleaf weed control. Available package mixtured with glyphosate as Sequence.
Intrro (alachlor)	2.5 lbs.	2.5 qts.	Requires rainfall or irrigation to be activated provides good small seeded broadleaf weed control.
Prefix (Fomesafen + S-metolachlor)	sandy loam: 1.33 lb. silt loam: 1.33-1.66 lb. silty clay loam: 1.82-1.99 lb.	2 pts. 2-2.5 pts. 2.75-3 pts.	Requires rainfall or irrigation to be activated provides good small seeded broadleaf weed control.
Prowl or Pendimax 3.3 (Pendimethalin)	sandy loam: 0.5-0.75 lb. silt loam: 0.75-1.0 lb. silty clay loam: 0.75-1.5 lbs.	1.2-1.8 pts. 1.8-2.4 pts. 1.8-3.6 pts.	Can be applied as a surface application after planting or preplant incorporated 1-2" deep. Surface applications may cause crop lodging later in season (soybeans 8-12" tall) if cool, rainy weather occurs during crop emergence.
Sencor 75DF (Metribuzin)	sandy loam: do not use silt loam: 0.38-0.5 lb. silty clay loam: 0.5-0.6 lb.	----- 0.5-0.67 lb. 0.67-0.83 lb.	Apply either preplant incorporated 1-2" deep or as a surface application after planting. Tank mix with a grass herbicide for more consistent control of Palmer and overall broad spectrum control. Two premixes with grass herbicides are (Domain =Sencor+Flufenacet and Boundary = Sencor+Dual).
Valor 51% WDG (flumioxazin) + broad spectrum herbicide	0.5 - 1 ozs.	1 - 2 ozs.	Apply 21 days before planting up to preemergence. Can see some soybean injury if applied preemergence to tilled soils, particularly sandy soils when rainfall occurs as soybeans emerge.
Postemergence			
Cobra 2E (Lactofen)	0.2 lb.	12.5 ozs.	Apply before Palmer amaranth reaches 6" in height. Add 2 pts. nonionic surfactant, or 2 to 4 pts. crop oil concentrate, per 100 gals. spray. Causes soybean foliar burn which is usually of short duration.

Herbicide	Active Ingredient	Formulation	Remarks												
Flexstar 1.88 SC (fomesafen + adjuvants)	0.24 – 0.35 lb.	1.0 – 1.5 pints	Apply before Palmer amaranth reaches 6” in height. Contains same active ingredient as Reflex, but is formulated with an adjuvant system that allows better tankmixing with glyphosate. Always add 1-2 qts. nonionic surfactant, or 0.5-1 gal. crop oil concentrate per 100 gals. of spray mix.												
Sequence (S-metolachlor + Glyphosate)	1.64 lb.	2.5 pts.	Apply up to 3 trifoliates.												
Ultra Blazer 2L (Acifluorfen)	0.13-0.38 lb.	0.5-1.5 pts.	Apply before Palmer amaranth reaches 6” in height. See label regarding the use of surfactant.												
COTTON															
Preplant Incorporated															
Treflan 4 EC and other trade names (Trifluralin)	0.5 lb. ^a 0.75 lb. ^b 1.0 lb. ^c	1.0 pt. ^a 1.5 pts. ^b 2.0 pts. ^c													
Preplant															
Reflex 2LC (Fomesafen)	0.25-0.38 lb.	1-1.5 pts.	A minimum of 14 days must pass and 1 inch of rainfall/irrigation must occur between Reflex application and planting of cotton. Do not plant sorghum within 18 months of application.												
Valor 51% WDG (flumioxazin) + broad spectrum herbicide	0.5 - 1 ozs.	1 - 2 ozs.	A minimum of 30 days must pass, and 1 inch of rainfall/irrigation must occur, between Valor application and planting of cotton in conventional till and 21 days for no-till.												
Preemergence															
Caparol 4L (Prometryn)	0.75-1.0 lbs. ^a 2.4 lbs. ^{bc}	1.5-2.0 pts. ^a 4.8 pts. ^{bc}	Good to excellent control of most annual grasses and broadleaf weeds, particularly residual pigweed control.												
Cotoran 4L or 85DF (Fluometuron)	1.0 lb. ^a	2 pts. 4L, or 1.2 lbs. 85DF, or 1.25 lbs. 80DF ^a	For improved pigweed control, particularly in no-till, reduced rates of Caparol may be applied in combination with Cotoran preemergence. See label for precautions. Rates in pints/A are based on soil texture: <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th><u>coarse</u></th> <th><u>medium</u></th> <th><u>fine</u></th> </tr> </thead> <tbody> <tr> <td>Caparol 4L</td> <td>1.5-2</td> <td>2</td> <td>-----</td> </tr> <tr> <td>Cotoran 4L</td> <td>2</td> <td>2.5-3</td> <td>3-3.5</td> </tr> </tbody> </table>		<u>coarse</u>	<u>medium</u>	<u>fine</u>	Caparol 4L	1.5-2	2	-----	Cotoran 4L	2	2.5-3	3-3.5
	<u>coarse</u>	<u>medium</u>	<u>fine</u>												
Caparol 4L	1.5-2	2	-----												
Cotoran 4L	2	2.5-3	3-3.5												
Direx 4L or Direx 80 DF (Diuron)	0.2-0.4 lb. + 2.0 lbs.	0.4-0.8 pt. 4L or 0.25-0.5 80 DF													

Prowl or Pendimax 3.3 (Pendimethalin) 0.5-0.75 lb. ^a	0.75-1.0 lb. ^b 1.0-1.5 lbs. ^c 1.2-1.8 pts. ^a	1.8-2.4 pts. ^b 2.4-3.6 pts. ^c	Excellent control of most annual grasses. Tank-mix with Cotoran or Zorial for improved broadleaf control. A compatibility agent may be required in tank mixes.
Postemergence			
Ignite 280 (Glufosinate) Liberty Tolerant Cotton Only	1.67-2.09 lbs.	22 – 29 ozs.	Apply before Palmer amaranth reaches 6” in height. Apply over the top to Ignite (Liberty) tolerant cotton varieties. No more than 40 ozs./A may be applied per application and no more than 80 ozs./A may be applied per cotton growing season. Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. See label for further application instructions.
Post-directed			
Cotoran (fluometuron) + MSMA	1.0 lb.+ 2.0 lbs.	32 + 42 ozs.	May be applied to cotton at least 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.
Direx (diuron)+ MSMA	0.8 -1.2 lbs.+ 2.0 lbs.	1.6 - 2.4 pts. + 42 ozs.	May be applied after cotton reaches 12 inches tall until bloom. May injure fall-seeded cover crops.
Reflex	0.25-0.375 lbs.	1-1.5 pts.	Reflex may be applied to cotton at least 6 inches in height through lay-by as post-directed application. All post-directed applications should avoid spray contact with any green non-barked parts of the cotton plant or foliage as unacceptable injury will occur. Apply Reflex at 1-1.5 pts./A in a minimum of 10 gallons spray solution per acre. Applications may be made broadcast or banded. Crop rotation is restricted 4 months for wheat and 10 months for corn.
Suprend (prometryn + trifloxysulfuron) + MSMA	1.25+ 2.0 lbs.	1.56 lbs+ 42 ozs.	May be applied to cotton at least 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.

(u)- Restricted Use Herbicide

CORN WEED CONTROL

Atrazine and Water Quality

Atrazine label restrictions regarding mixing, loading and application are discussed below. These restrictions are part of the overall ground and surface water contamination risk reduction measures. Atrazine users are strongly encouraged to follow these guidelines to comply with the label, and to share in the responsibility of preserving the future of this extremely valuable corn herbicide. **These restrictions, and the Restricted Use Pesticide designation, apply to all formulations of atrazine, and all package mix products which contain atrazine.**

Mixing, Loading and Application - Atrazine may not be mixed/loaded or used within 50 feet of all wells, including abandoned wells, drainage wells and sink holes. Atrazine may not be mixed or loaded within 50 feet of intermittent streams and rivers, natural or impounded lakes and reservoirs. Atrazine may not be applied aerially or by ground within 66 feet of the points where field surface runoff enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If atrazine is applied to highly erodible land, the 66-foot buffer or setback from runoff entry points must be planted to corn, seeded with grass, or another suitable crop.

Application rates - All soil applications prior to crop emergence -

* **Highly Erodible Soils** (as defined by NRCS) - If conservation tillage is practiced (at least 30 percent residue coverage at planting), apply a maximum of 2 lbs. a.i./acre. If residue coverage is less than 30 percent, apply a maximum of 1.6 lbs. a.i./acre.

* **Soils Not Highly Erodible** - Apply a maximum of 2 lbs. a.i./acre.

Postemergence Applications

If no atrazine was applied prior to corn emergence, apply a maximum of 2 lbs. a.i./acre. If a Postemergence treatment is required following an earlier herbicide application, the total atrazine applied may not exceed 2.5 lbs. a.i./acre/calendar year. Postemergence applications to corn must be made before corn exceeds 12 inches in height.

Perennial Broadleaf Control

Conventional plowing and disking for one year may give the best control of tough perennials such as honeyvine milkweed, trumpetcreeper, horsenettle, pokeweed and wild sweetpotato or bigroot morningglory. The roots should be chopped up by plowing and disking. Follow up with Banvel, Clarity or Distinct overtop when weeds are 4 to 6 inches tall or in early vining stage.

BURNDOWN HERBICIDES RECOMMENDED FOR NO-TILL CORN*

Burndown Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Gramoxone Inteon (Paraquat) (u)	0.5-0.75 lbs.	32 – 48 ozs.	Use the higher rate to kill sod or where hard-to-kill plants are present. Weeds more than 6" tall may not be adequately controlled. Always add surfactant (0.5 gal./100 gals. of spray mix) and apply in 20-30 gals. of water per acre.
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	22 – 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners.
Touchdown/others* (Glyphosate 3ae)	0.75-1.5 lbs. (a.e.)	32-64 ozs.	Better control of smartweed than Gramoxone. Fields infested with glyphosate-resistant horseweed require the addition of dicamba or 2,4-D to glyphosate at burndown. See page (7) for information on glyphosate-resistant horseweed management. Use the low rate on small, easy-to-kill annual weeds. Increase the rate on larger weeds and most perennials. See labels for additional information.
Roundup PowerMax* (Glyphosate 4.5ae)		22-43 ozs.	
Dicamba, 2,4-D			Add if glyphosate resistant horseweed is present. Can be applied prior to, at planting, or immediately after planting.

(u)- *Restricted Use Herbicide*

* NOTE: *Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.*

PREEMERGENCE PACKAGE MIX HERBICIDES FOR NO-TILL OR CONVENTIONAL CORN*

Herbicide	Formulation Rate/Acre Broadcast (Qts.)	Grass Herbicide Equivalent Rate	Atrazine 4L (Qts.) Equivalent Rate	Amount of Atrazine 4L (Qts.) (To add to give 2 qt./A equivalent)**	Remarks
Bicep II Magnum (u) (Dual II Magnum plus Atrazine)	1.3-1.6 ^a 1.6-2.1 ^b 2.1-2.6 ^c	0.8-0.9 pts. 0.9-1.3 pts. 1.3-1.6 pts.	1-1.24 1.24-1.63 1.63-2	1-0.76 0.76-0.37 0.37-none	Use the higher rate for each soil texture in minimum tillage or in no-tillage corn. See label. Also available as a premix with glyphosate (Expert).
Cinch ATZ (u) (Cinch plus Atrazine)	1.3-1.6 ^a 1.6-2.1 ^b 2.1-2.6 ^c	0.8-0.9 pts. 0.9-1.3 pts. 1.3-1.6 pts.	1-1.24 1.24-1.63 1.63-2	1-0.76 0.76-0.37 0.37-none	Use the higher rate for each soil texture in minimum tillage or in no-tillage corn. See label.
Degree Xtra (u) (Degree plus Atrazine)	2.9 ^a 2.9-3.7 ^b 3.2-3.7 ^c	4.1 pts. 4.1-5.3 pts. 4.6-5.3 pts.	0.9 0.9-1.24 1.1-1.24	1.1 1.1-0.76 0.9-0.76	Apply after planting before crop and weed emergence. In areas of heavy weed infestation use up to 4.3 qt./A on medium and fine textured soils. Degree is a micro-encapsulated version of acetochlor.
Expert (u) (Dual II Magnum + Glyphosate + Atrazine)	2.5 ^a 3.0 ^b 3.75 ^c	1.14 pts. 1.37 pts. 1.71 pts.	1.34 1.61 2.01	0.66 0.39 none	Can be used PRE on all corn hybrids. Can be used POST only on glyphosate tolerant corn hybrids. Good resistance management tool.
Guardsman Max (u) (Outlook plus Atrazine)	1.3-1.5 ^a 1.5-2.0 ^b 1.5-2.0 ^c	12-13 ozs. 13-14 ozs. 13-14 ozs.	1.1-1.2 1.2-1.7 1.2-1.7	0.9-0.8 0.8-0.7 0.8-0.7	Use the higher rate for each soil texture in minimum tillage or no tillage corn.
Halex GT (Dual II Magnum plus Glyphosate plus Callisto)	3.6-4 pts/A	0.98-1.09 pts	N/A	N/A	Can be used PRE on all corn hybrids. Can be used POST only on glyphosate tolerant corn hybrids. Good resistance management tool. Can be used in areas where atrazine use is not allowed.
Harness Xtra 5.6 (u) (Harness plus Atrazine)	1.4-1.7 ^a 1.7-2.6 ^b 2.3-3.0 ^c	1.25-1.5 pts. 1.5-2.3 pts. 2-2.6 pts.	0.9-1.1 1.1-1.6 1.4-1.9	1.1-0.9 0.9-0.4 0.6-0.1	Use the higher rate for each soil texture in conservation or minimum tillage systems. In areas of heavy weed infestations, use up to 2.3 qts./A on coarse textured soils, and 2.3-3.0 qts./A on medium and fine textured soils. See label.

^a Sandy Soils

^b Medium Textured Soils

^c Fine Textured Soils

*Recommended rates are based on soils with less than 3% organic matter. See labels for soils higher in organic matter content.

**Remember that for highly erodible soils with less than 30% residue cover at planting, the maximum pre-atrazine rate is 1.6 lb. a.i./A (1.6 qts./A of 4L formulation).

(u)- **Restricted Use Herbicide**

NOTE: For cases where weather or other factors prevent application of preemergence package mix herbicides until after corn emerges, most of the above products may be applied overtop small corn. Rates, corn size restrictions, and directions for addition of adjuvants vary by product. Consult the label for postemergence use directions.

PREEMERGENCE HERBICIDE TANK MIXTURES FOR NO-TILL OR CONVENTIONAL CORN

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient (lbs.)	Formulation	
Atrazine (u)	1.6-2.0	1.6-2.0 qts. 4L or 1.8-2.2 lbs. 90DF	Use to control most broadleaf weeds and a few grasses. Tank mix with a grass herbicide for broader spectrum control. Atrazine is a restricted use herbicide.
Axiom 68DF (Flufenacet + Metribuzin)+ Atrazine (u)	0.55-0.94 + 1.0-2.0	13-22 ozs. 68DF + 1-2 qts. 4L	Apply preemergence to control annual grasses and several broadleaf weeds. Use the higher rates required on fine-textured soils. Note: On overflow ground, if Axiom is applied without atrazine and corn stand is lost to flooding, soybeans can be replanted.
Authority MTZ (Sulfentrazone + Metribuzin)	0.096 + 0.16 lbs. ai/A	12 – 18 ozs.	
Balance Pro 4L (u) (Isoxaflutole)+ Atrazine (u)	0.047-0.094 + 1.0-1.5	1.5-3.0 oz. 4L + 1.0-1.5 qts. 4L	Apply preemergence to control annual grasses and several broadleaf weeds. Excellent control of pigweeds and velvetleaf. Plant corn at least 1.5 inches deep. Corn seed must be completely covered with soil and furrow firmed. Do not apply on coarse soils (sand, loamy sand, sandy loam) containing less than 1.5% organic matter. For other soils with less than 1.5% organic matter, do not exceed 2.76 oz. 4L on medium textured soils; or 3.0 oz. 4L on fine textured soils. See label for specific rates for your soil. Do not exceed 1.5 qt./A of Atrazine 4L with any rate of Balance. Crop injury may be noted on eroded hill sides, clay knolls, or other areas of coarser or low organic matter soils. If the water table is less than 25 ft. below the surface, do not use on loamy sands or sand surface soil and subsoils with less than 2% organic matter in the upper 12 inches.
Cinch (S-metolachlor)+ Atrazine(u)	0.78-1.56 + 1.0-2.0	0.8-1.67 pts. 7.64E + 1.0-2.0 qts. 4L	Apply one of these combinations for broader spectrum weed control than atrazine alone. Use the higher rates on fine-textured soils. All are available as package mixes. Some products offer further reduced rates when the product is used as part of a planned preemergence followed by postemergence program.
Define 60DF (Flufenacet)+ Atrazine (u)	0.45-0.8 + 1.0-2.0	12-21 ozs. 60DF + 1.0-2.0 qts. 4L	
Degree (u) (Acetochlor)+ Atrazine (u)	0.83-2.0 + 1.25-2.0	1.75-4.25 pts. 3.8ME + 1.25-2.0 qts. 4L	
Dual II Magnum (S-metolachlor)+ Atrazine(u)	0.78-1.56 + 1.0-2.0	0.8-1.67 pts. 7.64E + 1.0-2.0 qts. 4L	
Harness (u) (Acetochlor)+ Atrazine (u)	1.5-2.2 + 1.25-2.0	1-2.5 pts. 7E + 1.25-2.0 qts. 4L	
Outlook (Dimethenamid-P)+ Atrazine (u)	0.56-0.99 + 1.0-2.0	12-21 ozs. 6E + 1.0-2.0 qts. 4L	
Simazine (Princep)+ Atrazine (AAtrex) (u)	1.0 + 1.0 lb. ^a 1.2 + 1.2 lbs. ^b 1.5 + 1.5 lbs. ^c	2.0-3.0 pts. each of 4L, or 1.1-1.7 lbs. each of Nine-O	May give better annual grass control than atrazine alone. On setback areas where atrazine cannot be used, a tank mix of Princep + a preemergence grass herbicide may be used. See labels.

Surpass (u) (Acetochlor)+ Atrazine (u)	1.2-2.4 + 1.25-2.0	1.5-3.0 pts. 6.4E + 1.25-2.0 qts. 4L	
TopNotch (u) (Acetochlor)+ Atrazine (u)	1.6-2.4 + 1.5-2.0	2.0-3.0 qts. 3.2ME + 1.5-2.0 qts. 4L	
Prowl or Pendimax 3.3 (Pendimethalin)+ Atrazine (u)	0.74-1.49 + 1.0-2.0	1.8-3.6 pts. 3.3E + 1.0-2.0 qts. 4L	Do not apply preplant incorporated or serious corn injury can result. Plant corn at least 1.5 in. deep. Corn seed must be completely covered with soil. The use of no-till planters under conditions which do not allow good soil coverage of the corn seed can result in reduced crop stand or injury if the herbicide contacts the germinating corn seed. Apply after planting before emergence of weeds. Use the higher rates on fine-textured soils. In case of stand failure, corn seed should be replanted below the herbicide treated zone.
Python 80WDG (Flumetsulam)+ grass herbicide	0.05	1.0 oz.	For use primarily in areas where atrazine cannot be used (set-back zones, refuge fields, etc.) or in fields subject to flooding where soybeans may need to be planted. Plant corn at least 1.5" deep. Mix with a preemergence grass herbicide and apply on the surface. Good control of common lambsquarters, pigweed, spurge and velvetleaf. Do not apply where Counter or Thimet insecticides are to be used. Other corn insecticides should be applied in a T-band to avoid injury. Do not plant cotton within 18 months of application.
Sequence (Glyphosate Acid + S- metolachlor)			

(u)- Restricted Use Herbicide

POSTEMERGENCE HERBICIDES RECOMMENDED FOR CORN

Herbicide	Rate/Acre Broadcast		Remarks Note: To determine corn height, measure to highest leaf surface on free standing plants.
	Active Ingredient	Formulation	
Accent Q (Nicosulfuron)	0.49 oz.	0.9 oz.	Apply overtop or with drop nozzles to control rhizome johnsongrass 8 to 18" tall. Accent may be applied overtop corn up to 20" tall, or up to the 6 leaf collar stage , whichever is most restrictive. Accent may cause temporary yellowing of corn plants, but they usually recover quickly. Add nonionic surfactant at 1 qt./100 gal., or crop oil concentrate at 1 gal./100 gal. of spray mix. Avoid application during cool, cloudy weather. Consult the Accent label for directions on split applications, and tank-mixes or sequential applications with foliar herbicides and insecticides. Note: Now labeled on specified varieties of sweet corn refer to label for approved varieties.
Aim (Carfentrazone-ethyl)	0.008 lb.	0.5 oz.	Apply overtop corn up to the 8 leaf collar stage to control velvetleaf, black nightshade, common lambsquarters and small ivyleaf and pitted morningglory. Excellent on large velvetleaf. Temporary leaf burn may occur. Always add nonionic surfactant at 1 qt./100 gal. of spray mix. May be tank-mixed with atrazine, Banvel, Clarity or other herbicides to expand weed spectrum. See label. Do not tank mix with EC formulation pesticides, as excessive crop injury may occur. Do not apply more than a total of 1.9 oz./A per season. Any AIM labeled crop may be planted immediately following application.
Atrazine (u) + Crop Oil Concentrate	2.0 lb + 1 gal./100 gal	2 qts.	If no atrazine was applied prior to corn emergence, apply a maximum of 2 lbs. a.i./acre. If a postemergence treatment is required following an earlier herbicide application, the total atrazine applied may not exceed 2.5 lbs. a.i./acre/calendar year. Postemergence applications to corn must be made before corn exceeds 12 inches in height. Use to control most broadleaf weeds and a few grasses. Always add crop oil concentrate at 1 gal. per 100 gal. of spray mix. Atrazine is a restricted use herbicide.
Banvel or Clarity (Dicamba)	0.25-0.5 lb.	0.5-1.0 pt.	Apply Banvel or Clarity at the 1 pt. rate overtop corn up to 8" tall to give early control of vines and broadleaf weeds. The 0.5 pt. rate may be applied overtop corn up to 36" tall. Do not apply under conditions which favor drift onto nearby, sensitive crops.
Basagran (Bentazon)	0.75-1.0 lb.	1.5-2.0 pts.	Use to control yellow nutsedge and small broadleaf weeds. See label for specific rates for specific weed sizes. Add 1 qt. of crop oil concentrate per acre. May be tank-mixed with atrazine. See labels.
Buctril 4E (Bromoxynil)	0.25-0.38 lb.	0.5-0.75 pts.	Apply overtop corn from 3- to 8-leaf stage to control many broadleaf weeds. Apply when weeds are in the 2- to 4-leaf stage or less than 6" tall. Less danger of volatility drift than 2,4-D or Banvel.
Callisto 4L (Mesotrione) + Atrazine	0.094 + 0.25 lb.	3.0 ozs. 4L + 8.0 ozs. 4L	Apply overtop corn up to 12 inches tall. (Note: Without atrazine, Callisto may be applied to corn up to 30 inches tall). Good control of cocklebur, pigweed, and several other weeds. Always add crop oil concentrate at 1 gal./100 gal. of spray mix and UAN at a rate of 2.5% v/v or AMS at a rate of 8.5 lbs/100 gal. Do not use methylated seed oil (MSO) or MSO blend adjuvants. Do not apply postemergence if corn has been previously treated with Counter or Lorsban insecticides. See label for other insecticide precautions. Do not apply to popcorn, sweet corn, or ornamental corn. Callisto may be tank-mixed with Accent or Steadfast for grass control.

Distinct 70DG (Dicamba+Diflufenzopyr)	0.175-0.26 lb.	4-6 ozs.	Apply overtop to corn between 4" and 24" tall. For corn 4 to 10" tall, use 6 oz./A. For corn 10 to 24" tall, use 4 oz./A. Always add nonionic surfactant at 1 qt./100 gal. of spray mix. Do not use crop oil. Distinct provides excellent control of several broadleaf weeds, including cocklebur, jimsonweed, lambsquarters, morningglory, pigweed and ragweed. Some suppression of annual grasses may be noted, but they are not controlled by Distinct. Temporary corn injury (twisting, leaning) may be noted when applications are made during periods of rapid growth, or crop stress. Do not apply under conditions which favor drift onto nearby, sensitive crops. Do not tank-mix with growth regulator herbicides, such as Banvel, 2,4-D, Hornet, etc. See label. Do not tank mix with Lorsban, Ambush or Warrior insecticides. Do not use on sweet corn.
Halex GT (u) (S-metolachlor plus Glyphosate plus mesotrione)	2.0 – 2.2	3.6-4 pts/A	Can be used POST only on glyphosate tolerant corn hybrids. Good resistance management tool. Can be used in areas where atrazine use is not allowed.
Hornet (Flumetsulam + Clopyralid)	1.9-4.7 ozs.	1.6-4 ozs.	Apply as a postemergence spray from corn emergence (spike stage) up to 24 in. tall. For optimum control, apply when broadleaf weeds are less than 8 in. tall. Use higher end of range for heavy weed infestations. Good control of cocklebur and sicklepod. Always add a nonionic surfactant (1 qt. per 100 gal. of spray mix) or crop oil concentrate (1 gal. per 100 gal. of spray mix)
Impact	0.22 ozs.	0.75 ozs.	Apply postemergence up to 45 days to Corn harvest.
Lexar (atrazine + mesotrione +S-metolachlor)	2.78 – 3.24 lbs.	3 – 3.5 qts.	Atrazine is a restricted use product (see label). Use lower rates on coarse textured soils, higher rate on medium and fine-textured soils.
Liberty 1.67L (Glufosinate) <u>Liberty Link or Glufosinate-Resistant Hybrids Only</u>	0.21-0.37 lb.	16-28 ozs.	Apply overtop in Liberty Link (glufosinate resistant) corn from emergence up to 24" tall corn, or the 7 collar stage, which ever occurs first. Apply 16 ozs. to control small cocklebur, ragweed and smartweed. Increase rates to 20-28 ozs./A to control foxtails, crabgrass, fall panicum, horseweed, morningglory, sicklepod and other weeds. See label. Will not control rhizome johnsongrass. Always add ammonium sulfate (AMS) at 3 lb./A when applying Liberty. Do not add surfactant or crop oil. Do not exceed 56 ozs. per acre per season. Do not apply within 60 days of silage harvest.
Lightning 70DG (Imazethapyr + Imazapyr) <u>Clearfield Hybrids Only</u>	0.056 lb.	1.28 ozs.	Apply overtop in Clearfield corn from the spiking stage up to 20" tall corn. Good control of annual grasses, seedling johnsongrass, cocklebur, morningglory, pigweed and sicklepod. Does not provide residual control of cocklebur and other large seeded broadleaf weeds. Always add crop oil concentrate (1 gal./100 gal.) or nonionic surfactant (1 qt./100gal.) of spray mix. Do not make more than one application of Lightning per season. Do not apply within 45 days of silage harvest. Do not use Counter 15G insecticide when Lightning will be applied to IT hybrids. Counter 20 CR (banded) may be used. Lightning can be tank mixed with Atrazine or Distinct to broaden weed control. When tank mixing Lightning with Distinct, do not use crop oil concentrate.
Marksman (u) (Clarity + Atrazine)	0.8-1.4 lbs.	2-3.5 pts.	Apply overtop for broadleaf weed control. A maximum of 3.5 pts./A may be applied during the period from corn emergence through the 5 leaf stage or 8 in. tall, whichever occurs first. Reduce rate to 2 pts./A on coarse textured soils. Nonionic surfactant may be added. See label. Do not add oil. Note: 2 pts. of Marksman=0.56 pt. Clarity + .53 qts. Atrazine 4L. 3.5 pts. Marksman=1 pt. Clarity + 0.9 qt. Atrazine 4L. Do not apply under conditions which favor drift onto nearby sensitive crops.

Option (Foramsulfuron)	0.53-0.61 oz.	1.5-1.75 ozs.	Apply overtop corn when corn is 0-16 inches in height or when corn is in the emergence through V6 growth stage , whichever is more restrictive. Drop nozzles must be used for applications when corn is 16-36 inches in height. Option may cause temporary yellowing or stunting of corn plants, but they usually recover quickly. Methylated or ethylated seed oil (1.5 pts./A), with 10% emulsifier or greater, in combination with nitrogen fertilizer (1.5-2 qts./A of UAN or 1.5-3 lbs./A of AMS), is the recommended adjuvant type to provide optimum weed control (See label).
Permit (Halosulfuron)	0.5-1 oz.	0.67-1.33 ozs.	Apply overtop to control cocklebur, common ragweed, velvetleaf and yellow nutsedge. Weak on sicklepod and morningglory. Add surfactant or crop oil (See label). May be tank-mixed with Accent or Beacon for johnsongrass control. See label. Also available as a premix with dicamba (Yukon).

Resolve Q (Rimsulfuron + thifensulfuron)	0.14 + 0.003 lb.	1.25 ozs.	Apply overtop corn until it reaches a height of 20" or V7. Add 0.25% NIS and 2 qt/A of UAN or 2 lbs/A AMS. Some hybrids are susceptible to injury from rimsulfuron. Check with seed company for information.
Resource (Flumiclorac)	0.03 lb.	4 ozs.	Apply overtop corn from the 2-leaf through 10-leaf stages for control of velvetleaf. Add crop oil concentrate at the rate of 1 pt./A. May be tank-mixed with Accent, Atrazine, Clarity or 2,4-D. Do not add crop oil concentrate or any other adjuvant when tank-mixing with Clarity. With 2,4-D tank-mixes, restrict overtop applications to corn no taller than 8 inches. For 2,4-D ester, do not add any adjuvant. For 2,4-D amine, add nonionic surfactant at 0.25% by volume.
Status (Dicamba+Diflufenopyr + Isoxadifen)	0.18 to 0.35 lb.	5 to 10 ozs.	Add 0.25% NIS plus 1.25% UAN or 5 to 17 lbs AMS. Apply to corn from 4" tall or V2 to 36" tall or V10.
Touchdown/others (Glyphosate 3ae) Roundup Ready Hybrids Only	0.56-0.75 lb.(a.e.)	24-32 ozs. 3ae	Apply overtop in Roundup Ready corn up to the V8 stage (8 leaves with collars) or until corn height reaches 30", whichever comes first. Sequential applications may be made. Allow a minimum of 10 days between applications. May be tank mixed with Atrazine (up to 12" tall corn) for residual control, can be purchased as premix (Expert). See label for other tank-mixes. Avoid spraying under conditions which favor drift. Tank-mix with Clarity or 2,4-D for control of glyphosate-resistant horseweed.
Roundup PowerMax (Glyphosate 4.5ae) Roundup Ready Hybrids Only		16-22 ozs. 4.5ae	
Steadfast Q (Nicosulfuron + Rimsulfuron)	0.035 lbs.	1.5 oz.	Do not apply to corn taller than 20 inches or exhibiting 7 or more collars, whichever is the more restrictive. Always add crop oil concentrate at 1 gal. per 100 gallons of spray mix or a nonionic surfactant at 1-2 qt. per 100 gallons of spray mix. The label recommends the addition of liquid nitrogen (28% N at 2 qt./A; 10-34-0 at 1 qt./A). Do not apply to corn previously treated with organophosphate insecticide.
Stout (Nicosulfuron+ Thifensulfuron)	0.023 – 0.034 lb.	0.5 – 0.75 ozs.	Apply to corn that is up to 16 inches tall or exhibiting 5 collars.
2,4-D amine or low volatile ester	0.25-0.5 lb.	0.5-1.0 pt. of 4 lb./gal. formulation	Overtop application is satisfactory for corn under 8". On taller corn, use directed application to prevent crop injury and provide better spray coverage of weeds. Do not apply under conditions which favor drift onto nearby, sensitive crops.
Gramoxone Inteon (Paraquat) (u)+ surfactant	0.25-0.5 lb.	16-32 ozs.	Directed, shielded or hooded application only. Use low pressure to reduce drift. For directed applications without shields, corn must be at least 10" tall. Direct spray to contact no more than 3" of the corn stalks. Add surfactant at 1 qt. per 100 gals. of spray mix.

(u)- Restricted Use Herbicide

CORN HARVEST AIDS

Harvest aid chemicals are sometimes needed to desiccate weeds in order to improve timeliness of harvest. This is most frequently encountered with early maturing hybrids which may be ready for harvest prior to a killing frost. Harvest aid chemicals do not speed-up maturity of the corn plant; they merely reduce moisture in weeds and may improve harvest efficiency, in addition to timeliness. Producers are encouraged to make harvest aid decisions by comparing cost with anticipated benefits. Also, care must be taken to minimize chances of drift to adjacent crops. Be sure to read labels thoroughly and follow required preharvest intervals (PHI).

Harvest Aid	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Gramoxone Inteon (u)	0.52 lbs.	33 ozs.	Make one application at least 7 days prior to harvest. Ensure that maximum kernel fill is complete and the corn is physiologically mature (black layer formed). Always add nonionic surfactant at 1 qt./100 gal. of spray mix. Provides good desiccation of cocklebur, burcucumber, and moringglories.
Roundup PowerMax* (Glyphosate 4.5ae)	0.75-1.5 lbs. (a.e.)	22-44 ozs. 4.5ae 32-64 ozs. 3ae	Make applications at 35 percent grain moisture or less. Ensure that maximum kernel fill is complete and the corn is physiologically mature (black layer formed). Allow a minimum of 7 days between application and harvest of corn. Use a spray volume of 10 to 20 gallons of water per acre for ground applications, or 3 -10 gallons of water for aerial applications. Do not apply more than 1 qt./A with aerial applications. Do not apply to corn grown for seed as a reduction in germination or vigor may occur. Avoid spraying during conditions which favor drift. See labels for other glyphosate formulations.
Touchdown/others* (Glyphosate 3ae)		32-64 ozs. 3ae	
Sodium Chlorate, Defol 6, other trade names (Sodium Chlorate)	6.0 lbs.	2 gals. of a 3 lb./gal. formulation or 1 gal. of a 6 lb./gal. formulation	For desiccation of weeds in early maturing corn, make application in 5-7 gallons of water per acre by air at least 14 days before anticipated harvest date. Desiccation of morningglory and other vines may be erratic. Do not graze treated fields or feed fodder, forage or residual grain within 14 days of application. Do not apply under conditions which favor drift.

(u)- *Restricted Use Herbicide*

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application

EXPECTED WEED RESPONSE TO SOIL APPLIED CORN HERBICIDES

	Atrazine (u)	Axiom+ Atrazine (u)	Balance Pro (u)+ Atrazine (u)	Bicep II Magnum (u) or Cinch ATZ (u) + Atrazine (u)	Define + Atrazine (u)	Degree Xtra (u) or FulTime (u)+ Atrazine (u)	Valor	Harness Xtra (u) + Atrazine (u)	Princep+ Atrazine (u)	Prowl+ Atrazine (u)
Barnyardgrass	6	9	9	9	9	9	2	9	7	9
Broadleaf Signalgrass	4	8	8	8	8	8	2	8	5	7
Burcucumber	4	4	4	4	4	4	5	4	5	4
Cocklebur	7	7	6	7	7	7	6	7	7	7
Common Ragweed	9	9	9	9	9	9	-----	9	9	9
Fall Panicum	3	9	9	9	9	9	4	9	4	9
Foxtail	6	9	9	9	9	9	4	9	7	9
Giant Ragweed	6	6	6	6	6	6	7	6	8	6
Goosegrass	6	9	9	9	9	9	4	9	7	9
Horsenettle	3	3	3	3	3	3	-----	3	3	3
Jimsonweed	8	8	8	8	8	8	-----	8	8	8
Lambsquarters	9	9	9	9	9	9	8	9	9	9
Large Crabgrass	7	9	9	9	9	9	4	9	8	9
Morningglory	8	8	7	8	8	8	7	8	8	8
Nutsedge	4	7	-----	7	7	7	-----	7	4	4
Pigweed, Palmer	9	9	9	9	9	9	9	9	9	9
Pigweed, Smooth	9	9	9	9	9	9	9	9	9	9
Rhizome Johnsongrass	0	2	2	2	2	2	0	2	0	0
Seedling Johnsongrass	1	8	8	8	8	8	2	8	1	8
Sicklepod	6	7	5	7	7	7	4	7	6	6
Smartweed	9	9	9	9	9	9	5	9	9	9
Smooth Crabgrass	3	9	9	9	9	9	2	9	5	9
Velvetleaf	6	6	9	6	6	6	6	6	8	7

EXPECTED WEED RESPONSE TO POSTEMERGENCE CORN HERBICIDES

	Atrazine (u)+Oil	Aim	Clarity	Basagran	Steadfast Q	Stout	Buctril	Callisto + Atrazine (t)	Status	Halex GT***	2,4-D	Accent Q	Liberty*	Lightning*	Impact	Roundup PowerMax/ Touchdown/ others***
Barnyardgrass	4	0	0	0	----	----	0	----	1	9	0	----	6	7	----	9
Broadleaf Signalgrass	6	0	0	0	9	9	0	7	1	9	0	8	6	8	8	9
Burcucumber	4	----	8	3	7	7	7	----	8	----	3	7	----	----	----	----
Cocklebur	7	6	9	9	6	9	9	9	9	10	9	6	8	9	7	10
Common Ragweed	8	----	9	5	----	----	7	----	9	8	8	----	----	----	----	8
Fall Panicum	6	0	0	0	8	8	0	----	1	9	0	----	6	9	6	9
Foxtail	7	0	0	0	9	9	0	----	1	9	0	9	7	9	8	9
Giant Ragweed	6	2	9	5	3	4	7	8	9	7	9	2	9	----	8	6
Goosegrass	7	0	0	0	8	8	0	----	1	9	0	----	6	7	----	9
Horsenettle	4	4	6	0	2	5	4	6	6	----	4	2	----	6	----	----
Horseweed (glyphosate tolerant)	5	0	8	0	2	2	2	8	8	7	8	2	8	--	8	2
Lambsquarters	8	8	9	6	----	----	8	7	9	8	8	2	----	----	8	8
Large Crabgrass	6	0	0	0	6	6	0	7	1	9	0	5	6	7	8	9
Morningglory	7	8	9	4	7	8	9	7	9	8	9	7	9	8	6	7
Nutsedge	6	0	0	8	2	2	0	----	0	----	0	4	3	----	3	7
Pigweed, Palmer ^a	9	7	9	7	4	9 ^c	4	9	8	9	8	3	6	4	9	9
Pigweed, Smooth ^b	9	8	9	9	9	9	4	9	9	9	9	9	9	9	9	9
Rhizome Johnsongrass ^t	0	0	0	0	9	9	0	1	0	9	0	9	2	6	4	9
Ryegrass	5	0	0	0	8	8	0	6	1	7	0	8	2	7	----	7
Seedling Johnsongrass	0	0	0	0	9	9	0	5	1	10	0	9	7	8	6	10
Sicklepod	6	1	8	0	6	8	2	7	8	9	8	6	8	8	----	9
Smartweed	8	7	8	7	----	----	8	----	8	8	6	----	----	----	7	8
Smooth Crabgrass	4	0	0	0	2	2	0	6	1	9	0	5	6	7	7	9
Velvetleaf	7	10	8	8	7	8	8	----	8	9	8	7	6	8	---	7

KEY TO RESPONSE RATINGS: 0=No control; 10=100% control; ----=Data not available Ratings are based on application of labeled rates of each herbicide, applied at the optimum timing for each weed.

(U)Restricted Use Pesticide: Refer to label for precautions to be taken during handling and application.

^a No hairs on leaf.

^b Many hairs on leaf

^c Use 2 lbs. of atrazine a.i. to obtain the most consistent early season Palmer amaranth control.

*Hybrid must be Liberty Link or glufosinate resistant.

**Hybrid must be Clearfield.

***Hybrid must be Roundup Ready.

GRAIN SORGHUM WEED CONTROL

Introduction

Weeds can exert serious pressure on young grain sorghum through competition for water, nutrients and light. If allowed to compete through mid- to late-season, many weeds can grow taller than grain sorghum and reduce yields, delay maturity and hinder harvesting. In most fields, a season-long weed control program is needed for successful grain sorghum production.

Grain Sorghum and Johnsongrass

Do not plant grain sorghum in fields which are heavily infested with johnsongrass. Johnsongrass is a very vigorous competitor for water, nutrients and light. The weed is closely related to grain sorghum, and it harbors several diseases and insects which attack grain sorghum. No herbicides are available to adequately control johnsongrass in grain sorghum. **Do not apply and avoid drift of Accent, Accent Gold, Beacon, Option, or Steadfast to grain sorghum, as these herbicides will severely injure or kill grain sorghum.**

Atrazine and Water Quality

Atrazine label restrictions regarding mixing, loading and application are discussed below. These restrictions are part of the overall ground and surface water contamination risk reduction measures. Atrazine users are strongly encouraged to follow these guidelines to comply with the label, and to share in the responsibility of preserving the future of this extremely valuable grain sorghum herbicide. **These restrictions, and the Restricted Use Pesticide designation, apply to all formulations of atrazine and all package mix products which contain atrazine.**

Mixing, Loading and Application - Atrazine may not be mixed/loaded or used within 50 feet of all wells, including abandoned wells, drainage wells and sink holes. Atrazine may not be mixed or loaded within 50 feet of intermittent streams and rivers, natural or impounded lakes and reservoirs. Atrazine may not be applied aerially or by ground within 66 feet of the points where field surface runoff enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If atrazine is applied to highly erodible land, the 66-foot buffer of setback from runoff entry points must be planted to grain sorghum, seeded with grass, or another suitable crop.

Application rates - All soil applications prior to crop emergence -

- * **Highly Erodible Soils** (as defined by NRCS) - If conservation tillage is practiced (at least 30 percent residue coverage at planting), apply a maximum of 2 lbs. a.i./acre. If residue coverage is less than 30 percent, apply a maximum of 1.6 lbs. a.i./acre.
- * **Soils Not Highly Erodible** - Apply a maximum of 2 lbs. a.i./acre.

WARNING: These are the rates as listed on the AAtrex label, and they exceed the amount of atrazine recommended preemergence (in Bicep II Magnum, Bullet or Lariat) on grain sorghum by The University of Tennessee. **Grain sorghum, and particularly no-till grain sorghum, may be injured by preemergence applications of atrazine.** To reduce chances of injury, atrazine applications should be delayed until the crop has emerged.

Postemergence applications

If no atrazine was applied prior to grain sorghum emergence, apply a maximum of 2 lbs. a.i./acre. If a postemergence treatment is required following an earlier herbicide application, the total atrazine applied may not exceed 2.5 lbs. a.i./acre/calendar year. Postemergence applications to grain sorghum must be made before grain sorghum exceeds 12 inches in height.

Salvage Control of Large Weeds

A late-season rope wick application of glyphosate may be used to control johnsongrass or tall weeds, such as pigweed or giant ragweed, which extend at least 12 inches above grain sorghum. Adjust wiper height to prevent contact with the crop. Refer to the labels and the wick manufacturer's suggestions for rates, proper set-up and operation. This treatment is useful primarily to improve drydown and harvest conditions, because large weeds have already reduced crop yields.

BURNDOWN HERBICIDES RECOMMENDED FOR NO-TILL GRAIN SORGHUM*

Burndown Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Gramoxone Inteon (Paraquat) (u)	0.5-0.75	32 – 48 ozs.	Use the higher rate to kill sod or where hard-to-kill plants are present. Weeds more than 6" tall may not be adequately controlled. Always add surfactant (0.5 gal./100 gals. of spray mix) and apply in 20-30 gals. of water per acre.
Touchdown/others* (Glyphosate 3ae)	0.75-1.5 lbs. (a.e.)	32-64 ozs. 3ae	Better control of smartweed than Gramoxone Inteon. Use the low rate on small, easy-to-kill annual weeds. Increase the rate on larger weeds and most perennials. See labels for additional information.
Roundup PowerMax* (Glyphosate 4.5ae)		22-43 ozs. 4.5ae	

(u)- Restricted Use Herbicide

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

PREEMERGENCE HERBICIDES FOR GRAIN SORGHUM*

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Bicep II Magnum (u) (contains 2.4 lbs. Dual II Magnum + 3.1 lbs. Atrazine per gallon)	sandy loam: do not use silt loam: 0.95- 1.5 lbs. silty clay loam: 0.95-1.5 lbs.	sandy loam: do not use silt loam: 1.3-2.1 qts. silty clay loam: 1..3-2.1 qts.	Use 1.3-2 qts./A on soil with OM less than 1%. Controls most annual grasses and many broadleaf weeds. Do not use unless your seed has been treated with Concep or Screen seed safener.
Cinch (S-metolachlor)	sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.43 lbs. silty clay loam: 1.27-1.6 lbs.	sandy loam: 1.0-1.33 pts. silt loam: 1.33-1.5 pts. silty clay loam: 1.33-1.67 pts.	Recommended on overflow areas or fields where variable soil textures prevent preemergence application of atrazine. Will control most annual grasses and some broadleaf weeds. Use only with Concep or Screen safened seed. Use postemergence herbicides for broadleaf weed control.
Cinch ATZ (u) (Cinch plus Atrazine)	sandy loam: do not use silt loam: 2.2- 2.9 lbs. silty clay loam: 2.2-2.9 lbs.	sandy loam: do not use silt loam: 1.6-2.1 qts. silty clay loam: 1.6-2.1 qts.	Do not use on soils containing less than 1% organic matter. Controls most annual grasses and many broadleaf weeds. Do not use unless your seed has been treated with Concep or Screen seed safener.
Lariat or Bullet (u) (contains 2.5 lbs. Lasso + 1.5 lbs. Atrazine per gallon)	sandy loam: 2.5-2.75 lbs. silt loam: 2.75-3.75 lbs. silty clay loam: 3-4 lbs.	sandy loam: 2.5-2.75 qts. silt loam: 2.75-3.75 qts. silty clay loam: 3-4 qts.	Controls most annual grasses and many broadleaf weeds. Do not use unless your seed has been treated with a seed protectant containing the active ingredient flurazole. Use the higher rate for each soil texture in conservation or minimum tillage systems. See label.
Dual II Magnum (S-metolachlor)	sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.43 lbs. silty clay loam: 1.27-1.6 lbs.	sandy loam: 1.0-1.33 pts. silt loam: 1.33-1.5 pts. silty clay loam: 1.33-1.67 pts.	Recommended on overflow areas or fields where variable soil textures prevent preemergence application of atrazine. Will control most annual grasses and some broadleaf weeds. Use only with Concep or Screen safened seed. Use postemergence herbicides for broadleaf weed control.
Guardsman Max (u) (Outlook plus Atrazine)	sandy loam: do not use silt loam: 1.9-2.5 lbs. silty clay loam: 1.9-2.5 lbs.	sandy loam: do not use silt loam: 1.5-2 qts. silty clay loam: 1.5-2 qts.	Do not use on soils containing less than 1% organic matter. Controls most annual grasses and many broadleaf weeds. Do not use unless your seed has been treated with Concep or Screen seed safener.
Lasso EC (u) or Micro-Tech (u) (Alachlor)	sandy loam: 1.5-2.5 lbs. silt loam: 2-2.75 lbs. silty clay loam: 2-3 lbs.	sandy loam: 1.5-2.5 qts. silt loam: 2-2.75 qts. silty clay loam: 2-3 qts.	Recommended on overflow areas or fields where variable soil textures prevent preemergence application of atrazine. Will control most annual grasses and some broadleaves. Use only with seed properly treated with Screen seed protectant or a safener containing the active ingredient flurazole. Use the higher rate for each soil texture in conservation or minimum tillage systems. See label. Use postemergence herbicides for broadleaf control.

*NOTE: Postemergence treatments may be required to control cocklebur, sicklepod or other hard-to-control broadleaf weeds.

(u) **Restricted Use Pesticide**--Refer to label for precautions to be taken during handling and application.

POSTEMERGENCE HERBICIDES FOR GRAIN SORGHUM

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Aim (carfentrazone-ethyl)	0.008 lbs.	0.5 ozs.	Apply overtop grain sorghum up to the 6 leaf growth stage to control velvetleaf, black nightshade, common lambsquarters and small ivyleaf and pitted morningglory. Excellent on large velvetleaf. Temporary leaf burn may occur. Always add nonionic surfactant at 1 qt./100 gal. of spray mix. May be tank mixed with atrazine, Banvel, Clarity or other herbicides to expand weed spectrum. See label. Do not tank mix with EC formulation pesticides, as excessive crop injury may occur. Do not apply more than a total of 0.9 oz./A per season. Any crop may be replanted 30 days following application except small grains crops that do not have an established crop tolerance.
Atrazine (u)*	2.0 lbs.	2.0 qts. 4L 2.2 lbs. Nine-0	Apply overtop before weeds exceed 1.5 inches in height. Grain sorghum should be fully emerged. Refer to the label for directions on applying in combination with emulsifiable oil. Do not apply during cloudy weather. Postemergence applications must be made before crop exceeds 12 in tall.
Basagran (Bentazon)	0.75-1.0 lb.	1.5-2 pts.	Apply overtop grain sorghum to control most broadleaf weeds less than 4 inches tall. Refer to label for specific weed sizes.
Banvel or Clarity (Dicamba)	0.125-0.25 lb.	0.25-0.5 pt.	Apply overtop grain sorghum from emergence to 8" tall. Use drop nozzles to apply to row middles and prevent spraying into the crop whorl when sorghum is 8" to 15" tall. Do not apply by air. Use caution to prevent drift and injury to sensitive crops.
Buctril 4E (Bromoxynil)	0.25-0.38 lb.	0.5-0.75 pt.	Apply overtop grain sorghum from the 3-leaf state to 12" height to control most broadleaf weeds in the 2-4 leaf stage of growth. Less drift potential than Banvel or 2,4-D. Use 10 or more gallons of water per acre.
Peak 75WG (Prosulfuron)	0.023-0.035 lb.	0.5-0.75 ozs.	Soybeans must be of STS variety the following year.
Permit 75WSG (Halosulfuron)	0.32-0.047 lb.	0.67-1.0 oz.	Good option for broadleaf weed control where adjacent sensitive crops such as cotton or soybeans prevent application of 2,4-D or Banvel. Apply overtop from the 2-leaf through layby stage of growth. Use 0.67 oz. to control cocklebur, small pigweed, common ragweed and velvetleaf. Use 1 oz. to control yellow nutsedge. Add nonionic surfactant at 1-2 qt./100 gal. of spray mix. Temporary stunting may occur when Permit is applied to grain sorghum under stress. Make only one application per season. Do not harvest for forage or silage until 30 days following application.
2,4-D	0.25-0.5 lb.	0.5-1 pt.	Apply overtop grain sorghum that is 6" to 10" tall to control most broadleaf weeds. Use drop nozzles if sorghum is more than 10" in height. Do not apply the ester formulation if sensitive crops are nearby. Use caution to prevent drift and injury to sensitive crops.

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Prowl or Pendimax 3.3 (Pendimethalin) (culti-spray)	0.5-0.74 lb. ^a 0.74-1.0 lb. ^b 0.74-1.5 lb. ^c	1.2-1.8 pts. ^a 1.8-2.4 pts. ^b 1.8-3.6 pts. ^c	For extended control of seedling johnsongrass, signalgrass or late-season grasses cultivate to throw soil around stems and protect brace roots when sorghum is a minimum of 4" in height and immediately spray with Prowl. Use drop nozzles to apply if grain sorghum foliage will prevent uniform coverage of the soil surface. If rainfall (0.5") is not received within 7 days after application, incorporate with a sweep-type or rolling cultivator.

^a sandy loam

^b silt loam

^c silty clay loam

(u) **Restricted Use Pesticide**--Refer to label for precautions to be taken during handling and application.

*When using postemergence herbicides which contain Atrazine, be sure the total amount of Atrazine does not exceed 2.5 lbs. a.i. per acre per year.

GRAIN SORGHUM HARVEST AIDS

Harvest aid chemicals are sometimes needed to desiccate weeds in order to improve timeliness of harvest. This is most frequently encountered with early maturing varieties which may be ready for harvest prior to a killing frost. Harvest aid chemicals do not speed-up maturity of the grain sorghum plant; they merely reduce moisture in weeds and may improve harvest efficiency, in addition to timeliness. Producers are encouraged to make harvest aid decisions by comparing cost with anticipated benefits. Also, care must be taken to minimize chances of drift to adjacent crops. Be sure to read labels thoroughly and follow required preharvest intervals (PHI).

Harvest Aid	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Aim 2EC	0.016 lb	1.0 ozs.	3 days PHI. Excellent on morningglory spp.
Touchdown/others* (Glyphosate 3ae)	0.75-1.5 lbs. (a.e.)	32-64 ozs.	Apply at 30% grain moisture or less. Allow a minimum of 7 days between application and harvest. Use a spray volume of 10 to 20 gallons of water per acre for ground applications, or 3 -10 gallons of water for aerial applications. Do not apply to grain sorghum grown for seed as a reduction in germination or vigor may occur. Avoid spraying during conditions which favor drift. See labels for additional directions.
Roundup PowerMax* (Glyphosate 4.5ae)		22-43 ozs.	
Sodium Chlorate, Defol 6, other trade names (Sodium Chlorate)	4.5-6.0 lbs.	1.5-2 gals. of a 3 lb./gal. formulation or 0.75-1 gal. of a 6 lb./gal. formulation	Make application 7 to 10 days before anticipated harvesting date. Use the lower rates when grain moisture is low and the weather is clear and dry. Use the higher rates when conditions for desiccation are poor. Apply in a spray volume of 10- 20 gallons per acre by ground or 5-10 gallons per acre by air. Do not apply under conditions which favor drift. Sodium Chlorate has not proven beneficial in Tennessee research for reducing the moisture content of the grain itself.

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

EXPECTED HERBICIDE RESPONSE OF COMMON WEEDS IN GRAIN SORGHUM

	PREEMERGENCE		POST OVERTOP					
	Bicep II Magnum(u) or Cinch ATZ (u)	Lariat (u) or Bullet (u)	Aim	Atrazine (u)	2,4-D	Banvel	Basagran	Buctril
Bermudagrass	0	0	0	1	0	0	0	0
Black Nightshade	8	8	-	7	8	9	3	8
Broadleaf Signalgrass	8	8	0	6	0	0	0	0
Cocklebur	7	6	6	7	9	9	9	9
Common Ragweed	9	9	-	8	8	9	5	7
Fall Panicum	9	8	0	6	0	0	0	0
Foxtail	9	9	0	7	0	0	0	0
Giant Ragweed	6	5	2	6	9	9	5	7
Goosegrass	9	9	0	7	0	0	0	0
Groundcherries	8	8	-	7	8	9	3	8
Lambsquarters	9	9	8	9	8	9	6	8
Large Crabgrass	9	9	0	6	0	0	0	0
Morningglories	8	8	8	7	9	9	4	7
Pigweed	9	9	8	9	8	9	0	6
Prickly Sida	7	7	4	8	7	8	8	6
Rhizome Johnsongrass	0	0	0	0	0	0	0	0
Seedling Johnsongrass	8	8	0	0	0	0	0	0
Sicklepod	7	7	1	6	8	8	0	5
Smartweed	9	9	7	8	6	8	7	7
Smooth Crabgrass	9	9	0	4	0	0	0	0
Velvetleaf	6	5	9	7	8	8	8	7
Yellow Nutsedge	7	6	0	5	0	0	8	0
Sorghum Tolerance	2*	2*	3	3	3	2	0	1

*Rating refers to herbicide safened seed.

(u) **Restricted Use Pesticide**--Refer to label for precautions to be taken during handling and application.

KEY TO SYMBOLS: 0=No control or crop injury; 10=100% control or severe, yield reducing crop injury.

Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

COTTON WEED CONTROL

NO-TILL COTTON WEED CONTROL CONSIDERATIONS

Weed management systems for cotton should prevent weed interference, be economical and sustainable, reduce weed seed bank in soil, prevent weed resistance and neither injure cotton nor reduce quality, lint or seed yield. To be successful, weed management systems require advance planning and timely execution. A few days delay in an application may mean reduced control, higher herbicide rates, and greater herbicide costs.

The components of a weed management system for no-tillage cotton may include the following:

1. Early preplant burndown with or without residual herbicide(s)
2. At-planting burndown with or without residual herbicide(s)
3. Postemergence with or without residual herbicide(s)
4. Post-directed herbicide(s) with or without residual herbicide(s)
5. Layby herbicide(s)
6. Pre-harvest herbicide(s)

Our most consistent and effective early preplant burn down program has included glyphosate plus Clarity, especially where glyphosate-resistant (GR) horseweed is present. Valor can be added to extend the preemergence control, but cost is increased. Where this program has been followed by an at-planting burn down of Gramoxone Inteon or Ignite 280 with a residual herbicide (Cotoran, Direx, Caparol, etc), excellent control has been achieved. Prowl can also be included with the at-planting application for additional control at little extra cost.

Timely postemergence application of glyphosate alone or tank-mixed with Dual Magnum (available as package mixture trade named Sequence) to improve grass and nutsedge control or Staple to improve morningglory control are critical to prevent early weed competition and establish a height differential for subsequent post-directed or hooded sprayer application. Glyphosate should be applied before the cotton reaches 5-true leaves. Envoke can be applied postemergence overtop after cotton reaches 5-true leaves for improved morningglory control. Envoke does not control Palmer amaranth (pigweed).

Post-directed application of herbicides can be made to cotton once a height differential between cotton and weeds is achieved. Cotoran plus MSMA may be post-directed in cotton at least 3 inches tall and will provide contact and residual control of many weed species. After cotton reaches 6 inches, Caparol, Direx, Layby Pro, Goal, Suprend and Cobra may be used. Any of these products can be applied with glyphosate in RR cotton but spray must be directed to the base of the cotton plant. Expect some glyphosate antagonism, especially on grasses, with some tank mixtures. Aim, Gramoxone Inteon, Ignite 280, and Glyphosate may be used under hooded sprayers in any cotton varieties.

Layby herbicides for cotton include Caparol, Cotoran, Direx, Layby Pro, Suprend and Valor. Layby applications differ from normal post-directed application in that cotton should be >12 inches tall and generally higher application rates are used.

PREPLANT or PREPLANT INCORPORATED HERBICIDES FOR CONVENTIONAL COTTON

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Envoke	0.005 lb	0.10 ozs.	For control of existing horseweed tank mix either dicamba or 2,4-D.
Valor 51% WDG (Flumioxazin)	1 oz.	2 ozs.	A minimum of 30 days must pass for conventional tillage (21 days for no-till), and 1 inch of rainfall/irrigation must occur, between Valor application and planting of cotton.
Prowl or Pendimax 3.3 (Pendimethalin)	0.5-0.75 lb. ^a 0.75-1.0 lb. ^b 1.0-1.5 lbs. ^c	1.2-1.8 pts. ^a 1.8-2.4 pts. ^b 2.4-3.6 pts. ^c	Use to control annual grasses, seedling johnsongrass and some broadleaf weeds. For best results, apply and incorporate immediately with a field cultivator or Do-all. See label for specific incorporation instructions with other equipment. A second mixing with a shallow disking, field cultivator, or do-all generally improves weed control.
Treflan 4 EC and other trade names (Trifluralin)	0.5 lb. ^a 0.75 lb. ^b 1.0 lb. ^c	1.0 pt. ^a 1.5 pts. ^b 2.0 pts. ^c	

^a Sandy loam (coarse-textured soils)

^b Silt loam (medium-textured soils)

^c Silty clay loam (fine-textured soils)

BURNDOWN HERBICIDES FOR NO-TILL COTTON

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Gramoxone Inteon (u) (Paraquat 3SL)	0.5-0.75 lb.	32-48 ozs.	Apply at planting as a follow-up to an earlier application of glyphosate. Better control of chickweed, henbit, deadnettle and cutleaf eveningprimrose than glyphosate. Always add nonionic surfactant at 1 qt./100 gal. of spray mix.
Clarity (Dicamba 4SL)	0.25 lb.	8 ozs.	Apply in a tank-mix with glyphosate for hard- to-control weeds such as cutleaf eveningprimrose, vetch, caley pea and others. Good control of horseweed. Following application of Clarity, a minimum accumulation of 1 inch of rainfall or overhead irrigation and a waiting period of 21 days is required per 8 ounces, before planting cotton.
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	23-29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners.
Touchdown/others* (Glyphosate 3ae)	0.75-1.1 lb. (a.e.)	32-48 ozs.	Apply 2 to 4 weeks prior to your anticipated planting date to control non-resistant horseweed (marestail) and several other weeds. In most fields, a follow-up application of Gramoxone Inteon will be needed at planting.
Roundup PowerMax* (Glyphosate 4.5ae)		22-32 ozs.	

(u)- *Restricted Use Herbicide*

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

PREEMERGENCE HERBICIDES FOR CONVENTIONAL OR NO-TILL COTTON

Herbicide	Rate/Acre Broadcast		Remarks												
	Active Ingredient	Formulation													
Caparol 4L (Prometryn)	0.75-1.0 lbs. ^a 2.4 lbs. ^{bc}	1.5-2.0 pts. ^a 4.8 pts. ^{bc}	Good to excellent control of most annual grasses and broadleaf weeds, particularly residual pigweed control.												
Command 3ME (Clomazone)	0.5 lb.	1.3 pts.	For use where velvetleaf or spurred anoda are troublesome, and where application buffer zones can be observed (See label). Many trees, bushes, ornamentals and vegetables are sensitive to drift of this herbicide. See label for drift reduction directions and restrictions. Note: Di-Syston insecticide must be used in-furrow or severe crop injury may occur.												
Cotoran 4L or 85DF (Fluometuron)	1.0 lb. ^a	2 pts. 4L, or 1.2 lbs. 85DF, or 1.25 lbs. 80DF ^a	Good to excellent control of most annual grasses and broadleaf weeds. Tank mix with Zorial or Command for improved control of spurred anoda and velvetleaf. For improved pigweed control, particularly in no-till, reduced rates of Caparol may be applied in combination with Cotoran preemergence. See label for precautions. Rates in pints/A are based on soil texture:												
	1.5 lbs. ^b	3 pts. 4L, or 1.8 lbs. 85DF, or 1.88 lbs. 80DF ^b	<table style="margin-left: auto; margin-right: auto; border: none;"> <tr> <td></td> <td style="text-align: center;"><u>coarse</u></td> <td style="text-align: center;"><u>medium</u></td> <td style="text-align: center;"><u>fine</u></td> </tr> <tr> <td style="text-align: right;">Caparol 4L</td> <td style="text-align: center;">1.5-2</td> <td style="text-align: center;">2</td> <td style="text-align: center;">-----</td> </tr> <tr> <td style="text-align: right;">Cotoran 4L</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2.5-3</td> <td style="text-align: center;">3-3.5</td> </tr> </table>		<u>coarse</u>	<u>medium</u>	<u>fine</u>	Caparol 4L	1.5-2	2	-----	Cotoran 4L	2	2.5-3	3-3.5
	<u>coarse</u>	<u>medium</u>	<u>fine</u>												
Caparol 4L	1.5-2	2	-----												
Cotoran 4L	2	2.5-3	3-3.5												
	2.0 lbs. ^c	4 pts. 4L, or 2.4 lbs. 85DF, or 2.5 lbs. 80DF ^c	Staple may be added to Cotoran or Meturon preemergence for improved control of pigweed, prickly sida, spotted spurge, spurred anoda and velvetleaf. Add 0.6 oz./A to your normal rate of Cotoran or Meturon. A follow-up postemergence application of 1.2 oz. can be made for control of cocklebur, morningglory and other escapes. See label.												
Dual Magnum or Cinch (S-metolachlor)	Do not use ^a 0.63-1.27 lbs. ^b 0.96-1.27 lbs. ^c	Do not use ^a 0.66-1.33 pts. ^b 1.0-1.33 pts. ^c	Good to excellent control of annual grasses, nutsedge and seedling johnsongrass. Apply alone or in combination with Cotoran. May be purchased package mixed with glyphosate as Sequence.												
Prowl or Pendimax 3.3 (Pendimethalin)	0.5-0.75 lb. ^a 0.75-1.0 lb. ^b 1.0-1.5 lbs. ^c	1.2-1.8 pts. ^a 1.8-2.4 pts. ^b 2.4-3.6 pts. ^c	Excellent control of most annual grasses. Tank-mix with Cotoran or Zorial for improved broadleaf control. A compatibility agent may be required in tank mixes.												

^a Sandy loam (coarse-textured soils)

^b Silt loam (medium-textured soils)

^c Silty clay loam (fine-textured soils)

OVERTOP HERBICIDES FOR COTTON

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Assure II 0.88E (Quizalofop)	0.034-0.069 lb.	5-10 ozs.	Apply overtop to control rhizome johnsongrass . Apply 5 ozs. of Assure II when johnsongrass is 10-24" tall and retreat with 5 ozs. when grass regrowth reaches 6-10" tall. Add oil concentrate at 1 gal. (for ground application) or 1 qt. nonionic surfactant per 100 gals. of spray mixture. The higher rates may be needed to control annual grasses or bermudagrass . See label. Controls volunteer Roundup Ready corn in cotton.
Dual Magnum	0.96-1.27 lbs.	1.0-1.33 pts.	100 day PHI when applied.
Envoke 75DF (trifloxysulfuron)	0.0046-0.0069 lbs.	0.1-0.15 ozs.	Apply overtop of 5 leaf until 60 day PHI cotton for control of smooth pigweed, morningglories, and yellow nutsedge. Poor performance on Palmer pigweed. Apply with non-ionic surfactant (80-20 blend, NOT with 90-10 blend) at the rate of 1 quart per 100 gallons of water. DO NOT use with crop oil concentrate or tank-mix with Pix growth regulator or other pesticides. NEVER apply preemergence, substantial cotton injury will result.
Fusilade DX 2E (Fluazifop)	0.094-0.188 lb.	6-12 ozs.	Apply lower rate for control of most annual grasses before they exceed 4" tall. For johnsongrass control, apply the higher rate when it is 8-18" tall. Make a second application (8 ozs.) when regrowth is 6-12" tall. For bermudagrass , apply the higher rate when runners are 4-8" long, and repeat when regrowth reaches 4". Add oil concentrate (1 gal.) or nonionic surfactant (2 pts.) per 100 gal. of spray mixture. Controls volunteer Roundup Ready corn in cotton.
Fusion 2.56EC (Fluazifop + Fenoxaprop)	0.16-0.24 lb.	8-12 ozs.	Apply overtop for control of annual grasses and johnsongrass. Better control of annual grasses than Fusilade DX. Apply 8 ozs./A for control of most annual grasses , or 12 ozs./A for control of johnsongrass 8-18" tall. A second application of 8 ozs./A may be used to control regrowth up to 8" tall. For bermudagrass , treat 4-8" runners with 12 ozs./A, and apply a second application of 8 ozs./A to 4-8" regrowth. Always add crop oil concentrate (1% by volume) or nonionic surfactant (0.25% by volume). Controls volunteer Roundup Ready corn in cotton.
Ignite 280 (Glufosinate) <u>Liberty Tolerant Cotton Only</u>	1.67-2.09 lbs.	23-29 ozs.	Apply over the top to Liberty tolerant cotton varieties. No more than 40 ozs./A may be applied per application and no more than 80 ozs./A may be applied per cotton growing season. Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed and crop canopies require 20 to 40 gallons per acre. See label for further application instructions.
Poast 1.5E or Poast Plus 1E (Sethoxydim)	0.19 lb.	16 ozs. 1.5E or 24 ozs. 1.0E	Apply for control of most annual grasses . For best results, make applications before most grasses exceed 4" tall. Always include oil concentrate at 2 pts./A. Do not tank mix with other pesticides. Controls volunteer Roundup Ready corn in cotton.

Herbicide	Rate/Acre Broadcast		Remarks	
	Active Ingredient	Formulation		
Touchdown IQ/others* (Glyphosate 3ae) <u>Roundup Ready or Roundup Ready Flex Varieties Only</u>	0.56-0.75 lb. (a.e.)	24-32 ozs. 3ae	<u>Roundup Ready</u> Apply over-the-top up to 4 th true leaf. Post-directed there after. 22oz/A (4.5 lb material) any single application.	<u>Roundup Ready Flex</u> Over-the-top or post-directed as needed for weed coverage. 22-32oz/A (4.5 lb material) by ground: 22 oz/A aerial for any single application.
Roundup PowerMax* (Glyphosate 4.5ae) <u>Roundup Ready or Roundup Ready Flex Varieties Only</u>		16-22 ozs. 4.5ae	Make only two overtop applications, 10 days apart and with at least two additional nodes developed following the first application.	No restrictions on timing of sequential applications.
Select 2E or Arrow 2E (Clethodim)	0.094-0.25 lb.	6-16 ozs.	Apply 6 ozs./A for control of most annual grasses up to 6" tall. For johnsongrass , 12-24" tall, apply 8 ozs. A second application of 6 ozs./A can be made to regrowth, 6-10" tall. For bermudagrass , apply the higher rate on runners up to 6" long, and repeat on regrowth up to 6" long. Always use crop oil concentrate at 1 pt./A. If necessary, Select can be tank mixed with Orthene. Controls volunteer Roundup Ready corn in cotton.	
Sequence 5.25L (glyphosate + S-metolachlor) <u>Roundup Ready or Roundup Ready Flex Varieties Only</u>	0.75 ae + 0.94 ai lbs.	2.5 pints	Apply to cotton at least 3 inches tall but before cotton reaches fifth leaf stage. Do not add adjuvants and do not add other pesticides.	
Staple LX (Pyriithiobac)	0.043-0.095 lbs.	1.7-3.8 ozs.	Apply overtop or post-directed beginning at the first true leaf stage of cotton. Poor performance on Palmer pigweed. Add nonionic surfactant (1 qt./100 gal. of spray mix). A total of 5.1 oz./A may be applied per season. Do not tank-mix with malathion-containing insecticides (Cythion, etc.). To avoid injury, malathion should be applied at least 24 hrs. before or after Staple application. May be tank-mixed with glyphosate. See label.	

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

POST-DIRECTED HERBICIDES RECOMMENDED FOR COTTON

Recommended post-directed herbicides are listed in the following table. Each is usually applied in combination with MSMA for improved grass and nutsedge control. Various formulations of MSMA are available - some with a built-in surfactant and some without it. Be sure to check the MSMA label for surfactant content. The 6 lb./gal. formulation used as an example below usually contains surfactant. **Do not apply MSMA or DSMA after first bloom.** Rates are expressed on a broadcast basis. Use the conversion table, later in this section, to determine band rates.

Herbicide	Rate/Acre Broadcast*		Remarks
	Active Ingredient	Formulation	
For Cotton at Least 3" Tall			
DSMA 3.6 or DSMA Slurry 7.2 or MSMA 6	3.6 or 3.6 or 2.0	1 gal. 3.6L or 0.5 gal. 7.2L or 2.67 pts. 6L	Apply DSMA or MSMA as a directed spray when cotton is at least 3" tall. Follow label directions regarding addition of surfactant. MSMA may be tank-mixed with most herbicides labeled for post-directed use in cotton. Do not apply after first bloom.
Cotoran 4L or Cotoran 85 DF (Fluometuron) + MSMA 6	1.0 lb. + 2.0 lb.	1 qt. 4L or 1.2 lbs. 85 DF + 2.67 pts. 6L	Apply as a directed spray when cotton is at least 3" tall. If omitting MSMA, be sure to add surfactant (1 qt./100 gals. of spray mix).
For Cotton at Least 6" Tall			
Caparol/Cotton-Pro 4L (Prometryn) + MSMA	0.5-0.65 lb. + 2.0 lbs.	1-1.3 pts. + 2.67 pts. 6L	Apply as a directed spray when cotton is at least 6" tall. If omitting MSMA, be sure to add surfactant (1 qts./100 gals. of spray mix). Caparol can be applied, at a reduced rate, to 3 to 6" cotton. See label.
Cobra (Lactofen) + MSMA 6 + Crop Oil Concentrate	0.2 lb. + 2.0 lbs.	12.5 oz. + 2.67 pts. 6L + 0.5-1 pt.	Apply as a directed spray when cotton is at least 6" tall. Do not allow spray to contact cotton leaves or crop injury will result.
Direx 4L or Direx 80 DF (Diuron) + MSMA 6	0.2-0.4 lb. + 2.0 lbs.	0.4-0.8 pt. 4L or 0.25-0.5 80 DF + 2.67 pts. 6L	Apply as a directed spray when cotton is at least 6" tall. Lower rate is for pigweed under 2" tall only. If omitting MSMA, be sure to add surfactant (1 qt./100 gals. of spray mix).
Envoke 25DF	0.025 – 0.063	0.10 - 0.25 ozs.	For contact and residual control of morningglories and nutsedge.
Goal 2XL (Oxyfluorfen) + MSMA 6	0.25-0.5 lbs. + 2.0 lbs.	1-2 pts. + 2.67 pts. 6L	Apply as a directed spray when cotton is at least 6" tall. Do not allow spray to contact cotton leaves or crop injury will result. If target weeds have more than 3 true leaves, use the higher rate of Goal. If omitting MSMA, be sure to add surfactant (1-2 qts./100 gals. of spray mix).
Reflex	0.25-0.375 lbs.	1-1.5 pts.	Reflex may be applied to cotton at least 6 inches in height through lay-by as post-directed application. All post-directed applications should avoid spray contact with any green non-barked parts of the cotton plant or foliage as unacceptable injury will occur. Apply Reflex at 1-1.5 pts./A in a minimum of 10 gallons spray solution per acre. Applications may be made broadcast or banded. Crop rotation is restricted 4 months for wheat and 10 months for corn.
Suprend (prometryn + trifloxysulfuron)	1.25 lbs.	1.56 lbs	May be applied to cotton from 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.

Herbicide	Rate/Acre Broadcast*		Remarks
	Active Ingredient	Formulation	
For Cotton at Least 8" Tall			
Linex 4L (Linuron) + MSMA 6	0.5-0.75 lb. + 2.0 lbs.	1-1.5 pts. 4L +2.67 pts. 6L	State label for Tennessee. Apply as a directed spray when cotton is at least 8" tall and when weeds are not over 2" tall. If applying Linex 4L alone, add a nonionic surfactant at the rate of 2 qt. per 100 gal. of spray mix.
For Cotton at Least 12" Tall			
Aim 2EC (Carfentrazone-ethyl)	0.013-0.025 lb.	0.75-1.6 ozs.	Aim is a contact herbicide for postemergence directed spray control of broadleaf weeds. Apply Aim alone or tank mixed with other herbicides to emerged and actively growing weeds. Applications to cotton with less than 5 to 6 nodes must be made with hooded sprayers to completely avoid contact with the cotton plant. Layby applications of Aim or Aim tank mixtures at later growth stages may be made when cotton plants have achieved a height of 12 inches or more with sufficient bark development and height differential between crop and bottom leaves. Directed sprays should position nozzles a minimum of 3-4 inches above the soil with nozzles directed underneath the cotton canopy. Spray solution should be directed at the base of cotton plants for minimum contact with green stems and foliage while maintaining maximum contact with weeds. For best performance, make applications to actively growing weeds up to 4 inches tall. Coverage is essential for good control. Use a crop oil concentrate at 1% v/v (1 gallon per 100 gallons of spray solution).
For Cotton at Least 15" Tall			
Layby Pro (Linuron + Diuron)	0.4-0.6 + 0.4-0.6	1.6-2.4 pts./A	Apply after cotton is 15" tall. If weeds are present, add a nonionic surfactant at the rate of 2 qt. per 100 gal. of spray mix. Use rate based on soil type: 1.6 pt/A on coarse soils, 2 pt/A on medium soils, and 2.4 pt/A on fine soils.

Factors to convert Broadcast Rate/A to a Band Rate at Various Row and Band Widths.

Band Width (in.)	Row Width (in.)			
	30	36	38	40
12	0.40	0.33	0.31	0.30
15	0.50	0.42	0.39	0.375
18	0.60	0.50	0.47	0.45
19	0.635	0.53	0.50	0.475
20	0.67	0.56	0.53	0.50

To Convert: Find the factor for your combination of row width and band width and multiply the broadcast rate by this number.

Example: A producer plans to apply 0.5 lb. (broadcast rate) per acre of Direx 80 DF on a 12 in. band on 38 in. rows. Multiply 0.31 by 0.5 lb. to get 0.16 lb./A on a 12 in. band.

Hooded Sprayers

Hooded sprayers offer the capacity to use effective, non-selective herbicides in cotton weed management programs. This can be particularly beneficial in no-till cotton. Addition of residual herbicides will extend the duration of weed control.

HERBICIDES RECOMMENDED FOR USE IN HOODED SPRAYERS

Herbicide	Rate/Acre Broadcast*		Remarks
	Active Ingredient	Formulation	
Aim 2EC (Carfentrazone-ethyl)	0.013-0.025 lb.	0.75-1.6 ozs.	Aim is a contact herbicide for postemergence control of broadleaf weeds. Apply Aim with a hooded sprayer alone or tank mixed with other herbicides to emerged and actively growing weeds. Applications to cotton with less than 5 to 6 nodes must be made with hooded sprayers to completely avoid contact with the cotton plant. For best performance, make applications to actively growing weeds up to 4 inches tall. Coverage is essential for good control. Use a crop oil concentrate at 1% v/v (1 gallon per 100 gallons of spray solution).
Gramoxone Inteon (u) (Paraquat)	0.31-0.62 lb.	20-40 ozs.	State label for Tennessee. Apply in cotton at least 6" tall using hooded sprayers only. Avoid crop contact. Always add nonionic surfactant (1 qt./100gals.of spray mix). Operate hoods as close to soil surface as possible. Gramoxone Inteon is labeled for tank-mix applications with residual herbicides (Cotoran, Caparol, Direx). See labels for rates and precautions.
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	23 - 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Avoid contact of plant foliage.
Touchdown/others* (Glyphosate 3ae)	0.56-1.5 lbs. (a.e.)	24-64 ozs.	Apply in cotton at least 6" tall using hooded sprayers only. Avoid crop contact. Operate hoods as close to soil surface as possible.
Roundup PowerMax* (Glyphosate 4.5ae)		16-43 ozs.	
Reflex	0.25-0.375 lbs.	1-1.5 pts.	Use only hooded or shielded spray equipment to apply Reflex in cotton that is 6 inches to 12 inches in height. Adjust nozzles to provide full coverage of emerged target weeds. Crop rotation is restricted 4 months for wheat and 10 months for corn.
Valor 51% SX (flumioxazin)	0.5 - 1 ozs.	1 - 2 ozs.	Operate hoods as close to soil surface as possible. Provides good control of morningglories and pigweeds. Glyphosate may be added to control existing vegetation.

(u)- *Restricted Use Herbicide*

* NOTE: *Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.*

LAYBY HERBICIDES RECOMMENDED FOR COTTON

Producers should consider the use of layby herbicides to improve both yield and quality of cotton lint. Good layby programs can reduce lint stain and trash, improve grades, and increase picking speed and efficiency. Each of the following herbicides can be tank mixed with MSMA to improve postemergence grass and nutsedge control. **Do not apply MSMA, alone or in combination with other herbicides, after first bloom.**

Herbicide	Rate/Acre Broadcast*		Remarks
	Active Ingredient	Formulation	
Caparol 4L (Prometryn)	1.2-1.6 lb.	2.4-3.2 pts.	Apply when cotton is at least 12 in. tall and before it laps the row middles. Rate depends on soil texture. (Apply 2.8 pts. on a silt loam soil). Add nonionic surfactant (2 qts./100 gals. of spray mix) if weeds are present.
Cotoran/Meturon 4L or Cotoran 85 DF or Meturon 80 DF (Fluometuron)	1-2 lb.	2-4 pts. 4L or 1.2-2.4 lbs. 85 DF or 1.25-2.5 lbs. 80 DF	Apply before cotton laps the row middles. Add nonionic surfactant (1-2 qts./100 gals. of spray mix) if weeds are present. Do not make more than 3 applications of fluometuron to the same field per year. Do not apply within 60 days of harvest.
Direx 4L or Direx 80 DF (Diuron)	0.8-1.2 lb.	1.6-2.4 pts. 4L or 1-1.5 lbs. 80 DF	Apply when cotton is at least 12 in. tall and before it laps the row middles. Add nonionic surfactant (1 qt./100 gals. of spray mix) if weeds are present. Reduced rates (1-1.5 pt. 4L or 0.63-0.94 lb. 80DF) may be tank mixed with Roundup PowerMax at 22 oz./A.
Linex 4L (Linuron)	1-1.5 lb.	2-3 pts.	Apply after cotton is 20" tall. If weeds are present, add a nonionic surfactant at the rate of 2 qt. per 100 gal. of spray mix.
Layby Pro (Linuron + Diuron)	0.4-0.6 + 0.4-0.6	1.6-2.4 pts./A	Apply after cotton is 15" tall. If weeds are present, add a nonionic surfactant at the rate of 2 qt. per 100 gal. of spray mix. Use rate based on soil type: 1.6 pt/A on coarse soils, 2 pt/A on medium soils, and 2.4 pt/A on fine soils.
Reflex	0.25-0.375 lbs.	1-1.5 pts.	Make a post-directed Reflex application to the base of the cotton plant avoiding contact with any non-barked portion of the cotton plant or foliage. Use precision post-directed equipment or hooded or shielded sprayers on cotton that has developed a minimum of 4 inches of brown bark through lay-by. Application equipment should be configured to provide full coverage of emerged target weeds. Crop rotation is restricted 4 months for wheat and 10 months for corn.
Valor SX 51 DF (Flumioxazin)	0.5-1.0 oz	1-2 oz./A	Apply after cotton is 15" tall. If weeds are present, add a nonionic surfactant at the rate of 2 qt. per 100 gal. of spray mix. Take care not to direct Valor on to cotton foliage.

EXPECTED WEED RESPONSE TO COTTON HERBICIDES

	Trelan	Prowl or Pendimax 3.3	Cororan / Meturon	Command+ Cororan / Meturon	Dual II Magnum	DSMA or MSMA	Cororan or Meturon + MSMA	Aim	Direx + MSMA	Caprol + MSMA	Suprend + MSMA	Cobra + MSMA	Valor + Roundup	Layby Pro+ MSMA	Roundup PowerMax Touchdown/others**	Envoke	Ignite 280***	Staple	Assure II	Fusilade	Fusion	Poast/Poast Plus	Select Max
	PPI	PPI/PRE	PRE	PRE	PRE	EPD	EPD	LPD	LPD	LPD	LPD	LPD	LPD	LPD	OT/LPD	OT	OT	OT	OT	OT	OT	OT	OT
Broadleaf Signalgrass	8	8	7	8	8	7	7	0	8	7	7	8	9	8	9	---	6	0	8	8	9	9	9
Cocklebur	1	1	8	8	1	8	8	6	9	9	9	8	9	8	10	9	8	8	0	0	0	0	0
Common Ragweed	0	0	9	9	0	8	8	----	8	8	8	8	8	---	8	---	----	----	0	0	0	0	0
Crabgrass	9	9	8	8	8	8	8	0	9	8	8	8	9	8	9	2	6	0	8	8	9	9	9
Fall Panicum	9	9	8	8	8	8	8	0	9	8	8	8	9	9	9	0	6	0	8	8	9	9	9
Foxtail	9	9	8	8	8	8	8	0	9	8	8	8	9	9	9	0	7	0	8	8	9	9	9
Goosegrass	9	9	8	8	8	7	8	0	9	8	8	8	9	9	9	0	6	0	8	8	9	9	9
Jimsonweed	0	0	8	8	1	8	8	----	9	9	9	8	9	8	8	0	8	8	0	0	0	0	0
Johnsongrass (rhizome)	2	2	0	1	0	5	3	0	4	3	3	3	8	4	9	0	2	0	9	9	9	6	9
Johnsongrass (seedling)	9	8	6	6	8	8	8	0	8	8	8	8	9	9	10	5	7	0	9	9	9	9	9
Lambsquarters	7	7	9	9	7	7	8	8	9	9	9	7	----	7	8	---	----	----	0	0	0	0	0
Morningglory Entireleaf/Ivy ^a	5	5	7	7	0	6	8	8	8	6	9	9	9	8	8	9	9	8	0	0	0	0	0
Morningglory Pitted ^b	7	7	8	8	0	6	9	8	9	9	9	9	9	8	7	9	9	7	0	0	0	0	0
Morningglory Tall ^c	4	4	6	6	0	5	8	8	8	7	9	9	9	----	8	9	9	3	0	0	0	0	0
Pigweed, Palmer ^d	9	8/6 ^{tt}	5	5	6	4	5	7	4	8	8	8	8	6	9	2	6	7	0	0	0	0	0
Pigweed, smooth ^e	9	8	9	9	8	6	8	8	8	8	8	8	9	9	9	8	8	9	0	0	0	0	0
Prickly Sida	0	0	6	8	0	4	7	6	6	4	4	6	7	7	6	0	3	2	0	0	0	0	0
Sicklepod	0	0	8	8	2	6	8	0	7	7	9	6	8	8	8	9	8	3	0	0	0	0	0
Smartweed	0	0	8	8	1	6	7	----	8	8	8	8	8	8	8	---	8	7	0	0	0	0	0
Spotted Spurge	0	0	7	7	6	5	7	6	7	7	7	8	9	7	9	---	----	3	0	0	0	0	0
Spurred Anoda	0	0	4	8	0	2	3	----	5	4	5	5	7	7	7	5	----	8	0	0	0	0	0
Velvetleaf	0	3	5	9	0	4	5	10	5	6	6	5	7	6	7	---	6	9	0	0	0	0	0
Volunteer RR Soybeans	0	0	9	9	0	4	6	2	8	7	8	3	3	7	0	8	9	6	0	0	0	0	0
Yellow Nutsedge	0	0	0	1	8	7	7	0	7	7	9	7	5	7	7	9	2	1	0	0	0	0	0
Cotton Tolerance	1	1	1	1*	1	1	1	1	2	2	2	3	3	2	0**	2	0***	1	0	0	0	0	0

PPI=Preplant Incorporated PRE=Preemergence EPD=Early Post-Directed LPD=Late Post-Directed OT=Overtop

^a Many hairs on upper leaf surface ^b No plant hairs on upper leaf surface ^c A few hairs on upper leaf surface ^d No hairs on leaf ^e Many hairs on leaf

*Di-Syston must be used in-furrow. **Cotton variety must be Roundup Ready and applications properly timed. ***Cotton variety must be Liberty Tolerant. ^{tt}- 8 for PPI; 6 for PRE

KEY TO RESPONSE RATINGS: 0=No control or crop injury; 10=100% control or severe, yield reducing crop injury. Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

SOYBEAN WEED CONTROL

BURNDOWN HERBICIDES FOR NO-TILL SOYBEANS

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Gramoxone Inteon(u) (Paraquat)	0.5 -0.75 lbs.	32 -48 ozs.	Apply in a minimum of 10 gallons of water per acre. Weeds taller than 6" may not be controlled adequately. As density of stubble, crop residue or weeds increases, water volume should be increased to insure good coverage. Add a nonionic surfactant (at least 75% active) at 1 pt. per 100 gallons of mix. For aerial applications, apply at 5-10 gallons of water per acre.
Ignite 280 (Glufosinate)	1.67-2.09 lbs.	22 – 29 ozs.	Thorough spray coverage is essential for optimal performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tankmix partners.
Touchdown/others* (Glyphosate 3ae)	0.75-1.5 lbs. (a.e.)	32-64 ozs.	Apply in 10-20 gallons of water per acre. More effective than Gramoxone Inteon on weeds such as smartweed and fall panicum. Apply lower rates to control many annual weeds less than 6" tall. Increase the rate on larger annual weeds and perennials. (See label).
Roundup PowerMax* (Glyphosate 4.5ae)		22-43 ozs.	

(u)--Restricted Use Herbicide.

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

PREPLANT INCORPORATED HERBICIDES FOR SOYBEANS

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Treflan, Tri-4, Trilin and other trade names. (Trifluralin)	sandy loam: 0.5 lb. silt loam: 0.75 lb. silty clay loam: 1.0 lb.	1 pt. 1.5 pts. 2.0 pts.	For best results, incorporate immediately after application. Trifluralin is labeled for incorporation* into the top 2-3" of soil. The 2X or double the normal rate of trifluralin can be applied for increased suppression of rhizome johnsongrass. However, this must be followed by 2 or more timely cultivations. Use a recommended preemergence herbicide for broadleaf control.

*For proper incorporation, a disk should be set to cut about twice as deep as placement is desired. A second mixing with shallow disking or field cultivator usually improves weed control. See label for incorporation instructions with other implements.

PREEMERGENCE HERBICIDES FOR SOYBEANS

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Authority First / Sonic (Sulfentrazone + Cloransulam)	0.25 + 0.032 lbs.	6.45 ozs.	Applied PRE it provides good horseweed and pigweed. Controls horseweed up to 3 inches tall. Plant back restriction to cotton?
Authority MTZ (Sulfentrazone + Metribuzin)	0.096 + 0.16 lbs. ai/A	12 – 18 ozs.	Applied PRE it provides good horseweed and pigweed. Plant back restrictions to cotton.
Canopy 75DG (Chlorimuron + Metribuzin)	0.188 - 0.28 lbs.	4 – 6 ozs.	May be applied at planting or up to 45 days prior to planting.
Canopy EX (Chlorimuron + Tribenuron)	0.028-0.037 lbs.	1.5-2.0 ozs.	May be applied up to 7 days before planting. DOES NOT CONTROL GLYRES HORSEWEED
Command 3ME (Clomazone)	0.5-1.25 lbs.	1.3-3.3 pts.	Apply as a surface application. Use where velvetleaf, spurred anoda, prickly sida or annual grasses (signalgrass, etc.) are serious problems and where application buffer zones can be observed. See label. Note: Many trees, shrubs and vegetables are sensitive to drift of this herbicide. See label for drift reduction instructions. Do not plant wheat within 12 months of application.
Dual Magnum or Cinch (S-metolachlor)	sandy loam:0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam:1.27-1.59 lbs.	1-1.33 pts. 1.33-1.67 pts. 1.33-1.67 pts.	Good grass control. Use higher rate to control seedling johnsongrass. Use in tank-mix with a broadleaf herbicide for broad spectrum weed control. Available package mixtured with glyphosate as Sequence.
Gangster (Valor + FirstRate)	0.080-0.096 lbs. Valor 0.026-0.032 lbs. FirstRate	3.0-3.6 ozs. (2.5-3.0 ozs. of Valor + 0.5-0.6 ozs. of FirstRate)	Controls small glyphosate resistant horseweed less than 3 inches tall. Provides good residual pigweed and horseweed control.
Intrro (alachlor)	2.5 lbs.	2.5 qts.	Good control of grasses and small seeded broadleaves.
Outlook 6EC (Dimethenamid-P)	sandy loam: 0.47-0.66 lb. silt loam: 0.66-0.75 lb. silty clay loam: 0.75-0.84 lb.	10-14 oz. 14-16 oz. 16-18 oz.	Good grass control. Use in combination with a broadleaf herbicide for broad spectrum weed control.
Prefix (Fomesafen + S- metolachlor)	sandy loam: 1.33 lb. silt loam: 1.33-1.66 lb. silty clay loam: 1.82-1.99 lb.	2 pts. 2-2.5 pts. 2.75-3 pts.	Requires rainfall to be activated provides good small seeded broadleaf weed control. May be applied through 4 soybeans.
Prowl or Pendimax 3.3 (Pendimethalin)	sandy loam: 0.5-0.75 lb. silt loam: 0.75-1.0 lb. silty clay loam: 0.75-1.5 lbs.	1.2-1.8 pts. 1.8-2.4 pts. 1.8-3.6 pts.	Good grass control. Can be applied as a surface application after planting or preplant incorporated 1-2" deep. The 2X or double the normal rate can be applied preplant incorporated for increased suppression of rhizome johnsongrass. Use a recommended broadleaf herbicide for broad-spectrum weed control. Surface applications may cause crop lodging later in season (soybeans 8-12" tall) if cool, rainy weather occurs during crop emergence.

Pursuit 2AS or 70DG (Imazethapyr)	all soils 0.063 lb.	4 fl. ozs. or 1.44 ozs. 70 DG	Apply preemergence to control morningglories, nightshade, pigweed, spurge and many other broadleaf weeds. Mix with a grass herbicide for more complete control. Wheat can be planted after 3 months while corn requires 8.5 months. Edible beans and tobacco require a 9.5-month waiting period. Do not plant cotton for 18 months.
Sequence (S-metolachlor + Glyphosate)	1.64 lb.	2.5 pts.	Apply up to 3 trifoliolate.
Valor XLT (Flumioxazin + Chlorimuron)	0.9 + 0.3 lbs-1.2 + 0.4 lbs.	3-4 ozs.	Apply PRE to control pigweeds, horseweed, and morningglory spp.
Python 80WDG (Flumetsulam)	sandy loam: 0.04-0.045 lb. silt loam: 0.045-0.05 lb. silty clay loam: 0.045-0.05 lb.	0.8-0.89 oz. 0.89-1.25 oz. 0.89-1.25 oz.	Use Python with a recommended grass herbicide for broad spectrum control. Good control of pigweed, nightshade, spurge and velvetleaf. For hard-to-control weeds, such as sicklepod, apply 1.14-1.25 oz. on medium and fine textured soils. Do not apply to emerged soybeans (cracking stage or later) as severe crop injury will result. Do not plant cotton within 18 months or grain sorghum within 12 months. See label for other rotational crops.
Sencor 75DF (Metribuzin)	sandy loam: do not use silt loam: 0.38-0.5 lb. silty clay loam: 0.5-0.6 lb.	----- 0.5-0.67 lb. 0.67-0.83 lb.	Apply either preplant incorporated 1-2" deep or as a surface application after planting. Tank mix with a grass herbicide for broad spectrum control. Has controlled volunteer Roundup Ready cotton in research and demonstration trials in soybeans. For control of emerged cotton, Lexone/Sencor can be tank mixed with Gramoxone.
Scepter 1.5 AS or 70DG (Imazaquin)	sandy loam: 0.09 lb. silt loam: 0.125 lb. silty clay loam: 0.125 lb.	0.5 pt. or 2.1 oz. 0.67 pt. or 2.8 oz. 0.67 pt. or 2.8 oz.	Apply preplant incorporated or preemergence to control broadleaf weeds. Reduced rates (.33 to .5 pt./A) may be used for the control of a limited number of weeds such as cocklebur and pigweed-- see label. Do not plant grain sorghum within 11 months or cotton within 18 months of application. Do not plant corn or tobacco within 9.5 months of application. Corn may be planted the following spring if 15" or more of rainfall is received within six months following application. If the minimum rainfall requirement is not met, Clearfield corn hybrids may be planted. See label for other rotational crops. Use with a recommended grass herbicide for broad-spectrum control.
Squadron 2.33EC (Pendimethalin + Imazaquin)	0.87 lb.	3 pts.	Apply preplant incorporated or preemergence to control grass and broadleaf weeds. Refer to remarks under Scepter regarding crop rotation and see remarks under Prowl section for possible crop effects.
Valor 51WDG (Flumioxazin)	0.063-0.078 lb.	2-2.5 oz.	Apply preemergence to control pigweed, lambsquarters, hophornbeam copperleaf, morningglories and several other weeds. Weak on cocklebur and sicklepod. Apply in 10-30 gal. of water per acre. Mix with a grass herbicide for broad spectrum weed control.

Postemergence Weed Control in Soybeans: Postemergence herbicides work best under the following conditions: weeds are young and rapidly growing, high humidity and good soil moisture, and good spray coverage. Performance is reduced when weeds are stressed due to drought, disease or cultivation, or when weeds are too large. Select the most effective weed management program for the money you can afford to spend. The following tables should assist with selection of a program for controlling your weeds.

POSTEMERGENCE HERBICIDES FOR WEED CONTROL IN SOYBEANS

Herbicide	Rate/Acre Broadcast*		Remarks**
	Active Ingredient	Formulation	
Aim EC (carfentrazone-ethyl)	0.008-0.025 lb.	0.25-0.5 ozs.	Apply overtop of soybeans from V3 to V10 to control velvetleaf and morningglories. Causes soybean foliar burn which is usually of short duration. Always add 1 qt. nonionic surfactant per 100 gals. of spray mix. May be tank-mixed with glyphosate to control larger morningglories.
Assure II 0.88E (Quizalofop)	0.034-0.069 lb.	5-10 ozs.	Apply overtop to control rhizome johnsongrass . Apply 5 ozs. of Assure II when johnsongrass is 10-24" tall and re-treat with 5 ozs. when grass regrowth reaches 6-10" tall. Add oil concentrate at 1 gal. (for ground application) or 1 qt. nonionic surfactant per 100 gals. of spray mixture. The higher rates may be needed to control annual grasses or bermudagrass . See label. Controls volunteer Roundup Ready corn in soybeans.
Basagran 4SC (Bentazon)	0.75-1.0 lb.	1.5-2 pts.	Apply to control cocklebur, prickly sida and other broadleaf weeds. Addition of 1 qt./A of crop oil concentrate may improve control of ragweed and lambsquarters. Add 2 ozs. of 2,4-DB (Butyrac) to the regular rate of Basagran for improved control of morningglory. Do not add oil or surfactant when mixing with 2,4-DB.
Classic 25DF (Chlorimuron)	0.008-0.012 lb.	0.5-0.75 oz.	Apply to control cocklebur, pigweed, burcucumber and other broadleaf weeds. Can be applied after the first trifoliolate until 60 days before harvest. Weak on prickly sida and lambsquarters . Add 1 qt. of nonionic surfactant (80 percent active) per 100 gal. water. See label for information concerning the use of crop oil concentrate and liquid fertilizer. Classic may be tank-mixed with Roundup Ultra (Roundup Ready soybeans only) for improved control of morningglory and hemp sesbania (see label). Do not plant corn, cotton, or sorghum within 9 months after application. See label for other crops. For salvage control of cocklebur or smooth pigweed, apply .75 oz. and 1 qt. of crop oil concentrate.
Cobra 2E (Lactofen)	0.2 lb.	12.5 ozs.	Apply to control morningglory, balloonvine and several broadleaf weeds. Add 2 pts. nonionic surfactant, or 2 to 4 pts. crop oil concentrate, per 100 gals. spray. Causes soybean foliar burn which is usually of short duration.
FirstRate 84DG or	0.016 lb.	0.3 oz.	Apply overtop prior to 50% flowering stage of soybeans. Application prior to full emergence of the first soybean trifoliolate leaf may cause temporary yellowing. Good control of cocklebur, common ragweed, giant ragweed and sicklepod. Always add crop oil concentrate at 1.2 gal. per 100 gal. of spray mix. FirstRate can be tank-mixed with Roundup UltraMax or Touchdown (Roundup Ready soybeans only), and several other herbicides (see label). For FirstRate tank mixes with Roundup UltraMax, WeatherMax, PowerMax or Glyphomax Plus, DO NOT add additional surfactant or crop oil. Other glyphosate product tank mixes add non-ionic surfactant at 2 pt. per 100 gals. If needed, a sequential application can be made. See label.
Flexstar 1.88SC (Fomesafen plus adjuvants)	0.24-0.35 lb.	1.0-1.5 pts.	Contains same active ingredient as Reflex, but is formulated with an adjuvant system. Will control larger cocklebur, morningglories, and pigweed. Causes soybean foliar burn which is usually of short duration. Always add 1-2 qts. nonionic surfactant, or 0.5-1 gal. crop oil concentrate per 100 gals. of spray mix.

Herbicide	Rate/Acre Broadcast*		Remarks**
	Active Ingredient	Formulation	
Frontrow (Chloransulam- methyl + Flumetsulam)	0.022 lb.	0.42 oz.	Apply overtop prior to 50% flowering stage of soybeans. Application prior to full emergence of the first soybean trifoliolate leaf may cause temporary yellowing. Controls prickly sida, in addition to the weeds controlled by FirstRate. Frontrow can be tank mixed with Roundup Ultra or Touchdown (Roundup Ready soybeans only), and several other herbicides (see label). Always add crop oil concentrate (1.2 gal.) or nonionic surfactant (1 qt.) per 100 gal. of spray mix. If needed, a sequential application can be made. See label.
Fusilade DX 2E (Fluazifop)	0.094-0.188 lb.	6-12 ozs.	Apply lower rate for most annual grasses before they exceed 4" tall. For johnsongrass control, apply the higher rate when it is 8-18" tall. Make a second application (8 ozs.) when regrowth is 6-12" tall. For bermudagrass , apply the higher rate when runners are 4-8" long, and repeat when regrowth reaches 4". Add oil concentrate (1 gal.) or nonionic surfactant (2 pts.) per 100 gal of spray mixture. Controls volunteer Roundup Ready corn in soybeans.
Fusion 2.56E (Fluazifop + Fenoxaprop)	0.16-0.24 lb.	8-12 ozs.	Apply overtop for control of annual grasses and johnsongrass. Better control of annual grasses than Fusilade DX. Apply 8 ozs./A for control of most annual grasses, or 12 ozs./A for control of johnsongrass 8-18" tall. A second application of 8 ozs./A may be used to control regrowth, 8" tall. For bermudagrass, treat 4-8" runners with 12 ozs./A, and apply a second application of 8 ozs./A to 4-8" regrowth. Add oil concentrate (1 gal.) or nonionic surfactant (2 pts.) per 100 gal of spray mixture. Controls volunteer Roundup Ready corn in soybeans.
Poast 1.5E or Poast Plus 1.0E (Sethoxydim)	0.19 lb.	16 ozs. 1.5E or 24 ozs. 1.0E	Apply for control of most annual grasses . For best results, make applications before most grasses exceed 4" tall. Always include oil concentrate at 2 pts./A. Controls volunteer Roundup Ready corn in soybeans.
Pursuit 2AS or 70DG (Imazethapyr)	0.063 lb.	4 fl. ozs. or 1.44 ozs. 70DG	Apply to control morningglory, spurge, pigweed, cocklebur and other broadleaf weeds. For most effective control, apply before weeds exceed 3" in height. Use nonionic surfactant at the rate of 1 qt. per 100 gallons of spray mix. Use 10 or more gallons of spray solution per acre to ensure good weed coverage. See label regarding rotational crop restrictions. Also available as a premix with glyphosate (Extreme) for use in Roundup Ready soybeans. See label.
Raptor 1AS (Imazamox)	0.03-0.04 lb.	4-5 ozs.	Apply overtop prior to soybean bloom and before most weeds exceed 5 inches tall (see label). Good control of cocklebur, morningglory, pigweed, velvetleaf and seedling johnsongrass. Weak on sicklepod and hophornbeam copperleaf. Always add either crop oil concentrate at 1 gal. per 100 gals. or nonionic surfactant at 1 qt. per 100 gals. of spray mix. Do not make more than one application per season.
Reflex 2LC (Fomesafen)	0.25-0.38 lb.	1-1.5 pts.	Apply to control morningglory (high rate only) and several broadleaf weeds. Add 1-2 qts. nonionic surfactant or 1 gal. crop oil concentrate per 100 gals. of spray. Reflex may be tank-mixed with Roundup Ultra (Roundup Ready soybeans only) for improved control of morningglory and hemp sesbania (see label). It is usually very safe on soybeans. Do not plant sorghum within 18 months of application. Has controlled volunteer Roundup Ready cotton that is 6 inches or smaller in research and demonstration trials in soybeans.
Resource 0.86E (Flumiclorac)	0.03 lb.	4 ozs.	Apply to control velvetleaf with up to 6 leaves. Larger plants will require higher rates (see label). Add oil concentrate at 1 qt./A.
Sequence (S- metolachlor + Glyphosate)	1.64 lb.	2.5 pts.	Apply up to 3 trifoliolate.

Herbicide	Rate/Acre Broadcast*		Remarks**
	Active Ingredient	Formulation	
Touchdown/others* ** (Glyphosate 3ae) Roundup Ready Soybeans Only	0.75-1.1 lb. (a.e.)	32-48 ozs.	The Roundup Ready system has been most successful where soybeans are drilled, where fields are scouted early, and when applications are timely. Apply overtop to control many annual broadleaf and grass weeds, and johnsongrass. Excellent control of crabgrass, fall panicum, goosegrass, signalgrass, johnsongrass, cocklebur, copperleaf, and spurge. Some of the more difficult to control weeds include morningglory, black nightshade, groundcherry, hemp sesbania, prickly sida, spurred anoda, and giant ragweed. Consider tank-mixing with reduced rates of Classic, Ultra Blazer, Cobra or Reflex for improved control of morningglories and hemp sesbania. Tank mixing with FirstRate will improve control of giant ragweed. See product labels for specific tank-mix directions. Avoid drift to adjacent crops. Be sure that your spray system has been thoroughly cleaned and flushed prior to and after application. Applications can be made from the cracking stage throughout flowering. Repeat applications may be required to maintain control. Dry conditions will reduce weed control.
Roundup PowerMax*** (Glyphosate 4.5ae) Roundup Ready Soybeans Only		22-32 ozs.	
Scepter 1.5AS or 70DG (Imazaquin)	0.063-0.125 lb.	0.33-0.67 pt. or 1.4-2.8 ozs.	Use .33 pt. to control cocklebur and pigweed. Use higher rate to control other broadleaf weeds. Weak on jimsonweed and nightshade. Add 1 qt. nonionic surfactant (80 percent active) per 100 gals. of spray volume. See label for information concerning the use of crop oil concentrate and rates to use on specific weeds. Do not plant sorghum within 11 months or cotton within 18 months of application. Corn may be planted the following spring if 10 inches of water is received within 6 months following application. See label for other crops. For salvage control of cocklebur or smooth pigweed, apply 0.5-.67 pt./A (2.1-2.8 ozs. 70DG) per acre plus nonionic surfactant (1 qt./100 gal.). Also available as a premix with glyphosate (Backdraft) for use in Roundup Ready soybeans. See label.
Select Max 1EC (Clethodim)	0.094-0.125 lb.	12-16 ozs.	Apply 12 ozs./A for control of most annual grasses up to 6" tall. For johnsongrass , 12-24" tall, apply 16 ozs. A second application of 12 ozs./A can be made to regrowth, 6-10" tall. For bermudagrass , apply the higher rate on runners up to 6" long, and repeat on regrowth up to 6" long. Always use crop oil concentrate at 1 qt./A. Controls volunteer Roundup Ready corn in soybeans.
Storm (Basagran + Blazer premix)	0.75 lb.	1.5 pts.	Broad spectrum control of cocklebur, morningglory, and several other broadleaf weeds. Always add crop oil concentrate (1-2 pts./A) or nonionic surfactant (0.125-0.25% by volume) with Storm. Causes soybean foliar burn which is usually of short duration. Note: 1.5 pt./A of Storm is equivalent to 1 pt. of Basagran and 1/pt. of Blazer per acre.
Synchrony (chlorimuron + thifensulfuron)	0.018-0.05 lbs.	1-3 oz.	May be tank-mixed at a reduced rate with glyphosate to provide residual control.
Ultra Blazer 2L (Acifluorfen)	0.13-0.38 lb.	0.5-1.5 pts.	Apply to control morningglory, pigweed and several other broadleaf weeds. See label regarding the use of surfactant. Ultra Blazer may be tank-mixed with Roundup Ultra (Roundup Ready soybeans only) for improved control of morningglory and hemp sesbania (see label). Add 2 ozs. of 2,4-DB (Butyrac) to improve control of cocklebur and large morningglory.

*If a band treatment is used, the rate should be reduced proportionately according to band width and row spacing.

**For rhizome johnsongrass control, do not tank mix postemergence grass herbicides with broadleaf herbicides.

*** NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

SOYBEAN HARVEST AIDS

Harvest aid chemicals are sometimes needed to desiccate weeds in order to improve timeliness of harvest. This is most frequently encountered with early maturing varieties which may be ready for harvest prior to a killing frost. Harvest aid chemicals do not speed-up maturity of the soybean plant; they merely reduce moisture in weeds and may improve harvest efficiency, in addition to timeliness. Producers are encouraged to make harvest aid decisions by comparing cost with anticipated benefits. Also, care must be taken to minimize chances of drift to adjacent crops. Be sure to read labels thoroughly and follow required preharvest intervals (PHI).

Harvest Aid	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Aim 2EC	0.023 lbs.	1.5 ozs.	Aim has a 3 day pre-harvest interval.
Touchdown/others* (Glyphosate 3ae)	0.75-1.5 lbs. (a.e.)	32-64 ozs.	Apply after pods have set and lost all green color. Allow a minimum of 7 days between application and harvest of soybeans. Use a spray volume of 10 to 20 gallons of water per acre for ground applications, or 3 -10 gallons of water for aerial applications. Do not graze or harvest treated crop for livestock feed within 25 days of application. Do not apply to soybeans grown for seed as a reduction in germination or vigor may occur. Avoid spraying during conditions which favor drift.
Roundup PowerMax* (Glyphosate 4.5ae)		22-43 ozs.	
Sodium Chlorate, Defol 6, other trade names (Sodium Chlorate)	6.0 lbs.	2 gals. of a 3 lb./gal. formulation or 1 gal. of a 6 lb./gal. formulation	Make application 7 to 10 days before anticipated harvesting date when soybeans are mature and ready for harvest. Apply in a minimum spray volume of 20 gallons per acre by ground or 5 gallons per acre by air. Do not graze treated fields or feed treated soybean foliage. Do not apply under conditions which favor drift.
Gramoxone Inteon(u) (Paraquat)	0.13-0.26 lb.	8-16 ozs.	For indeterminant varieties(maturity Group III or IV) apply when at least 65% of the seed pods have reached a mature brown color or when seed moisture is 30% or less. For determinant varieties(maturity Group V) apply when plants are mature, i.e., beans fully developed, one-half of leaves have dropped, and remaining leaves are yellowing. Immature soybeans will be injured. Use the higher rate when cocklebur is present. Use a minimum spray volume of 20 gallons per acre by ground or 5 gallons per acre by air. Do not apply within 15 days of harvest. Do not graze or harvest for forage or hay. Do not apply under conditions which favor drift.

(u)--Restricted Use Herbicide.

* NOTE: Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates, addition of surfactant and registration on Roundup Ready crops. Always read the label before application.

EXPECTED SOIL APPLIED HERBICIDE RESPONSE OF COMMON WEEDS IN SOYBEANS

	PPI	PREPLANT INCORPORATED/PREEMERGENCE						PREEMERGENCE					
	Treflan	Boundary	Canopy /5DG	Prowl or Pendimax 3.3	Python	Scepter	Senecor	Authority First/ Sonic	Command	Dual II Magnum	Outlook	Pursuit	Valor
Annual Morningglories	6	5	9	6	6	6	5	8	3	2	2	7	8
Broadleaf Signalgrass (Urochloa)	8	8	8	8	4	4	6	6	9	8	8	6	2
Cocklebur	0	5	8	0	7	9	5	8	5	0	0	8	5
Common Ragweed	0	7	8	0	----	7	8	7	6	0	0	8	8
Crabgrass, Foxtails, Goosegrass	9	9	8	9	5	6	8	6	9	9	9	8	4
Groundcherries/Black Nightshade	0	7	8	0	9	5	6	----	3	7	7	8	2/8
Hophornbeam Copperleaf	0	6	9	0	----	6	6	8	2	4	4	5	9
Jimsonweed	0	7	----	0	----	5	8	----	5	0	0	8	----
Lambsquarters	7	8	----	8	----	9	8	----	7	6	6	7	9
Pigweed, Palmer	8	7	7	8/6 ^{tt}	4	3	7	9	0	6	6	3	9
Pigweed, Smooth or Redroot	8	9	9	7	9	9	9	9	2	8	8	9	9
Prickly Sida	0	8	8	0	9	7	8	----	9	0	0	8	----
Seedling Johnsongrass	9	8	6	8	4	5	4	5	8	8	8	8	2
Sicklepod	0	6	5	0	7	7	6	0	0	3	2	0	4
Smartweed	4	7	----	3	9	8	7	----	6	0	0	8	5
Spotted Spurge	0	7	----	0	9	7	8	----	8	7	7	9	----
Spurred Anoda	0	6	----	0	9	4	7	----	9	0	0	8	----
Velvetleaf	2	6	----	2	9	6	7	7	9	0	0	8	----
Yellow Nutsedge	0	7	9	0	----	4	0	----	0	8	8	3	0
Soybean Tolerance	1	2	T	2	1	3	3	1	0	1	1	1	2

(u) Restricted Use Pesticide: Refer to label for precautions to be taken during handling and application.

KEY TO SYMBOLS: 0=No control or crop injury; 10=100% control or severe, yield-reducing crop injury; ----=data not available (Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.) T-Tolerance related to variety and environmental conditions. ^{tt}- 8 for PPI; 6 for PRE

EXPECTED WEED RESPONSE FROM POSTEMERGENCE SOYBEAN HERBICIDES

	Aim	Basagran	Classic	Cobra	FirsRate	Pursuit	Reflex	Touchdown/others* ^a	Roundup Power/Max/	Scepter	Ultra Blazer	Assure II	Fusilade DX	Poast, Poast Plus	Select Max
Annual grasses	0	0	1	4	----	7	5	9	4	4	8	8	9	9	
Burcucumber	0	3	8	6	----	----	5	----	5	6	0	0	0	0	
Cocklebur	6	9	9	7	9	8	8	10	9	7	0	0	0	0	
Common Ragweed	-	5	7	7	9	7	7	9	7	7	0	0	0	0	
Giant Ragweed	2	3	5	7	8	6	7	6	5	6	0	0	0	0	
Groundcherry/Nightshade	7	1	2	8	----	8	8	6	4	8	0	0	0	0	
Hemp Sesbania	9	0	9	9	2	0	9	4	2	9	0	0	0	0	
Hophornbeam Copperleaf	7	2	2	9	----	4	9	7	2	9	0	0	0	0	
Jimsonweed	7	8	5	7	5	9	7	8	5	7	0	0	0	0	
Johnsongrass (rhizome)	0	0	1	1	0	6	2	9	1	1	9	9	6	9	
Johnsongrass (seedling)	0	0	1	4	2	7	5	10	2	4	9	9	8	9	
Lambsquarters	8	7	0	6	----	5	5	8	1	5	0	0	0	0	
Morningglory Entireleaf/Ivy ^a	7	2	8	8	8	8	8	8	1	8	0	0	0	0	
Morningglory Pitted ^b	7	5	8	9	8	8	9	7	4	9	0	0	0	0	
Morningglory Tall ^c	7	3	7	9	5	9	9	8	2	9	0	0	0	0	
Pigweed, Palmer	7	0	4	8	4	3	8	9	3	8	0	0	0	0	
Pigweed, Smooth or Redroot	8	0	8	8	4	9	8	9	9	8	0	0	0	0	
Prickly Sida	4	7	0	6	3	6	2	6	1	2	0	0	0	0	
Sicklepod	1	0	8	1	8	0	1	9	5	1	0	0	0	0	
Smartweed	7	8	5	7	----	6	7	8	5	7	0	0	0	0	
Spotted Spurge	6	0	3	7	----	8	7	9	3	7	0	0	0	0	
Velvetleaf	9	9	8	4	6	8	4	7	2	3	0	0	0	0	
Yellow Nutsedge	0	8	4	1	----	3	6	7	2	1	0	0	0	0	
Soybean Tolerance	3	0	2	3	0	0	1	0*	1	2	0	0	0	0	

*Soybean variety must be Roundup Ready ^a Many hairs on upper leaf surface ^b No hairs on upper leaf surface ^c A few hairs on upper leaf surface
KEY TO RESPONSE RATINGS: 0=No control or crop injury; 10=100% control or severe, yield reducing crop injury; ----=No data available Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

BURLEY AND DARK TOBACCO WEED CONTROL

Weed Control in the Field

Growers should give consideration to weed problems when selecting fields for tobacco production. Many weeds, such as groundcherry, jimsonweed, horsenettle, and cocklebur are not controlled by tobacco herbicides. When rotating with other crops, care should be taken to avoid herbicide carryover into tobacco. Tobacco is very sensitive to persistent herbicides such as atrazine, Princep and some soybean herbicides. Always know the field history, and read the herbicide labels to know the required waiting periods for tobacco. Dry weather, high herbicide rates and lack of post-season tillage will all increase the risk of carryover.

A combination of soil-applied herbicides and timely, shallow cultivation will be required for adequate weed control in most fields. Recommended herbicides are listed on the following pages. Begin shallow (no deeper than 2 inches) cultivation as soon as weeds begin to emerge after transplanting. Deep cultivation only brings more weed seed to the surface. Cease cultivation before tobacco leaves or roots are damaged.

HERBICIDES FOR TOBACCO FIELDS

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Command 3ME (Clomazone)	0.75-1 lb.	2-2.67 pts.	Apply Command 3ME on the surface prior to transplanting, or overtop up to 7 days following transplanting. If Command is applied prior to transplanting and field conditions require the need for additional preparation, tillage should be shallow (no deeper than 2 inches). Excellent control of hairy galinsoga, prickly sida and annual grasses. Good control of ragweed. For use only where application buffer zones can be observed (1200 feet from towns and housing developments, commercial fruit/nut or vegetable production, commercial greenhouses or nurseries). See label for other restrictions and drift control measures. Weak on pigweed and morningglory. Command may persist and cause injury to small grain cover crops. Consider using vetch as a cover crop, and a tobacco variety resistant to black root rot.
Devrinol (Napropamide)	1 lb. 1.5 lbs. 2.0 lbs.	2 lbs. 50DF (coarse textured or sandy soils) 3 lbs. 50DF (medium-textured or loamy soils) 4 lbs. 50DF (fine-textured or silty clay loams)	Apply preplant incorporated by shallow disking or overtop transplants immediately after transplanting. If rainfall is not received within 24 hours of a post-transplant application, irrigation or tillage is necessary for activation. Controls hairy galinsoga, pigweed, ragweed and several other broadleaf weeds. Will not control morningglories. Apply full labeled rate to control hairy galinsoga. Devrinol may persist and cause injury to winter cover crops. Consider using vetch as a winter cover crop where Devrinol is used and use a tobacco variety resistant to black root rot. Some growers have had good success with reduced rates of Devrinol (1 lb. 50 DF on sandy soils or 2 lbs. on heavier soils) tank-mixed with Prowl. The reduced rate gives good weed suppression with reduced carryover potential.

Prowl 3.3 EC (Pendimethalin)	1.0 lb. 1.5 lb.	2.4 pts. (coarse-textured soils) 3.6 pts. (fine-textured soils)	Apply on soil surface and incorporate with a disk set to cut 3-4" deep. Disk twice for thorough mixing. Use the higher rate of chemical in each rate range where weed pressure is heavy or where high rates of manure have been applied. Controls most annual grasses and pigweeds. Note: Generic versions of EC formation are available. See labels.
Prowl H ₂ O 3.8 CS (Pendimethalin)	0.95 lb. 1.43 lb.	2.0 pts.-(coarse-textured soils) 3.0 pts. (medium-to-fine textured soils)	
Spartan 4F (Sulfentrazone)	0.25-0.31 lb.	8.0-10.1 ozs. 4F formulation (See label)	Apply Spartan 4F to the soil surface following land preparation prior to transplanting. Use a well calibrated sprayer with good agitation. Avoid excessive overlap of spray swaths. Spartan may be mechanically incorporated, but no deeper than 2 inches. Do not apply overtop after transplanting, as severe crop injury will occur. Excellent control of morningglory, pigweed, lambsquarters and yellow nutsedge. Good annual grass suppression. For improved grass control, use with Command 3ME or Prowl. Weak on ragweed and hairy galinsoga. For improved control of these weeds, apply with Command 3ME or Devrinol.
Poast 1.5 EC (Sethoxydim)	0.28 lb.	1.5 pt. (See label)	Apply overtop to control annual grasses, johnsongrass and bermudagrass. Two applications at 1.5 pt./A may be made up to 7 weeks after transplanting. Always add crop oil concentrate at 2 pt./A. Be sure to use a clean sprayer. Johnsongrass and bermudagrass will likely require 2 applications for satisfactory control. Poast may also be applied to conventional tobacco transplant beds. See label.

Each of these recommended chemicals has proven to be safe to tobacco and provide effective weed control when used properly. However, if cold, wet weather or hot, dry weather persists after transplanting, some crop stunting may occur. Command, Devrinol and Prowl are persistent herbicides which may injure crops planted after tobacco harvest. For best safety to rotational or cover crops (1) use no more than recommended rates, (2) disk or break soil after harvesting tobacco, (3) delay planting for two or more weeks, and (4) plant a combination of a legume and a grass.

WARNING: Poor stands and/or growth of rotational or cover crops have been observed in some fields where "Prime+" sucker control material has been used in conjunction with dinitroaniline herbicides such as Prowl. Although crop injury has not occurred in all cases where these materials were used in the same field, the potential for such problems definitely exists.

NOTES:

EXPECTED HERBICIDE RESPONSE OF COMMON WEEDS IN TOBACCO

Weed	Command 3ME	Devrinol	Prowl	Spartan 4F	Poast
Cocklebur	5	0	0	6	0
Common ragweed	6	7	0	2	0
Crabgrass	9	8	9	7	9
Fall panicum	9	8	9	7	9
Foxtail	9	8	9	7	9
Goosegrass	9	8	9	7	9
Groundcherry	3	0	0	-----	0
Hairy galinsoga	9	7*	0	5	0
Horsenettle**	0	1	0	0	0
Jimsonweed	5	0	0	7	0
Johnsongrass, rhizome	1	0	2	1	7
Johnsongrass, seedling	8	7	8	6	8
Lambsquarters	7	8	7	8	
Morningglories	3	1	5	9	0
Pigweed (carelessweed)	2	9	8	9	0
Purslane	-----	9	7	-----	0
Smartweed	6	6	2	7	0
Spiny Amaranth	2	9	8	9	0
Yellow nutsedge	0	0	0	8	0

*2 lb. a.i./acre required for this level of control. 0

**Horsenettle is a deep-rooted perennial. For best results, spray mature weeds after tobacco harvest with a cupful of Roundup mixed with two gallons of water. Wet foliage thoroughly and wait seven days before disking or turning. This application will also give excellent control of rhizome johnsongrass.

RATING SCALE: 0=No Control; 9=90% Control or Greater; -----=Data not available. These ratings are based on labeled herbicide rates and proper application methods.

WHEAT WEED CONTROL

Wild garlic, annual ryegrass and cheat are major weed problems in Tennessee wheat fields. Wild garlic infestations may cause dockage at harvest. Annual ryegrass and cheat compete with wheat for light, nutrients and water, and will reduce wheat yield. Weeds which infest wheat may delay harvest in the spring. Thus, an effective weed management program should be used for producing optimum wheat yields.

Good production practices aid in the control of weeds. Using weed-free seed, proper seeding rate, proper seedbed preparation and planting following a good weed management program in a summer cultivated crop will assist in effective weed control.

Wild Garlic

A major weed problem in our wheat fields is wild garlic (commonly called wild onion). To obtain the best control of wild garlic and the least amount of injury to the wheat crop, the following procedure should be followed:

1. Apply 0.45 to 0.90 ounces Harmony Extra Total Sol per acre. **Note: If double cropping beans must use STS bean variety.**
2. Apply at least 15 gallons spray volume per acre to ensure coverage. **Note: Thorough coverage is essential for control.**
3. Add nonionic surfactant (80% active or greater) at a rate of 1 quart per 100 gallons of water. Liquid nitrogen fertilizer may be used as a spray carrier for Harmony Extra Total Sol. Surfactant must be included (1 to 2 pints per 100 gallons of spray solution). Wheat plants may exhibit temporary yellowing and stunting when sprayed with the liquid nitrogen.
4. Apply when wild garlic plants are less than 12 inches tall, with 2 to 4 inches of new growth. New growth is essential for control. See instructions in the table on the following page for wheat stage.
5. Apply when daytime temperatures of at least 60 F are expected for three or more days. Adequate soil moisture before, during and immediately after application will improve control.
6. Harvest wheat early, prior to excessive lodging, in order to remove as few aerial bulblets with the combine as possible.

No-till Wheat

A burndown application of Gramoxone Inteon may be needed to desiccate summer weeds such as broadleaf signalgrass, pigweed and cocklebur for easier planting and reduction of competition with emerging wheat. Additionally, Gramoxone Inteon will control winter annuals such as chickweed and henbit if they are already present at planting. Prior to planting wheat is also a good opportunity for control of perennial weeds such as johnsongrass, bermudagrass and some vines with Roundup PowerMax/Touchdown/others.

Ryegrass can be troublesome in no-till wheat just as it is in conventionally-tilled wheat. If Hoelon is used preemergence, it can be tank-mixed with Gramoxone Inteon.

Fall applications of Harmony Extra have performed very well in no-till wheat on weeds such as wild garlic and dock. Harmony Extra can be applied after wheat reaches the two-leaf stage. In most studies, the fall application has eliminated the need for a late-winter or spring application.

Wheat Harvest Aid

Touchdown/others (32 ozs./A) or Roundup PowerMax (22 ozs./A) may be applied preharvest in wheat for control or suppression of johnsongrass, smartweed and several other weeds (see label). Make applications after the hard-dough stage of grain (30 percent or less grain moisture) and at least seven days prior to harvest. May be applied either by ground or air. It is not recommended that wheat grown for seed be treated because a reduction in germination or vigor may occur.

HERBICIDES FOR USE IN WHEAT

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Axial XL (pinoxaden + Adigor adjv.)	0.05 lb.	0.5 pt.	
Buctril 4EC (Bromoxynil)	0.375-0.5 lb.	0.75-1 pt.	For postemergence control of several small, annual broadleaf weeds. Buctril may be applied anytime after wheat emergence, but for best results, use only in the fall. May be tank-mixed with Hoelon for broader spectrum weed control. See label for tank-mix instructions.
Finesse Grass & Broadleaf (Chlorsulfuron + Metsulfuron)	0.033-0.040 lb.	0.75-0.90 oz.	Apply in the fall. Plant STS beans only if double cropped.
Harmony Extra Total Sol 50 DF (Thifensulfuron)	0.014-0.028 lb.	0.45-0.90 oz.	For postemergence control of actively growing weeds such as wild garlic, buttercup and dock. Apply to wheat in at least the two-leaf stage but before the third node is detectable. Add nonionic surfactant (80% active or greater) at 0.25% (1 qt./100 gallons of water) to the spray solution. Use in at least 15 gallons spray volume per acre for ground application and in 3-5 gallons with aerial application. May be tank-mixed with 2, 4-D for improved vetch control. Add Clarity (3 oz.) for control of cornflower and horseweed. See label for directions.
Hoelon 3EC (Diclofop) (u) Note: Hoelon-resistant ryegrass is in Tennessee. Growers are encouraged to rotate infested fields where possible, and avoid yearly applications of Hoelon to the same field.	0.75-1.0 lb.	2.0-2.6 pts.	For preemergence control of annual ryegrass in fall-planted wheat use 2 pts./A Increase rate to 2.6 pts. for areas having a history of heavy annual ryegrass pressure. Do not incorporate.
	0.5-1.0 lb.	1.3-2.6 pts.	For postemergence control of annual ryegrass in fall-planted wheat apply 1.3 to 2 pts./A on 1- to 5-leaf ryegrass prior to wheat jointing. Increase rate to 2.0 to 2.6 pts./A for ryegrass with 4 to 5 leaves. NOT EFFECTIVE ON CHEAT. Apply in at least 10 gallons of water/A with ground equipment or in at least 5 gallons of water/A by airplane. Use a minimum pressure of 40 PSI. Do not tank mix with Harmony Extra.
Osprey (mesosulfuron-methyl) 0.45DF	0.013 lb.	4.75 ozs.	For control of Hoelon-resistant ryegrass and other annual grass and broadleaf weeds in winter wheat. Applications may be made from time of wheat emergence up to the jointing stage of development. Apply with NIS 2 qt./100 gal and UAN at 1-2 qts/A or AMS at 1.5-3 lbs/A. Methylated seed oil at a rate of 1.5pts./A in 10 gallons or more of water carrier per acre may be substituted for the NIS and Nitrogen additives. Do not apply Osprey within 14 days before or after nitrogen fertilizer application, or crop injury may result.
Sencor 75DF (Metribuzin)	0.14-0.19 lb. ^A 0.19-0.23 lb. ^B 0.23-0.28 lb. ^C (See label for other formulations of Sencor)	3-4 oz. ^A 4-5 oz. ^B 5-6 oz. ^C	Use only in wheat fields having a history of heavy cheat pressure and where crop injury can be tolerated. Apply after the wheat plants have developed 3 to 4 tillers and have at least 4 secondary roots, 2 inches long. High moisture conditions may cause an underdeveloped root system. Crop tolerance is related to a good root system and healthy wheat plants prior to and at the time of application. Wheat varieties vary in their tolerance to Sencor. Various degrees of injury have been observed. Correct timing is critical or increased crop injury should be expected. Decisions regarding Sencor use on sensitive wheat varieties should be made by comparing expected yield loss from Sencor injury with yield loss from expected weed competition. See label for further instructions. Do not apply Sencor to wheat which has begun to joint. <u>Alternative low rate program:</u> Reduced rates of Sencor (1-3 ozs./A of the 75DF formulation) may be applied on young wheat (2-leaf to 2-tiller stage). This treatment for cheat, little barley, chickweed and henbit has performed well in UT research and demonstrations. The 3 oz. rate will be required for control of one-leaf cheat and other weeds. This will normally require a fall application.

2,4-D	0.33 lb. Low volatile ester or 0.5-0.75 lb. amine	See label See label	For postemergence control of weeds such as vetch, wild mustard and turnips, apply when wheat is well tillered but prior to jointing.
	0.75-1.0 lb. Low volatile ester	See label	For postemergence control of above weeds plus wild garlic.

(U) Restricted Use Pesticide--See label for precautions to be taken during handling and use.

^A *Coarse--sandy loam*

^B *Medium--silt loam*

^C *Fine--silty clay loam*

NOTES:

EXPECTED WEED RESPONSE TO WHEAT HERBICIDES

	POSTEMERGENCE							PREEMERGENCE
	Axial XL	Harmony Extra	2,4-D	Buctril	Hoelon (u)	Osprey	Sencor	Hoelon (u)
Buttercup	0	9	9	6	0	0	-----	0
Cheat	--	0	0	0	0	0	9	3
Chickweed	0	8	2	5	0	0	9	0
Corncockle	0	7	3	7	0	0	-----	0
Cornflower	0	5	5	8	0	0	6	0
Dock, curly/broadleaf	0	9	7	7	0	0	3	0
Downy brome	-----	0	0	0	-----	-----	5	0
Eveningprimrose (Cutleaf)	0	5	8	3	0	0	-----	0
Garlic (onion), wild	0	9	7	5	0	0	4	0
Geranium, Carolina	0	5	9	3	0	0	8	0
Henbit/deadnettle	0	7	1	5	0	0	7	0
Horseweed (marestail)	0	6	9	8	0	0	8	0
Mayweed	0	9	6	6	0	0	7	0
Mustard, wild	0	9	8	8	0	0	6	0
Pepperweed, Virginia	0	8	9	7	0	0	9	0
Ragweed, common	0	-----	9	8	0	0	9	0
Ryegrass, annual	8	0	0	0	8*	8	4	9*
Shepherdspurse	0	9	7	3	0	0	4	0
Turnip, wild	0	9	8	8	0	0	6	0
Vetch	0	7	8	7	0	0	5	0

(u) **Restricted Use Pesticide**--Refer to label for precautions to be taken during handling and application.

KEY TO RESPONSE RATINGS: 0=No control; 10=100% control; -----=Data not available.

Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

* Hoelon resistant bio-types will not be controlled.

SUNFLOWER WEED CONTROL

Sunflowers are routinely grown for doves and clean fields have historically produced better results. Although herbicides labeled for sunflower production are limited, good weed control can be obtained with proper application. It is recommended that sunflowers be drilled or seeded so that all seed are properly covered with soil. Broadcast seeding may result in poor seed to soil contact and herbicide applications may result in sunflower injury. Reduced rates of preemergence herbicides may be necessary for sunflowers planted on sandy or lighter textured silt loam soils to reduce the potential for injury. Activating rainfall or irrigation is needed for optimum preemergence herbicide activity and weed control.

PREPLANT INCORPORATED HERBICIDES FOR SUNFLOWERS

**For proper incorporation, a disk should be set to cut about twice as deep as placement is desired. A second mixing with shallow disking or field cultivator usually improves weed control. See label for incorporation instructions with other implements.*

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Dual Magnum	sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam: 1.27-1.59 lbs.	1.0-1.33 pts. 1.33-1.67 pts. 1.33-1.67 pts.	Good control of annual grasses, nutsedge and small-seeded broadleaf weeds. Use higher rate to control seedling johnsongrass. Avoid high rates on sandy or silt loam soils. Rates higher than 1.27 lbs. ai (1.33 pts./A) could result in crop injury.
Prowl 3.3 EC or Pendimax 3.3 EC	sandy loam: 0.5-0.74 lbs. silt loam: 0.74-1.0 lbs. silty clay loam: 1.0-1.5 lbs.	1.2-1.8 pts. 1.8-2.4 pts. 1.8-3.6 pts.	Good control of annual grasses and small-seeded broadleaf weeds. Use higher rate to control seedling johnsongrass. For maximum weed control, the herbicide must be incorporated within 7 days of application.
Sonalan HFP	sandy loam: 0.56-0.75 lbs. silt loam: 0.75-0.9375 lbs. silty clay loam: 0.9375-1.125 lbs.	1.5-2.0 pts. 2.0-2.5 pts. 2.5-3.0 pts.	Good control of annual grasses and small-seeded broadleaf weeds. Sonalan HFP must be incorporated after application. Follow soil preparation, application and incorporation application procedures recommended by the label.
Treflan HFP, Trilin, Trifluralin 4 EC	sandy loam: 0.5 lbs.	1.0 pts. 1.25-1.5 pts. 1.5-2.0 pts.	Good control of annual grasses and small-seeded broadleaves. Trifluralin must be incorporated immediately after application.

PREEMERGENCE HERBICIDES FOR SUNFLOWERS

Herbicide	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulation	
Dual Magnum	sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam: 1.27-1.59 lbs.	1.2-1.0 pts. 1.33-1.67 pts. 1.33-1.67 pts.	Good control of annual grasses, nutsedge and small-seeded broadleaf weeds. Use higher rate to control seedling johnsongrass. Dual Magnum must be applied immediately after planting to avoid crop injury. Avoid high rates on sandy or silt loam soils. Rates higher than 1.27 lbs. ai (1.33 pts./A) could result in crop injury. Tank mix with Spartan 4F for improved broadleaf weed control.
Prowl 3.3 EC or Pendimax 3.3 EC	sandy loam: 0.5-0.74 lbs.	1.2-1.8 pts.	Good control of annual grasses and small-seeded broadleaf weeds. Pendimethalin must be applied immediately after planting to avoid crop injury. Preemergence applications of pendimethalin on conventional tillage sunflowers may increase the likelihood of crop injury and decrease the herbicide performance when compared to preplant incorporated applications. Tank mix with Spartan 4F to improve broadleaf weed control.
Spartan 4F	0.125 lbs.	4.0 oz	Spartan 4F may be applied on the soil surface at planting to control broadleaf weeds. Spartan must be applied within 3 days of planting to reduce the potential for injury. Tank mixes with Dual Magnum, Prowl 3.3 EC or Pendimax will improve grass control. DO NOT apply Spartan 4F as a postemergence treatment.

Postemergence Weed Control in Sunflowers

Postemergence herbicides work best under the following conditions: weeds are young and rapidly growing, high humidity, good soil moisture, and good spray coverage. Performance is reduced when weeds are stressed due to drought, disease or cultivation, or when weeds are too large. Select the most effective weed management program for the money you can afford to spend. The following tables should assist with selection of a program for controlling your weeds.

POSTEMERGENCE HERBICIDES FOR SUNFLOWERS

Herbicide	Rate/Acre Broadcast*		Remarks**
	Active Ingredient	Formulation	
Select 2 EC	0.094-.25 lbs.	6-16 oz	For best results, add 1% v/v Crop Oil Concentrate. The addition of AMS has shown improved control for difficult to control weeds like quackgrass, rhizome johnsongrass, and wild oats.
Clearfield Sunflowers Only			
Beyond	0.031 lbs.	4 oz	APPLY to Clearfield Sunflowers ONLY. Applications should be made to actively growing sunflowers during the 2-8 true leaf stage. A nonionic surfactant and a nitrogen based fertilizer must be added for optimum weed control.

EXPECTED WEED RESPONSE TO SUNFLOWER HERBICIDES

	Preplant Incorporated				Preemergence			Postemergence	
	Treflan	Prowl	Dual Magnum	Sonalan	Prowl	Dual Magnum	Spartan	Select	Beyond**
Annual Morningglories	6	6	2	3	6	2	8	0	7
Broadleaf Signalgrass	8	8	8	8	8	8	6	9	7
Cocklebur	0	0	0	1	0	0	6	0	8
Common Ragweed	0	0	0	3	0	0	5	0	6
Crabgrass, Foxtails,	9	9	9	9	9	9	7	9	7
Groundcherries/Black	0	0	7	8	0	7	--	0	--
Hophornbeam Copperleaf	0	0	4	--	0	4	--	0	3
Jimsonweed	0	0	0	3	0	0	7	0	6
Lambsquarters	7	8	6	8	8	6	7	0	5
Pigweed, Palmer	8	8	8	--	6	6	8	0	3
Pigweed, Smooth or	8	7	8	8	7	8	8	0	8
Prickly Sida	0	0	0	3	0	0	6	0	6
Seedling Johnsongrass	9	8	8	9	8	8	6	9	8
Sicklepod	0	0	3	--	0	3	6	0	0
Smartweed	4	3	0	6	3	0	6	0	6
Spotted Spurge	0	0	7	--	0	7	--	0	8
Spurred Anoda	0	0	0	--	0	0	--	0	--
Velvetleaf	2	2	0	--	2	0	7	0	8
Yellow Nutsedge	0	0	8	1	0	8	8	0	0

(u) Restricted Use Pesticide: Refer to label for precautions to be taken during handling and application.

KEY TO SYMBOLS: 0=No control or crop injury; 10=100% control or severe, yield-reducing crop injury; ---=data not available

(Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.)

***Apply ONLY to Clearfield sunflowers or crop injury will result.*

FORAGE CROP AND PASTURE WEED CONTROL

*HERBICIDES FOR ALFALFA AND OTHER LEGUME HAY CROPS**

Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
ALFALFA-PREPLANT, NO-TILL	Gramoxone Inteon 2SL (Paraquat)	0.63-1.0 lbs.	2.5-4.0 pts.	Use to control most annual and some perennial weeds prior to seeding. In sod, best results have been obtained with a split application (1.25-2.5 pts./A, 10 days to 3 weeks prior to planting, followed by 1.25 pts./A at planting). Apply in a minimum of 10 gals. of water/A. Add nonionic surfactant at 2 pts. per 100 gal. of spray mix.
	Touchdown/others** (Glyphosate 3ae)	0.75-2.25 lbs. (a.e.)	32-96 ozs. 3ae	For control of most annual weeds and better control of perennial weeds than Gramoxone Inteon. On most perennial weeds, glyphosate performs better in the fall than in the spring. See label for rates on individual weed species.
	Roundup WeatherMax** (Glyphosate 4.5ae)		22-64 ozs. 4.5ae	
Alfalfa, Birdsfoot Trefoil, Ladino or Red Clover - SEEDLING	Butyrac 200 2SC (2,4-DB)	1-1.5 lbs.	4-6 pts.	Controls small seedlings of musk thistle, turnips, cocklebur and ragweed. Does not control chickweed or henbit. Treat before weeds exceed 3 inches tall and when legume has two or more trifoliate leaves.
Alfalfa, Birdsfoot Trefoil, Ladino or Red Clover - SEEDLING or ESTABLISHED	Kerb 50WP (Pronamide)	0.75-1 lb.	1.5-2 lbs.	On pure alfalfa stands, use to control chickweed and several winter grasses such as ryegrass, cheat and annual bluegrass. Apply after legumes have reached the trifoliate stage. Do not apply if temperatures are above 55 F.
Alfalfa, SEEDLING or ESTABLISHED	Pursuit 2AS or 70DG (Imazethapyr)	0.063-0.094 lb.	4-6 ozs. 2AS or 1.44-2.16 ozs. 70DG	Apply overtop in seedling or established alfalfa to control several annual broadleaf weeds and some annual grasses. Higher rate required for grass control. Seedling alfalfa must be in the 2 trifoliate stage or larger. Apply before most weeds exceed 3 inches in height. Good control of pigweed, morningglory, cocklebur, foxtails and seedling johnsongrass. Always add nonionic surfactant at 1 qt./100 gal. of spray mix.
Alfalfa-ESTABLISHED	Butyrac 200 2SC (2,4-DB)	1-1.5 lbs.	4-6 pts.	Controls small seedlings of musk thistle, turnips, cocklebur and ragweed. Does not control chickweed, henbit, plantain or dock. Treat before weeds exceed 3 inches tall.
Alfalfa, Clover, Birdsfoot Trefoil - SEEDLING OR ESTABLISHED	Poast 1.5E (Sethoxydim)	0.19-0.28 lb.	1-2.5 pts. 1.5E	Apply low rate overtop to seedling or established crop for control of crabgrass, goosegrass, foxtails and other annual grasses. Use higher rate for johnsongrass and bermudagrass. A second application may be needed for control of regrowth. Always add crop oil concentrate at 2 pts./A.
Alfalfa, Birdsfoot Trefoil - SEEDLING OR ESTABLISHED	Select Max (Clethodim)	0.07 – 0.12 lb.	9 – 16 ozs.	Apply overtop to control crabgrass, fall panicum, broadleaf signalgrass or other annual grasses and johnsongrass. Use 9 to 16 ozs./A in seedling alfalfa and 12 to 16 ozs./A in established alfalfa for annual grasses. Use 12 ozs./A for johnsongrass or bermudagrass and follow with a second application if needed. See label. Always add crop oil concentrate at 1 qt./A.

EXPECTED WEED RESPONSE TO AT-PLANTING AND POSTEMERGENCE ALFALFA HERBICIDES

	Butyrac	Pursuit	Poast	Select Max	Gramoxone Between Cuttings
Annual grasses	0	7	9	9	7
Annual ryegrass	0	----	8*	8*	NA
Chickweed	2	----	0	0	NA
Cocklebur	8	8	0	0	6
Curly dock	1	----	0	0	2
Deadnettle	1	----	0	0	NA
Henbit	1	----	0	0	NA
Johnsongrass, Rhizome	0	6	7	9	2
Johnsongrass, Seedling	0	7	9	9	6
Lambsquarters	4	5	0	0	6
Morningglory	8	8	0	0	7
Musk thistle	7**	----	0	0	2
Nutsedge	1	3	0	0	2
Pigweed	6	9	0	0	7
Plantain	2	----	0	0	2
Ragweed	6	7	0	0	7

*Fall application

**Newly-emerged seedlings

NA = Not applicable

KEY TO RESPONSE RATINGS: 0=No control; 10=100% control; --=Data not available.

Ratings are based on labeled rates of each herbicide, applied at the optimum timing for each weed.

HERBICIDES FOR PASTURES*

Crop and Application Timing	Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
		Active Ingredient	Formulation	
Pasture, Bermudagrass - (only) DORMANT	Gramoxone Inteon 2SL (Paraquat)	0.25-0.5 lb.	1.0-2.0 pts.	Apply to dormant bermudagrass for control or suppression of emerged winter annual weeds. For control of little barley, apply before the mid-boot stage. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture, Bermudagrass - (only) ESTABLISHED	Metsulfuron 60DF (various brands)	0.0038-0.011 lb.	0.1-0.3 oz.	Bermudagrass should be established at least 60 days prior to application. Apply before weeds are 4 inches tall or in diameter. Use 0.1 to 0.2 ozs./A for control of bitter sneezeweed, buttercup, Carolina geranium, common chickweed, dandelion, horseweed, plantain, curly dock and several others. For dogfennel, common yarrow, and musk thistle, use 0.2 to 0.3 ozs./A. Add nonionic surfactant at 1 to 2 pts./100 gal. of spray mix. Avoid application during spring green-up.
Pasture - Seedling, GRASS ONLY	Aim 2EC (carfentrazone)	0.016-0.023 lb.	1.0-1.5 oz.	Apply to seedling forage grasses no sooner than 7 days following emergence. Use for control of a limited number of broadleaved weeds, under 4 inches tall, such as pigweeds, black nightshade, lambsquarters, and velvetleaf. Do not make applications less than 7 days apart. Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture - Seedling, GRASS ONLY	2,4-D Amine 4L	0.5- 0.75 lb.	1- 1.5 pts.	Can be used on all forage grasses for control of buttercup, thistles, wild turnip, horseweed and plantain. Apply when weeds are less than 4 in. tall and actively growing. This treatment will kill clovers and other legumes in the seedling stage. Do not apply if seedling grasses do not show good vigor. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture – Newly Established, GRASS ONLY	ForeFront R&P (Aminopyralid + 2,4-D)	0.06 + 0.5 – 0.11 + 0.87 lbs.	1.5 – 2.6 pts.	During the year of establishment, apply after grasses have begun to tiller, develop a good secondary root system, and show good vigor. Use for control of buttercups, thistles, cocklebur, pigweeds, bitter sneezeweed, horsenettle, tall ironweed, plantains, and several others. See label for individual weed rates. Will kill pasture legumes, but reseeding may be possible one year later (see label). Always add a nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture - Newly Established, GRASS ONLY	Grazon P+D (picloram + 2,4-D) For use only in approved TN counties. See map later in this section	0.14 + 0.5 – 0.2 + 0.75 lb.	2-3 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Apply after newly seeded grasses have begun to tiller and develop a secondary root system (usually around the 4-leaf stage of grasses). Use for thistles, horsenettle, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding may be possible one year later. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture - Newly Established, GRASS ONLY	Milestone (Aminopyralid)	0.063 - 0.11 lb.	4 - 7 oz.	During the year of establishment, apply after grasses have begun to tiller and develop a secondary root system, and show good vigor. Use for control of buttercups, thistles, cocklebur, pigweeds, bitter sneezeweed, horsenettle, tall ironweed, and several others. Weak on plantains. Control may be improved by tank mixing with 2,4-D. A limited number of weeds such as cocklebur and smartweed may be controlled with 3 oz./A. See label for individual weed rates. Will kill pasture legumes, but reseeding may be possible one year later. Always add a nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
	Rage D-Tech (Carfentrazone + 2,4-D ester)	0.008 +0.25 – 0.033+1.0	0.5 – 2.0 pts.	Broader spectrum control than Carfentrazone (Aim) applied alone. May be applied to newly established grasses beginning at the 5-leaf stage. Add non-ionic surfactant at the rate of 1qt./100 gal. of spray mix.
	Redeem R&P (triclopyr + clopyralid)	0.56 + 0.19 - 0.84 + 0.28 lb.	2-3 pts.	For use when products containing 2,4-D are not an option. Apply after newly seeded grasses have begun to tiller and develop a secondary root system (usually around the 4-leaf stage of grasses). Use for thistles, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding is usually possible the next growing season. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.

Pasture - Established, GRASS and WHITE CLOVER	2,4-D Amine 4L OR 2,4-D Low Volatile Ester 4EC	0.75-1.0 lb.	1.5-2 pts.	Can be used on all established mixtures of grass and white clover. Apply in March to early April for control of buttercup, musk thistle, dandelion and plantain. Apply in June for control of cocklebur, bitter sneezeweed, pigweed, spiny amaranth and ragweed. NOTE: The amine formulation is less volatile than low volatile ester formulations, but is less effective on hard-to-control species such as thistles, plantain and other perennials. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture - Established, GRASS and ANNUAL LESPEDEZA	2,4-D Amine 4L	0.5-0.75 lb.	1-1.5 pts.	Can be applied when lespedeza is 3 to 7 inches tall (normally mid-June). Earlier applications will result in more severe injury. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture – Established GRASS ONLY	Aim 2EC (carfentrazone)	0.023 – 0.031 lb.	1.5 - 2 oz.	Use for control of a limited number of broad leaved weeds, under 4 inches tall, such a pigweeds, black nightshade, and velvetleaf. Do not make applications less than 7 days apart. Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture - Established, GRASS ONLY	2,4-D Ester 4EC	2.0 lbs.	2 qts.	For wild garlic control, apply in October to mid-November or March to mid-April when daytime temperature is at least 65 F. Repeat twice annually for 2 years to eliminate wild garlic. This same programs is effective on buckhorn plantain. This rate of 2,4-D will kill all legumes, including established white clover. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Pasture –Established, GRASS ONLY	ForeFront R&P (Aminopyralid + 2,4-D)	0.06 + 0.5 – 0.11 + 0.87 lbs.	1.5 – 2.6 pts.	Use for control of buttercups, thistles, cocklebur, pigweeds, bitter sneezeweed, horsenettle, tall ironweed, plantains, beggarweed, and several others. See label for individual weed rates. Will kill pasture legumes, but reseeding may be possible one year later (see label). Always add a nonionic surfactant at the rate of 1 qt. /100 gal. of spray mix.
	Grazon P+D (picloram + 2,4-D) For use only in approved TN counties. See map later in this section.	0.14 + 0.5 – 0.2 + 0.75	2-3 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Use for thistles, horsenettle, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding may be possible one year later. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
	Milestone (Aminopyralid)	0.063 - 0.11 lb.	4 - 7 oz.	Use for control of buttercups, thistles, cocklebur, pigweeds, bitter sneezeweed, horsenettle, tall iron weed, and several others. Weak on plantains. Control may be improved by tank mixing with 2,4-D. A limited number of weeds such as cocklebur and smartweed may be controlled with 3 oz./A. See label for individual weed rates. Will kill pasture legumes, but reseeding may be possible one year later. Always add a nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
	Rage D-Tech (Carfentrazone + 2,4-D ester)	0.008 +0.25 – 0.033+1.0	0.5 – 2.0 pts.	Broader spectrum control than Carfentrazone (Aim) applied alone. Applications to the established grasses may be made up to the boot stage. Add non-ionic surfactant at the rate of 1qt./100 gal. of spray mix.
	Redeem R&P (triclopyr + clopyralid)	0.56 + 0.19 - 0.84 + 0.28	2-3 pts.	For use when products containing 2,4-D are not an option. Use for thistles, ragweed, cocklebur, buttercup and others. Will kill pasture legumes, but reseeding is usually possible the next growing season. On most weeds apply in March to mid-summer when actively growing. Most perennials will require higher rates (see label). Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.

	Surmount (picloram + fluroxypyr) For use only in approved TN counties. See map later in this section.	0.13 + 0.13- 0.5 + 0.5	1.5 – 6 pts.	This is a Restricted Use Pesticide (RUP) which requires a license to purchase and apply. Use for brush control plus residual broadleaf weed control. Especially good on blackberry, ironweed, horsenettle, thistles, etc. For woody plant control, apply in summer after plants have fully leafed out. For blackberry, apply in summer after fruit drop when good moisture is available. Usual broadcast rates for woody plant control: 3-4 pints/acre. Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
	PastureGard (triclopyr + fluroxypyr)	0.38 + 0.13 - 1.5 + 0.5	2-8 pts.	Use when brush or woody plants have begun to establish in pasture. May be tank-mixed with other products to improve control of herbaceous weeds. Excellent control of serecia lespedeza. Especially good on blackberry and other woody plants. For woody plant control, apply in summer after plants have fully leafed out. For blackberry, apply in summer after fruit drop when good moisture is available. Usual broadcast rates for woody plant control: 3-4 pints/acre. May be used on fencerows and for individual plant treatments of trees and brush. Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
Sorghum-Sudangrass Hybrids - POSTEMERGENCE	Weedmaster 3.87SL (Dicamba + 2,4-D Amine)	(0.125 + 0.36) to (0.5 + 1.4 lbs.)	1-4 pts.	Will usually give control of a wider range of weeds than either herbicide alone. Only partially effective on difficult-to-control perennials such as dock, brambles and horsenettle. High rates (see label) required for difficult-to- control species. Will kill all pasture legumes. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
	AAtrex 4L or 90WDG (Atrazine)	2.0 lbs.	2 qts. or 2.2 lbs.	Apply overtop once a stand is obtained and before weeds exceed 1.5 inches in height. Do not apply after crop is 12 inches in height. See label for surface and groundwater protection measures. Atrazine is not labeled on sweet sorghum.

*See Table for Grazing, Hay Cutting and Slaughter Restrictions.

Pasture and Grass Hay Herbicide Residues – Precautions and Reminders

Certain pasture herbicides (ForeFront R&P, Grazon P+D, Milestone and Surmount) contain active ingredients which may persist in treated soil, grass, harvested hay, and in cattle manure and urine. Numerous broadleaf crops, garden vegetables and ornamentals are very sensitive to minute amounts of these active ingredients. Because of this, careful planning is required regarding use of treated pastures and hay, in the movement of animals which have been grazing in treated pastures or which have been fed treated hay, and in the use of manure from animals which have been grazing in treated pastures or which have been fed treated hay. **These herbicides are for use in permanent grass pastures and grass hay fields only. They should not be used in fields which will be rotated to broadleaf crops.**

Manure from animals which have been grazing treated pastures or which have been fed treated hay should not be used to fertilize broadleaf crops or home gardens unless the animals have been withdrawn from treated pastures or hay (3 days for ForeFront R&P and Milestone, 7 days for Grazon P+D and Surmount). Likewise, treated hay should not be used for mulch in vegetable production, gardens or landscape beds. Do not transfer animals which have been grazing treated pastures or which have been fed treated hay to fields which will be rotated to sensitive crops unless they have been withdrawn from treated pastures or hay (3 days for ForeFront R&P and Milestone, 7 days for Grazon P+D and Surmount).

EXPECTED WEED RESPONSE TO PASTURE HERBICIDES

	LATE WINTER TO EARLY SPRING APPLICATIONS							FALL (NOVEMBER TO EARLY DECEMBER) APPLICATIONS					
	2,4-D Ester	2,4-D Amine	ForeFront R&P	Grazon P+D*	Milestone	Redeem R&P	Weedmaster	2,4-D Ester	2,4-D Amine	Grazon P+D*	Milestone	Redeem R&P	Weedmaster
Bedstraw	3	3	9	9	9	----	3	2	2	9	9	----	2
Broadleaf plantain	8	7	8	8	2	8	9	8	7	8	2	8	9
Buckhorn plantain	7	6	7	8	2	8	8	7	6	8	2	8	8
Bull thistle	8	7	9	9	9	9	8	9	7	9	9	9	9
Buttercups	9	8	9	9	8	9	9	9	8	9	8	9	9
Carolina geranium	5	4	9	9	9	----	7	4	3	9	9	----	6
Common chickweed	2	1	----	8	----	8	5	3	2	9	----	9	8
Curly dock	4	3	9	9	9	----	4	5	3	9	9	----	6
Dandelion	9	8	9	9	9	8	8	9	8	9	9	8	8
Henbit	2	1	----	8	----	8	4	3	2	8	----	8	7
Horseweed	9	8	9	9	9	9	9	9	8	9	9	9	9
Musk thistle	8	7	9	9	9	9	7	9	8	9	9	9	8
Prickly lettuce	8	7	9	9	9	8	8	8	6	9	9	8	8
Red sorrel	3	3	----	8	----	7	5	3	3	8	----	8	6
Sowthistle	8	8	9	9	9	----	9	7	7	9	9	----	8
Wild garlic	8	6	6	5	4	----	6	8	6	5	5	----	6

Key to Response Ratings: 0=No control; 10=100% Control; -- = Data not available

Ratings are based on labeled rates of each herbicide, applied at the optimum time for each weed.

*For use only in approved TN counties. See map later in this section

EXPECTED WEED RESPONSE TO PASTURE HERBICIDES: LATE-SPRING TO SUMMER APPLICATIONS

	2,4-D Ester	2,4-D Amine	ForeFront R&P	Grazon P+D*	Milestone	Redeem R&P	Weedmaster
Beggarweed	3	2	8	9	9	----	4
Bitter sneezeweed	8	7	9	9	9	----	8
Brambles	4	2	4	6	3	6	5
Chicory	5	4	----	8	----	8	8
Common cocklebur	9	9	9	9	9	9	9
Common lambsquarters	9	9	9	9	9	8	9
Cudweed	3	2	9	9	9	----	6
Dogfennel	6	6	7	8	4	7	7
Goldenrod	6	4	5	8	4	6	7
Horsenettle	3	2	8	9	8	5	4
Jimsonweed	8	7	8	4	8	9	8
Maypop passionflower	0	0	4	4	3	0	0
Milkweed	3	2	----	5	3	----	6
Oxeye daisy	5	4	9	8	9	----	8
Pigweeds	9	9	8	7	8	4	9
Pokeweed	5	4	8	4	8	2	6
Prickly pear	0	0	0	6	0	0	0
Prickly sida	4	4	8	5	8	----	5
Purple (perilla) mint	8	7	8	7	8	----	8
Ragweeds	9	8	9	9	9	9	9
Smartweed	7	5	9	----	9	----	8
Spiny amaranth	9	7	9	7	8	4	9
Sumpweed	9	8	----	7	----	8	9
Tall ironweed	7	6	8	6	8	6	7
Trumpetcreeper	0	0	0	0	0	0	0
White heath aster	7	5	----	8	----	----	7
White snakeroot	6	6	9	8	9	----	7
Wild carrot	7	7	8	8	6	8	7
Wingstem	8	7	9	8	9	----	8

Key to Response Ratings: 0=No control; 10=100% Control; -- = Data not available

Ratings are based on labeled rates of each herbicide, applied at the optimum time for each weed.

*For use only in approved TN counties. See map later in this section

SPOT TREATMENTS FOR SPECIFIC WEEDS IN PASTURES*

Weed	Herbicide	Amount of Formulation Per		Remarks
		1 gal.	100 gal.	
Bermudagrass	Roundup Ultra 4L (Glyphosate)	5 Tbsp.	2 gal.	Apply a 2% mixture of Roundup Ultra in water to actively growing bermudagrass when seed heads are present. Retreatment may be required. See labels for other glyphosate formulations.
Brambles	Metsulfuron 60DF (various brands)	0.01 oz.	1 oz.	Apply as a foliar spray to runoff in the spring after brush is fully leafed. Complete coverage of all foliage and stems is required for control. On tall, dense stands it is often necessary to spray from both sides to get adequate coverage. Add a nonionic surfactant at the rate of 1 to 2 qts./100 gal. of spray mix.
	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray to runoff in the spring after brambles are fully leafed. Complete coverage of leaves and green stems is needed.
	PastureGard (triclopyr + fluroxypyr) + surfactant	1.3 to 2 oz. + 4 tsp.	1 to 1.5 gal. + 2 qt.	Apply as a foliar spray after fruit drop in summer. Apply when moisture is adequate. Spray to wet, avoiding runoff. Spray all leaves and branches
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray to thoroughly cover all leaves and green stems in the spring after brambles are fully leafed.
	Roundup Ultra 4L (Glyphosate)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray in late summer or early fall after berries have set or dropped. See labels for other glyphosate formulations.
Buckbrush	Metsulfuron 60DF (various brands)	0.01 oz.	1 oz.	University of Tennessee demonstrations have shown good performance of Metsulfuron on buckbrush. See Remarks for Metsulfuron under Brambles section.
Honeysuckle	2,4-D Amine 4L	2 Tbsp.	3 qts.	Apply as a foliar spray when plants are actively growing, prior to bloom stage. Thorough coverage is needed. Add a nonionic surfactant at the rate of 2 qts./100 gal. of spray mix (2 Tbsp./1 gal.).
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray when plants are actively growing, prior to bloom stage. Complete coverage is necessary.
	Roundup Ultra 4L (Glyphosate)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray when plants are actively growing, at or beyond the bloom stage. Use the higher rate for plants that have reached the woody stage. Thorough spray coverage is needed. See labels for other glyphosate formulations.
Ironweed	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray in late spring to early summer when plants are actively growing. Thorough coverage is needed.
	PastureGard (triclopyr + fluroxypyr) + surfactant	1.3 oz. + 4 tsp.	1 gal. + 2 qt.	Apply as a foliar spray in late spring through early summer when plants are actively growing.
Multiflora Rose	Metsulfuron 60DF (various brands)	0.01 oz.	1 oz.	See remarks under brambles section for Cimarron.
	Crossbow 3EC (2,4-D ester+ Triclopyr ester)	2.5 to 4 Tbsp.	1 to 1.5 gal.	Apply as a foliar spray to runoff in spring when plants are at the early to mid-flower stage. Complete coverage of leaves and green stems is needed.

Multiflora Rose	PastureGard (triclopyr + fluroxypyr) + surfactant	1.3 to 2.6 oz. + 4 tsp.	1 to 2 gal. + 2 qt.	Apply as a foliar spray after plants have complete foliage. Apply when moisture is adequate. Spray to wet, avoiding runoff. Spray all leaves and branches.
	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray to runoff in spring when plants are at the early to mid-flower stage. Complete coverage of leaves and green stems is needed.
	Roundup Ultra 4L (Glyphosate)	2.5 Tbsp.	1 gal.	Apply as a foliar spray in the summer after full bloom stage. Apply before Japanese beetles or other leaf-feeding insects damage leaves. Complete leaf coverage is needed. See labels for other glyphosate formulations.
Osage orange (bois d'arc) Locust, Sassafras, Sumac, Sweetgum	Remedy 4EC (Triclopyr) + surfactant	4 tsp. + 4 tsp.	2 qt. + 2qt.	Apply as a foliar spray following full leaf development. Thorough coverage of all foliage is necessary for control.
Thistle, Canada	Metsulfuron 60DF (various brands)	0.01 oz.	1 oz.	Apply as a foliar spray in the spring when plants are at least 6 to 10 inches tall and before flowering. Thorough coverage is needed. Add a nonionic surfactant at the rate of 1 to 2 qts./100 gal. (2 to 4 tsp./gal).
Thistle, Musk	2,4-D Ester 4EC OR 2,4-D Amine 4L	2 Tbsp.	3 qts.	Apply ester formulation as a foliar spray to the point of runoff to small plants, less than 6-8 inches tall in late winter to early spring, or in the fall. If treating regrowth following mowing in the summer, use the amine formulation to reduce vapor drift.
Yucca	Remedy 4EC (Triclopyr) in diesel or fuel oil	5 Tbsp.	2 gal.	Prepare a 2% (by volume) solution of Remedy in diesel or fuel oil. Thoroughly wet the center of the plant including growing point and leaf bases to the soil surface. Complete coverage of leaves is not necessary.

**See Table for Grazing, Hay Cutting and Slaughter Restrictions*

Grazon P+D and Surmount Guidelines for Tennessee

Grazon P+D and Surmount are marketed in a limited number of counties in Tennessee. These counties were chosen because they have little or no acreage of cotton, tobacco, and certain other sensitive crops or because the counties have had a history of Grazon P+D use without non-target problem. The University of Tennessee does not recommend the use of Grazon P+D or Surmount outside of these counties. See figure on page 83 of this manual.

Grazon P+D and Surmount are safe on established cool-and warm-season grasses used for pasture and hay production. They provide good control of a number of broadleaf weeds. Both provide some residual control. The residual effect will depend on temperature, soil type, moisture and plant sensitivity. These products will kill all pasture legumes and re-seeding should not be attempted within one year of application.

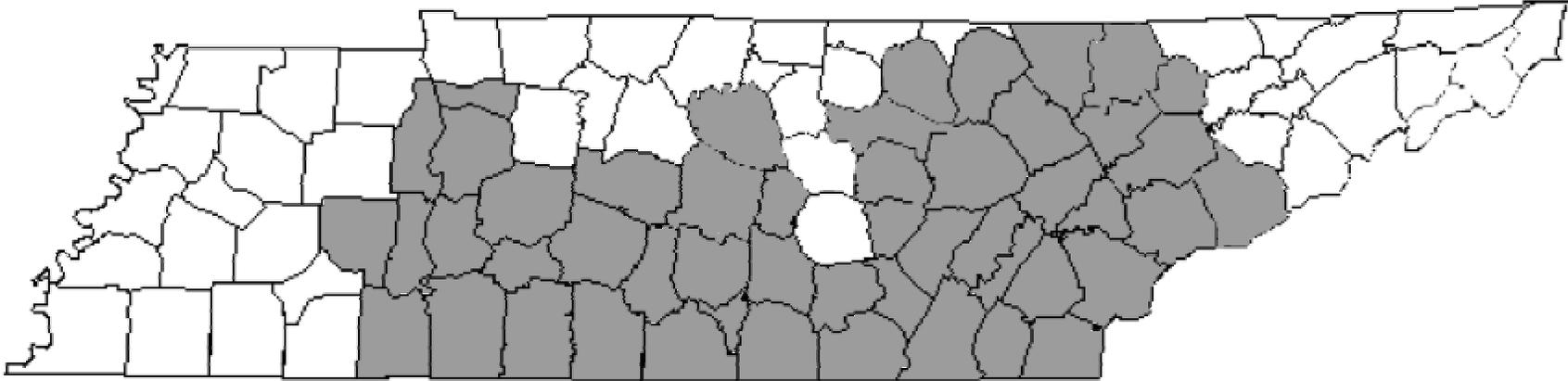
Grazon P+D and Surmount are restricted use pesticides, requiring applicators to have a commercial pesticide applicator certification card. They are restricted use due to the risk of injury to susceptible, non-target plants. Broadleaf crops, like cotton, tobacco, tomatoes and others, are very sensitive to both herbicides. Care must be taken in use of hay from fields treated with Grazon P+D or Surmount. Do not spread manure from animals which have grazed on, or have been fed hay on fields where picloram sensitive crops will be grown. Due to this sensitivity, it is recommended to use a sprayer dedicated to pasture applications only. Read and understand the label restrictions before use of this product.

Check List for Grazon P+D and Surmount Use

If all of the following are answered as “satisfactory,” then an application of Grazon P+D or Surmount may be recommended.

- Is the site located within one of the approved counties for this herbicide?
- Does the applicator have a restricted use applicator certification or use a custom applicator?
- Is the site properly buffered from sensitive crops and other off-target species, including ornamentals?
- Is there surface water (ponds or streams) on site? If so, does the applicator know to keep a 50 foot buffer?
- Has the required personal protective equipment been prepared?
- Are the wind conditions calm enough to prevent drift?
- Is rain in the forecast? If so, the application should be delayed.
- Does the applicator / land manager understand the grazing, haying and manure restrictions (see label)?
- Is there a risk of surface runoff of the herbicide, including erosion? (e.g., does the site contain steep slopes with bare soil?) If so, the application is not recommended.
- Is the site a permanent pasture? (If there is intention to rotate to any field crops, ornamentals, tobacco, vegetables or other vegetation, application is not recommended.)
- Does the applicator understand the sprayer cleanout requirements?

**Tennessee Counties Approved for
Grazon P+D and Surmount Application***



*Shaded counties are approved for Grazon P+D and Surmount application.

Anderson	Cannon	Grundy	Knox	Maury	Polk	Sevier	Wilson
Bedford	Coffee	Hamilton	Lawrence	McMinn	Putnam	Scott	
Benton	Cumberland	Hardin	Lewis	Meigs	Overton	Union	
Bledsoe	Decatur	Henderson	Lincoln	Monroe	Rhea	Van Buren	
Blount	Fentress	Hickman	Loudon	Moore	Roane	Wayne	
Bradley	Franklin	Houston	Marion	Morgan	Rutherford	White	
Campbell	Giles	Humphreys	Marshall	Perry	Sequatchie	Williamson	

Grazing, Hay Cutting and Animal Slaughter Restrictions for Pasture Herbicides (Days to Wait or Withdraw Animals)

Herbicide	Beef cattle, Non-lactating dairy cattle and other livestock			Lactating Dairy Cattle		
	Grazing	Hay Cutting	Slaughter	Grazing	Hay Cutting	Slaughter
Aim	0	0	**N	0	0	**N
Metsulfuron	0	0	0	0	0	0
Crossbow*	0	7	3	14	1 yr.	3
ForeFront R&P	0	7	3	0	7	**N
Gramoxone Inteon (dorm. bermudagrass)	40	40	**N	40	40	**N
Grazon P+D (picloram + 2,4-D)	0	30	3	7	30	3
Milestone	0	0	3	0	0	3
PastureGard (triclopyr + fluroxypyr)	0	14	3	Next growing season	14	3
Rage D-Tech	0	30	3	7	30	3
Redeem R&P	0	7	3	14	1 yr.	3
Remedy	0***	7***	3	14***	1 yr.	3
Roundup WeatherMax (spot treatment)	14	14	**N	14	14	**N
Surmount (picloram + fluroxypyr)	0	30	3	Next growing season	30	3
2,4-D	0	30	3	7	30	3
Weedmaster	0	37	30	7	37	30

*2 gals./A or less

**N = no information on label

*** = 2 qt./A or less

Weed Control in Switchgrass Grown for Biofuel Feedstock

The Tennessee Biofuels Initiative is a unique partnership among the State of Tennessee, The University of Tennessee, Oak Ridge National Laboratory (ORNL), and DuPont Danisco Cellulosic Ethanol LLC. The centerpiece of the program is a 250 thousand gallon per year cellulosic ethanol pilot research plant under construction in Vonore. One of the feedstocks which will be used for ethanol production at this plant will be switchgrass, and the University of Tennessee has contracted with area producers to grow it. The following weed control suggestions are intended for those producers who are growing switchgrass for biofuel production.

Weed Competition during establishment

Our previous experience with switchgrass establishment for wildlife food plots and subsequent experience with switchgrass grown for biofuel has shown that the stand is slow to establish, and weed problems during the first two years, particularly during year one, can be severe. While it was found that most broadleaf weeds can be effectively managed with existing herbicides used in grass pastures and hay fields, grass weeds such as large crabgrass, broadleaf signalgrass, goosegrass and johnsongrass are more challenging.

Site selection and planning

As with other crops, one of the first steps in a well-planned weed management program begins with site selection and preparation. Because switchgrass is not a strong competitor with weeds during the first two years of growth, producers are encouraged, if possible, to avoid planting switchgrass into fields which have a history of heavy weed pressure. If this is not possible, a number of steps can be taken during the year prior to switchgrass planting to reduce weed pressure. For converted crop fields, producers are encouraged to consider planting these fields to Roundup Ready soybeans during the year prior to switchgrass. This will allow the use of sequential applications of glyphosate to control weeds. For converted pastures with a history of broadleaf weed pressure, several effective herbicide options are available to control broadleaf weeds and still utilize these pastures for grazing during the year prior to switchgrass.

Weed Control in Switchgrass Grown for Biofuel Feedstock (continued)

Plant no-till if possible

Because many candidate switchgrass fields in East Tennessee are rolling and subject to soil erosion, producers are encouraged to establish switchgrass using no-till. In converted cropland, apply at least one burndown application of glyphosate or Gramoxone Inteon in the spring prior to planting. As with other no-till crops, make the burndown choice based upon weeds present. Use the burndown table of this publication in the selection process (see table of contents for page number). For converted pastures where no fall grazing is planned, consider making an application of glyphosate in the fall prior to planting switchgrass. Research at the University of Tennessee has shown that tall fescue is much easier to kill in the fall than in the spring. Also, this same research has shown that soil erosion over the winter is not a problem where a dense tall fescue sod has been killed during the previous fall. Orchardgrass is more difficult to kill than is tall fescue. A follow-up application of glyphosate will likely be needed. Gramoxone Inteon is weak on orchardgrass. Also, a follow-up application may be required the next spring to control winter weeds which can emerge after the fall glyphosate application.

Conventional tillage situations

Certain weeds such as bermudagrass, dallisgrass and broomsedge cannot be effectively controlled in no-till. These are warm season perennial grasses which will be strong competitors with switchgrass seedlings. **Avoid fields which are heavily infested with bermudagrass.** Producers are encouraged to consider tillage in the fall prior to planting switchgrass in fields infested with dallisgrass and broomsedge. Producers are also strongly advised to sow a wheat cover crop following fall tillage so as to reduce soil erosion over the winter. The wheat cover crop may be easily killed with an application of glyphosate the following spring prior to planting switchgrass.

Herbicides for use in switchgrass

Currently there are no labeled preemergence herbicides for use in switchgrass grown for biofuel in Tennessee, but there are a number of postemergence options. Because of this, producers are encouraged to closely monitor newly-planted fields for weed emergence. While weeds should be controlled while they are small, care must be taken regarding use of most herbicides on small, seedling switchgrass so as to minimize the chances of crop injury. In certain situations, clipping weeds at a height above the switchgrass may be an option to open the canopy and allow sunlight to reach the crop. This will allow the switchgrass to grow to a stage where it will be more tolerant of herbicides such as Accent. As with other perennial grasses, herbicide tolerance of switchgrass is related to the plant's developmental stage. Plants which have developed a healthy secondary root system and which have begun to tiller are tolerant of most labeled herbicides. The following table contains suggested postemergence herbicides for use in switchgrass.

Herbicides for use in Switchgrass grown for biofuels

Herbicide	Rate/Acre Broadcast		Weeds Controlled, Remarks and Precautions
	Active Ingredient	Formulation	
AAtrex 4L (atrazine) Restricted use herbicide Special Local Need 24 (c) Label for the following Tennessee counties only: Anderson, Blount, Bradley, Cumberland, Gibson, Greene, Hamilton, Knox, Loudon, Meigs, McMinn, Monroe, Morgan, Polk, Rhea, Roane and Sevier.	1-2 lb.	1-2 qts.	For use only in the year of establishment or the year following establishment. Apply overtop to control small broadleaf weeds and a limited number of grasses. Use 1 qt./A on soils containing from 1-2% organic matter, and 2 qt./A on soils with 2% or more organic matter. Use only on loam, silt loam, silty clay loam, clay loam, and silty clay soils with at least 1% organic matter. Add crop oil concentrate at the rate of 1 gal./100 gal. of spray mix. <u>Do not feed treated switchgrass for hay or allow cattle to graze on areas that have been treated.</u>
Accent 75DF (nicosulfuron) Special Local Need 24 (c) Label for Tennessee.	0.031 lb.	0.67 oz.	Apply overtop to control barnyardgrass, broadleaf signalgrass, foxtails, fall panicum, ryegrass and johnsongrass. Does not control crabgrass, bermudagrass, nor dallisgrass. Expect to see some crop injury, but this usually is temporary. Applications can be made any time after the switchgrass has reached the 2-leaf stage. Delaying applications can reduce crop injury but may result in poor control of large weeds. Do not make more than 2 applications per year. Always add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix. Do not apply with crop oil concentrate. Do not apply if switchgrass does not show good vigor. <u>Do not feed treated switchgrass for hay or allow cattle to graze on treated areas.</u>
2,4-D Amine 4L	0.5- 0.75 lb.	1- 1.5 pts.	Can be used on seedling switchgrass for control of cocklebur, ragweed, pigweed, sicklepod and a few other summer annual weeds. Apply when weeds are less than 4 in. tall and actively growing. Do not apply if seedling switchgrass does not show good vigor. Add nonionic surfactant at the rate of 1 qt./100 gal. of spray mix.
ForeFront R&P (Aminopyralid + 2,4-D)	0.06 + 0.5 – 0.11 + 0.87 lbs.	1.5 – 2.6 pts.	During the year of establishment, apply after switchgrass has begun to tiller and develop a good secondary root system. Do not apply if switchgrass does not show good vigor. Use for control of thistles, cocklebur, pigweeds, ragweed, sicklepod, horsenettle, tall ironweed, and several others. See label for individual weed rates. Always add a nonionic surfactant at the rate of 1 qt. /100 gal. of spray mix.
Metsulfuron 60DF (various brands)	0.004 lb.	0.1 oz.	Apply at 0.1 oz./A anytime after emergence of switchgrass during the year of establishment. Higher rates can be used once switchgrass is established (second or later years after planting). See label. Add nonionic surfactant at the rate of 1-2 pt./100 gal. of spray mix. Do not apply with crop oil concentrate. There are no grazing or hay cutting restrictions for Metsulfuron.
Milestone (Aminopyralid)	0.063 - 0.11 lb.	4 - 7 oz.	For use primarily in areas where 2,4-D drift is of concern. During the year of establishment, apply after grasses have begun to tiller and develop a secondary root system, and show good vigor. Use for control of thistles, cocklebur, pigweeds, ragweed, sicklepod, horsenettle, tall ironweed, and several others. A limited number of weeds such as cocklebur and smartweed may be controlled with 3 oz. /A. See label for individual weed rates. Always add a nonionic surfactant at the rate of 1 qt. /100 gal. of spray mix.
PastureGard (triclopyr + fluroxypyr)	0.38 + 0.13 - 0.57 + 0.195	2- 3pts.	For use in converted pastures or other fields where sericia lespedeza, brambles and woody plants are troublesome. Apply in summer after plants have fully leafed out. Always add nonionic surfactant at the rate of 1 qt. /100 gal. of spray mix. For spot sprays, mix at the rate of 1 gal. of PastureGard + 1 qt. of nonionic surfactant / 100 gal. of spray mix and spray to thoroughly wet the foliage.

WEED MANAGEMENT IN FARM PONDS

G. Neil Rhodes, Jr. and Ronald E. Blair, Extension Director Henderson Co.

Introduction

Ponds are valuable resources in our state. Many producers and landowners rely on them for watering livestock, irrigating tobacco, vegetables and other crops, recreational fishing and swimming. Aquatic plants (algae and higher plants) are essential for a balanced aquatic ecosystem. First and foremost, plants (particularly planktonic algae) provide oxygen for fish and other aquatic animals, and they provide cover and breeding habitat for these same organisms. Unfortunately, this balance is often hard to maintain and aquatic plants can become weeds due to excessive growth.

Aquatic weeds may be divided into four general groups: algae (planktonic, filamentous); floating weeds (duckweed, watermeal, water hyacinth, etc.); submersed weeds (naiads, pondweeds, coontail, hydrilla, watermilfoil, etc.); and immersed or marginal weeds (cattail, waterlilies, grasses, arrowhead, etc.).

Aquatic weed management begins with pond construction. Ponds which have extensive areas of shallow (less than 2 feet deep) water are prone to have weed problems due to ready penetration of sunlight to the bottom of the pond. Planktonic algae growths can actually reduce certain submersed weed problems in properly constructed ponds due to shading of the bottom. This is one of the reasons why fertilization of farm ponds is recommended. Fertilization must, however, be done properly. For information on farm pond fertilization, please obtain a copy of Publication 1231 - *Management of Farm Ponds in Tennessee* from your local county extension office. In general, aquatic weeds grow in response to nutrient inputs. Ponds which receive runoff from livestock holding areas or fertilized fields, or ponds where livestock have free access will usually have weed problems every year. The most common problems in these areas are algae (planktonic and filamentous), duckweed and watermeal. Herbicide treatments will only provide temporary control. Grass carp may be useful for biological control of certain aquatic weeds. In general, these plant-eating fish are much more effective on submersed weeds than on immersed or floating weeds. Information on grass carp and stocking rates may be found also in Publication 1231. Also, consider contacting the Southern Regional Aquaculture Center (<http://srac.tamu.edu>) for a complete listing of current aquatic weed control fact sheets.

Triploid Hybrids

New ponds can be stocked with 2- to 6-inch grass carp at a rate of 5 fish/acre as a preventative measure. In ponds with existing bass populations, grass carp at least 8 to 10 inches long must be stocked to avoid having them eaten by the bass. If you have a problem with a weed that grass carp are known to consume, stocking rates of at least 15 to 30 fish/acre are required to provide control within a year or two. When more immediate results are required, applying a herbicide followed by stocking of grass carp (once the treated weeds have decomposed) may be the best option. Grass carp are capable of fast growth and can reach 20 to 25 pounds in weight. As these fish become older and mature, their rate of weed consumption declines, and additional fish should be stocked every 3 to 5 years.

Aquashade

Aquashade is a non-toxic dye that controls filamentous algae by blocking light penetration for up to six weeks after application. It may be used in lakes, ponds, ornamental ponds and fountains, and commercial fish ponds that have little or no outflow. Apply 1.0 gallon of Aquashade per one acre of water that averages 4.0 feet deep in the early spring before weed growth begins, or apply when plants are seen on the bottom of the pond. Additional applications will be necessary through the year. Aquashade is non-toxic to livestock.

Watermeal

A surface layer of this floating weed will prevent sunlight from reaching into the pond. As a result, algae and submerged plants can no longer produce oxygen through photosynthesis. This lack of oxygen can greatly stress or even kill fish. This plant is typically found in nutrient rich environments ranging from trees around the edge, failing septic fields, or livestock (including waterfowl) waste. Bottom sediments will be black and have a disagreeable odor. Watermeal can be spread to ponds by "hitchhiking" on livestock, pets, and birds. Herbicidal control has not been consistent. Reducing nutrient loading and consider using tilapia. Tilapia, however, will not overwinter in Tennessee. Restocking will be required.

Filamentous Algae

This group of algae, commonly referred to as "pond scum" or "moss", form mats on the pond surface in early spring. This algae usually begins along edges or in the bottom, often attached to underwater structure. The use of copper complexes, including granules, have given excellent control to most species when applied to the area in early spring. Barley straw applied at 250 pounds/acre has shown mixed results.

Herbicides

Aquatic herbicides should be used only as a last resort. The use of these chemicals is very restrictive due to use of water for domestic consumption, livestock watering, irrigation, swimming and fishing. **It is essential that aquatic herbicides be used in strict accordance with label directions.** Also, just because a herbicide is labeled for one aquatic site does not mean that it can be used in all aquatic situations. For example, some materials are labeled for ditch banks, but not for ponds or lakes. Most herbicides also have specific waiting periods between application and various uses of the water (fishing, irrigation, livestock watering, etc.). **Be sure to thoroughly read the label prior to purchasing aquatic herbicides. Do not attempt to use them if you do not understand the instructions on the label, or if you do not intend to follow them.** Most aquatic herbicides, when used according to the label, are not toxic to fish. The greatest risk of harm to fish comes from oxygen depletion which occurs as the weeds die. **Applications should be made early in the season.** At this time, weeds are actively growing, the amount of vegetation for decay is lower, and the cooler water generally contains higher levels of dissolved oxygen. Most aquatic weeds begin growth in the early spring when water temperatures are 55 to 60 F. **Early treatment, treatment of only portions of the pond at one time, and mechanical aeration will reduce the risk of oxygen depletion.**

Copper Sulfate

Copper sulfate is recommended for algae control in this publication. However, even the low rates listed on the label for “soft” waters could cause a fish kill in very low alkalinity waters common in Tennessee farm ponds, particularly if large areas are treated at one time. Trout are particularly sensitive to copper.

Where loss of fish is of concern, it is important to check the total alkalinity of the water before recommending treatment with copper sulfate. If the alkalinity is below 50 mg/L, copper sulfate should not be used. It is important to treat only one-third of a body of water at a time to avoid dissolved oxygen problems or direct toxicity to fish. Fish can sense copper in the water and will move away from treated areas. Mechanical aeration will reduce the risk of oxygen depletion.

Aquatic herbicide rates are expressed in different ways, depending on the individual chemical. Some are expressed as amount of chemical per surface acre of water, and others are expressed as amount per acre-foot of water. One acre-foot of water is one surface acre of water, one foot deep. For example, a three-acre pond averaging five feet deep would contain 15 acre-feet of water. Other rates are expressed as parts per million (ppm). One ppm is 2.7 lbs. of chemical per acre foot.

RESTRICTIONS AND WAITING PERIODS

Herbicide	Restrictions
Tennessee Brand, K-Tea, Komeen, other trade names (Copper sulfate or liquid copper complexes)	No restrictions on use of treated water. If treated water is to be used as a source of potable water, the copper residual must not exceed 1 ppm (4 ppm copper sulfate pentahydrate). Check tolerance of crop to copper applied in irrigation water. Trout are very susceptible to copper. Toxicity to other fish increases with decreasing hardness of water.
Reward (Diquat)	Fishing and Swimming: no restrictions. Livestock Watering: 24 hrs. Human consumption, and use of treated water for irrigating turf and ornamentals: 3 days for 2 gal./surface acre; 2 days for 0.75 to 1.0 gal./surface acre; 1 day for 0.5 gal./surface acre or less. Irrigating food crops: 5 days, regardless of rate.
Navigate (2,4-D)	Do not apply to water used for irrigation, agricultural sprays, watering dairy animals or domestic water supplies.
Rodeo (Glyphosate)	Do not apply within 0.5 mile of an active, potable water intake. No restrictions on the use of treated water for irrigation, recreation or domestic purposes.
Sonar (Fluridone)	Fishing, Swimming, Livestock Watering: no restrictions. Irrigation restrictions are based upon concentration in water. See label. A waiting period of 30 days may not be adequate for sensitive crops such as tobacco, tomatoes and peppers.

AQUATIC HERBICIDES FOR WEED CONTROL IN FARM PONDS

Weed	Herbicide	Amount of Formulation	Precautions and Remarks*
ALGAE, blue-green	Copper sulfate (various)	3-6 lb/acre foot see label	Apply as a surface spray dissolved in at least 3-5 gals. of water. For best results, apply on a clear day. Do not apply to muddy water. Warning: Copper is toxic to fish.
ALGAE, filamentous, planktonic, chara, etc.	Copper sulfate (various)	3-6 lb/acre foot see label	Same as under Algae, blue-green. For best results break up floating mats of filamentous algae before treatment. Warning: Copper is toxic to fish.
	K-Tea, Komeen (Copper complex)	0.2-1.0 ppm see label	Dilute with water in ratio of at least 9 to 1 and apply uniformly. For best results, apply on a clear day and break up floating mats of filamentous algae before treatment. Warning: Copper is toxic to fish.
	Reward (Diquat)	2 gal/surface acre see label	For suppression of certain filamentous algae - <i>Pithophora</i> spp. and <i>Spirogyra</i> spp. Check label for application instructions. For best results, break up floating mats before treatment.
Submersed Weeds	Reward (Diquat)	2 gal/ surface acre see label	Weeds controlled: bladderwort, coontail, elodea, naiads, pondweeds. Apply early in season by pouring directly into water in strips or as a diluted spray in water. Not effective in muddy water.
	Navigate (2,4-D)	100-200 lb/surface see label	Rate depends upon weed to be controlled and depth of water. Check labels for species and rates. Apply uniformly with a rotary seeder.
Floating Weeds (except watermeal)	Reward (Diquat)	0.5-0.75 gal/ surface acre see label	Weeds controlled: pennywort, salvinia, water hyacinth, water lettuce. Apply in a spray volume of 150 to 200 gal of water per acre plus 1 pt. nonionic surfactant per acre. Spray volume may be reduced to 100 gal. for pennywort.
		1 gal/surface acre see label	For duckweed control - apply in a spray volume of 50 to 150 gal of water per acre. Take care to cover all plants on water and damp marginal areas. Will require retreatment. Add nonionic surfactant at 1 pt./acre.
Floating Weeds (duckweed and watermeal)	Sonar (Fluridone)	See label	Apply maximum labeled rate for the average depth of pond. Do not apply when there is substantial outflow from the pond. Take care to cover all plants in damp and marginal areas. Not effective as a spot treatment. See label for other weeds controlled.
Immersed and Marginal Weeds	Navigate (2,4-D)	150-200 lb/surface area see label	Weeds controlled: spatterdock, water chestnut, water lily, water shield. Rate depends upon species and depth of water. Check label. Apply early, when weeds are actively growing with a rotary seeder. Spatterdock may require retreatment.
	Reward (Diquat)	1 gal/surface area see label	For control of cattails in ponds or lakes. For top kill, apply in 100 gal of water per acre with 1 pt. nonionic surfactant. Apply before flowering for best results. Thorough coverage is necessary. Retreat as needed.
	Rodeo 5.4 lb/gal (Glyphosate)	see label	For control of cattail, spatterdock, American lotus, water primrose and several other aquatic weeds, prepare a 0.75% by volume spray mixture (3 qts./100 gal. of spray mix) and spray to wet foliage. For cattail control, apply at or following the bloom stage. Always add a nonionic surfactant, labeled for use with herbicides, at 2 qts./100 gal. of spray mix.

*Also see comments for specific herbicides under "Restrictions and Waiting Periods."

PROPER SPRAYER SYSTEM CLEANING

Small amounts of herbicides left in sprayers can cause serious damage to sensitive crops. Each year we get many calls and make numerous farm visits to investigate excessive crop injury. Too many times the crop injury is traced to insufficient or improper sprayer cleaning or decontamination. These unfortunate, preventable mistakes cost growers and commercial applicators time and money.

Traces of phenoxy (and phenoxy type) herbicides commonly used for pasture weed control such as 2,4-D, Banvel, Weedmaster, Crossbow, etc. can create serious problems if sprayed on crops such as tobacco, cotton, tomatoes and many other vegetables. Most of these herbicides, particularly the ester formulation of 2,4-D and Crossbow, are difficult to thoroughly wash out of a sprayer. For this reason, we recommend using a dedicated sprayer for pasture and brush control herbicides. The “new” herbicide chemistry (sulfonyleureas and imidazolinones) has created sprayer cleaning challenges. Herbicides such as Accent, Classic, Exceed, Staple, Scepter and others have a high unit activity (very active at a small amount per acre). The bottom line is that it does not take much of these materials to cause serious damage to non-target, susceptible crops.

Often times we talk about tank cleaning. Remember that the tank is only one part of the sprayer. You can do an excellent job of cleaning the tank, but if residues are left in the hoses, strainers and pump, serious damage can still occur. Herbicides can be absorbed into the lines, in addition to polyethylene or fiberglass tanks, where they can remain for a long time. We have also encountered problems with some of the dry flowable and wettable powder formulations building up on the bottoms of spray tanks, particularly in sprayers with inadequate agitation. The longer a spray mix is left in the system, the greater is the potential contamination problem. Sprayers should be cleaned as soon as practical following use. Herbicide spray mixtures should never be allowed to dry in the sprayer.

Many herbicide labels have sprayer cleanup recommendations, specific for that chemical or family of chemistry, on the label. For example, the sprayer cleanup guidelines on the Classic label outline a procedure using household ammonia at 1 gal. of ammonia for each 100 gallons of water. The guidelines for other sulfonyleurea herbicides are similar. Ammonia is also useful for helping to clean 2,4-D ester residues out of the sprayer, in that the ammonia actually changes the less soluble ester into a more highly water soluble ammonium salt of 2,4-D. Remember, for personal safety's sake, NEVER mix ammonia and chlorine bleach, even if you are outside. A variety of commercial tank cleaners are available and most do a good job, if properly used, of cleaning a sprayer. They are just like ammonia, in that plenty of water and proper procedure are required.

A general, stepwise procedure for cleaning a sprayer is as follows:

1. Drain spray equipment. Rinse the tank and flush hoses, boom and nozzles with clean water. Loosen and physically remove any visible deposits.
2. Fill the sprayer with clean water and add commercial tank cleaner (or one gallon household ammonia per 100 gallons of water). Flush the hoses, boom and nozzles. Shut-off the boom and then top-off the tank with water. Let the material circulate for at least 15 minutes, then flush the hoses, boom and nozzles again. Drain the tank.
3. Remove screens, strainers and tips and clean in a bucket of water. (remember to wear gloves to prevent chemical exposure)
4. Repeat step 2. **If possible, allow the water+cleaning solution to sit in the tank, booms and lines overnight. This helps especially with phenoxyes.**
5. Thoroughly rinse the tank, hoses, boom and nozzles.

Remember to clean all other associated application equipment. Personal protective equipment, as outlined on the label for that herbicide, should be worn during clean-up. Do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.

Sprayer Calibration

Accurate application of herbicides is essential to adequately control weeds, avoid excessive crop injury and to get the most for your investment in chemicals. This has become even more critical in recent years as we have seen some herbicide rates go from pounds per acre to fractions of one ounce per acre. Sprayer calibration, unfortunately, is often neglected or avoided. There are many ways to calibrate a sprayer, some more difficult than others. The bottom line is if you have a reliable method with which you are comfortable, stick with it. The following information is provided as a guide to a couple of simple, straightforward methods.

Regardless of the method, sprayer calibration should be done with clean water, not with the chemical mix in the spray system. Prior to beginning calibration, thoroughly clean your sprayer. Procedures for this are outlined on page 87 of this publication. Also, be sure to check for nozzle uniformity, as defects or uneven wear may cause some nozzles to put out significantly more than others of the same type. To do this, catch and measure the output of *each* nozzle for a specific length of time (30 seconds, 1 minute, etc.) and determine the average output per nozzle (total combined output of all nozzles divided by the number of nozzles). Discard and replace any nozzle that varies more than 5 percent from the average.

Spray-an-acre method

This is perhaps the most direct method. The procedure is as follows:

1. Measure and flag the boundaries of one acre of ground similar to your fields.
2. Select a gear and engine speed combination which will allow you to comfortably drive across your fields and develop adequate spray pressure for the particular spray nozzles on your rig.
3. On level ground, fill the spray tank completely or to a recorded mark on the tank or sight gauge.
4. With the sprayer operating, drive the rig over the measured acre while spraying water at the preselected engine speed and gear combination.
5. Return to the level spot where you filled the sprayer. Measure how many gallons of water it takes to refill the sprayer or to return the water level to your recorded mark. This number of gallons equals gallons per acre.

A modification of this procedure involves spraying one-half acre. Follow the above procedure and multiply the gallons required to refill by 2.

1/128 acre method

This is perhaps the most frequently used and quickest method of calibration. Unlike the previous method, it involves measuring a specific driving distance rather than an area. Follow these steps to calibrate by the 1/128 acre method.

1. Measure a specific distance in a field according to the table below. Select a driving distance which matches the nozzle spacing on your boom (for broadcast sprays) or row spacing you use (for band applications). The distance should be measured in a field typical of those you will be spraying.

Nozzle or Row spacing (inches)	Distance to time for calibration (feet)	Nozzle or Row spacing (inches)	Distance to time for calibration (feet)
40	102	26	157
38	107	24	170
36	113	22	185
34	120	20	204
32	127	18	227
30	136	16	255
28	146	14	291

2. Select a gear and engine speed combination which will allow you to comfortably drive across your fields and develop adequate spray pressure for the particular nozzles on your rig. Drive the measured distance at the preselected gear and engine speed combination and record the time required to drive the distance in seconds. To improve precision, you may want to time two separate runs and take the average of two runs.
3. Park the sprayer and using a measuring cup or bucket, catch the spray output from a single nozzle for the length of time it took you to drive the measured distance in step one. Be sure that the sprayer is running at the same engine speed and spray pressure. Note: For banding rigs where you used row spacing to determine the distance in step 1 and where more than one nozzle is directed to the row, catch the output for *all* nozzles directed to a single row.
4. The total amount of water, measured in ounces, collected per nozzle or row in step 3 equals gallons per acre (GPA).

Determining how much chemical to add to the tank

Now that you have successfully calibrated your sprayer, the next step is to determine how much chemical you need to add to the tank.

1. Divide the tank capacity by gallons per acre to calculate the number of acres a full tank can spray.

$$\frac{\text{Tank capacity (gallons)}}{\text{GPA}} = \text{Number of acres covered by one full tank}$$

2. Multiply the recommended herbicide rate (pts./A, oz./A, lbs./A, etc.) by the number of acres covered by a full tank.
3. Note: All herbicide rates in this weed control manual are expressed as *broadcast rates*. For band applications, you must adjust the rate using the following formula:

$$\frac{\text{Band Width} \times \text{Broadcast Rate}}{\text{Row Width}} = \text{Band Rate}$$

Use the previous formula to adjust rates if you have calibrated your sprayer on a *row width* basis for band applications.

Calibration Examples

Broadcast Application

A producer plans to spray Gramoxone Max plus nonionic surfactant for burndown on corn ground. His sprayer has a uniform nozzle spacing of 18 inches. He has thoroughly cleaned his sprayer and replaced all non-uniform nozzles.

1. From the chart, note that the distance to drive is 227 feet. Measure this distance in the field to be sprayed.
2. At the desired engine speed and gear combination, let's assume it took 39 seconds to cover 227 feet. This is 4 mph.
3. At the same engine speed and spray pressure, catch the output in ounces. Our producer caught 20 ounces during the 39 second time period. Output is therefore 20 GPA.
4. After reading the Gramoxone Max label and the weed control manual recommendations for corn, he decides to spray Gramoxone Max at 1.5 pts./A plus nonionic surfactant at 1 qt./100 gallons of spray mix. Let's assume he has a 300 gallon spray tank.

$$\frac{\mathbf{300\ gal\ per\ tank\ load}}{\mathbf{20\ GPA}} = \mathbf{15\ acres\ covered\ by\ one\ tank\ load}$$

$$\mathbf{1.5\ pts./A\ X\ 15\ acres = 22.5\ pints\ (2.8\ gallons)\ of\ Gramoxone\ Max\ per\ tank\ load}$$

What about the surfactant?

$$\mathbf{300\ gal.\ X\ 1\ qt.\ / 100\ gal = 3\ qts.\ per\ tank\ load}$$

Band Application

A producer wants to apply Staple plus nonionic surfactant in a 19 inch band on 38 inch rows. His banding rig is set up with three nozzles directed to the band on each row. The sprayer has been thoroughly cleaned, and the nozzles are uniform in output.

1. The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Let's assume it took 18 seconds (4 mph).
2. Park the sprayer and at the same engine speed and pressure, collect the output of each of the three nozzles for 18 seconds. If the combined total output of the three nozzles is, for example, 25 ounces, the sprayer is applying 25 gallons per acre.
3. The sprayer has a 200 gallon tank. The *broadcast rate* for Staple is 1.2 oz./A, and nonionic surfactant is to be added at 1 qt./100 gal. of spray mix.

$$\frac{\mathbf{200\ gal.\ tank}}{\mathbf{25\ GPA}} = \mathbf{8\ acres\ covered\ per\ tank}$$

4. Now, reduce the rate for a 19 inch band.

$$\frac{\mathbf{19\ inch\ band}}{\mathbf{38\ inch\ row}} \mathbf{X\ 1.2\ oz./A = 0.6\ oz.}$$

$$\mathbf{8\ acres\ X\ 0.6\ oz./A = 4.8\ oz.\ Staple\ per\ tank}$$

$$\mathbf{200\ gallons\ X\ 1\ qt./100\ gal. = 2\ qts.\ nonionic\ surfactant\ per\ tank}$$

Note that since the surfactant rate in this example is based on amount per volume of spray mix, rather than amount per acre, it is calculated the same as for broadcast applications.

Post-Directed and Hood Applications

A producer plans to use a hooded sprayer to make post-directed and hooded applications in his 38 inch row cotton. The producer realizes that the gallons per acre (GPA) under the hood needs to be as close as possible to the GPA of his post-directed band. The hooded rig is set up to use two nozzles post-directing on a 13 inch band and has three nozzles under the hood spraying a 25 inch band.

Scenario 1: One pump applying one tank mix.

- The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Lets assume it took 18 seconds (4mph).
- Park the sprayer and at the same engine speed and pressure, collect the output of the three nozzles under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, for example 20 ounces, equals the application rate in GPA. In this case the hoods are applying at 20 GPA.
- Next, with the sprayer running at the same engine speed and pressure, collect the output of the two post-directing nozzles. Combine the output from these two nozzles and measure. The combined total, for example 13 ounces, equals the application rate in GPA. In this case the post directing nozzles are applying at 13 GPA.
- Remember, you want the application rate to be the same for both the post-directed and hooded application. To accomplish this, decide which application rate fits your particular needs. In this example we will assume that 13 GPA post-directed is ideal. To get your hooded application to be 13 GPA instead of 20 GPA, reduce the size of the spray tips under the hood and re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

Scenario 2. Two pumps applying separate tank mixes.

1. The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Lets assume it took 18 seconds (4mph).
2. Park the sprayer and at the same engine speed and pressure, collect the output of the three nozzles under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, for example 18 ounces, equals the application rate in GPA. In this case the hoods are applying at 18 GPA.
3. Next, with the sprayer running at the same engine speed and pressure, collect the output of the two post-directing nozzles. Combine the output from these two nozzles and measure. The combined total, for example 15 ounces, equals the application rate in GPA. In this case the post directing nozzles are applying at 15 GPA.
4. Remember, you want the application rate to be the same for both the post-directed and hooded application. To accomplish this, decide which application rate fits your particular needs. In this example we will assume that 15 GPA post-directed is ideal. To get your hooded application to be 15 GPA instead of 18 GPA, you have two options. First reduce the pressure for the pump applying under the hood. Caution: Be sure that after reducing the pressure the spray tip still produces an acceptable spray pattern. Re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar. The second option is to change to a smaller spray tip size under the hood to reduce the application rate to 15 GPA. Then re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

NOTES:

HERBICIDE DRIFT - HOW IT CAN HAPPEN, HOW TO PREVENT IT

Spray drift can result in reduced weed control at the target field, damage to adjacent crops and desirable vegetation, environmental pollution, expensive fines and/or lawsuits, and bad publicity for our industry. Most of the calls we receive concerning herbicide drift involve pasture herbicides.

Movement of small amounts of commonly-used pasture herbicides (2,4-D, Banvel, Crossbow, Weedmaster, etc.) away from treated fields can cause serious damage to sensitive crops such as cotton, tobacco, tomatoes and other vegetables, and ornamental nurseries. Two types of drift, physical and vapor, can occur. Physical drift is the movement of liquid spray droplets (usually the finer or smaller droplets) away from the target. Factors which increase the likelihood of drift include wind, high temperatures, and a sprayer set-up which produces high pressures and low application volume (a large number of small spray droplets). Vapor drift is most influenced by air temperature. Some chemicals volatilize (change from a liquid to a gas or vapor) readily at warm (85 F) temperatures. While less obvious than physical drift at the time of application, vapor drift can be just as damaging. Similarly, small amounts of herbicides such as 2,4-D in sprayers can create serious problems if the same sprayer is used to apply pesticides to crops such as tobacco, tomatoes, peppers, melons and other vegetables. It is strongly advisable to have a dedicated sprayer for pasture herbicides, and to not use this sprayer on sensitive crops.

The following are suggestions to reduce the likelihood of drift from herbicides:

1. Know adjoining farms and other properties well. Most producers are familiar with their neighbors and know if they grow sensitive crops. Check on when your neighbor, for example, plans to set tobacco, and which field he or she plans to use this year. Information of this nature will allow you to plan accordingly for individual fields. Also, be familiar with locations of outdoor tobacco float beds, greenhouses and container nursery operations, as the numbers of these are rapidly increasing in Tennessee.
2. Calibrate your sprayer for low pressure. High volume (20 to 30 gallons per acre), low pressure (20 psi or less) applications will reduce the number of “fines” or small spray droplets. One of the problems with low pressure in the past has been that flat fan nozzles would not develop patterns adequately at low pressure. Manufacturers have made great advances during the last several years with the development low pressure air induction spray tips which will perform adequately at low pressure. If your farm supply store does not stock these tips, ask the dealer to order them for you.
3. Try to spray at a time of year when sensitive crops are not growing. This is often difficult to accomplish, because the optimum time for weed control may occur when a sensitive crop is in the field. However, some weeds, such as musk thistle, may be treated after mid-October with 2,4-D. This would be a good approach for a field across the fence from your neighbor’s tomatoes or tobacco, in that you could treat at a time of year when the crop has already been harvested. This should also be considered in areas where Cole crops (broccoli, cauliflower, cabbage) are grown, as most producers in Tennessee grow spring crops rather than fall crops, of these sensitive vegetables.
4. Avoid spraying on windy days. Although this is common sense, it is one of the most effective ways to reduce physical drift. In general, calm conditions are more likely to be encountered either early or late in the day.
5. If sensitive crops are nearby, use the amine formulation of 2,4-D rather than the low volatile ester formulation. This is particularly important with late spring to summer applications, when warm (85 F) temperatures are likely to be encountered at or shortly after spraying. The amine formulation is much less volatile than the low volatile ester formulation. This is very important to remember, in that vapor drift will be worse under warm conditions, and that it can occur even a few days after application. Other herbicides which are temperature sensitive include Banvel, Crossbow and Weedmaster. Drift reduction measures such as low pressure, special nozzles, drift retardants, etc. do not reduce vapor drift.
6. Last but not least, read the herbicide label for drift reduction measures or restricted zones for application. Many herbicide labels contain specific warnings and suggest measures for reducing the likelihood of drift of the product. Command herbicide, for example, lists specific application buffer zones. Application within the buffer zone would be a violation of federal law.

WEED RESISTANCE TO HERBICIDES

Weed resistance to herbicides is one of the most important weed control issues facing producers. One way to manage a potential herbicide resistant population is to construct a weed management program in a way that does not repeatedly expose the weed population to herbicides that kill plants in the same way (same site of action).

Herbicide mode of action (MOA) describes how a herbicide inhibits plant growth. Placing herbicides into mode of action families provides a good frame work for understanding how a group of herbicides kills a plant. Herbicide site of action (SOA) describes the exact location within the plant where the herbicide binds. Subdividing the herbicide MOA families into their respective SOA properties can provide a clearer picture when constructing a resistance management plan. For example, classifying herbicide MOA as “amino acid synthesis inhibitor” places Roundup, Accent and Liberty in the same family. Though all three are amino acid synthesis inhibitors they bind in completely different systems in the plant. Therefore classifying them down to their respective SOA places these three herbicides into distinctly different sub-families. Classification of herbicides by MOA families and SOA subfamilies are provided on the following pages.

One might ask, "How do resistant weed populations develop"? Any herbicide that provides control of a particular weed can miss that one in a million individual that is resistant. If the primary weed control program for a field relies on the same herbicide or use of herbicides with the same SOA that one resistant weed can turn into a large population of resistant weeds over the course of a few years. The most extensive example of this is during the late 1980 through early 1990s when a class of chemistry that kills weeds by inhibiting the ALS enzyme was extensively used in many crops. In soybeans alone by the late 1980s well over 90% of the acres in the mid-south relied on this one site of action (ALS inhibitor) to control weeds. The herbicides in this class of chemistry include Scepter, Pursuit, Canopy, Classic, Pinnacle, Harmony Extra, Beacon, Accent, Python, and Staple. The result of this is that today some of the cocklebur and Palmer amaranth populations in Tennessee are resistant to ALS inhibiting herbicides. The most recent example is the development of glyphosate-resistant horseweed (marestail) that now is a problem in most of West Tennessee. The main cause of this is that weed control programs on well over 90% of the soybean and cotton acres relied exclusively on glyphosate over the last several years.

Some general recommendations to avoid weed resistance are as follows:

1. Rotate crops where possible.
2. Use cultivation and other cultural practices where possible.
3. Rotate to herbicides with different sites of action.
4. Use tank or package mixes containing herbicides with different sites of action.
5. Avoid sequential application of the same herbicide or herbicides having the same sites of action.

If you suspect resistance:

1. Control escapes with alternative herbicides or cultural practices. **DO NOT LET THEM GO TO SEED!**
2. Notify your county extension agent and sales representative.

The biggest concern going forward is that the heavy reliance on glyphosate for weed control in Tennessee makes it very likely that weeds other than horseweed will develop resistance. One by product however, of managing glyphosate resistant horseweed is that weed control programs are now utilized that expose all weeds in a field to herbicides with several different sites of action. This should at least help delay the development of glyphosate resistance in “new” weed species. Refer to the glyphosate resistant horseweed section on page (8) for further details.

One final point should be made. Weed escapes are very common. Seldom do we achieve 100% control. Regrowth frequently occurs, but this is not necessarily resistance. Weather conditions, soil moisture stress, misapplication and a number of other factors can often account for weed escapes. It is advisable to inspect an area very closely for other species that may have escaped control. If there are other species present that are normally controlled by the herbicide application; that is a good indicator that the problem is something other than resistance. Crop rotation and the utilization of herbicides with different sites of action both over the course of the growing season and over years provides the foundation of a weed control program that can both delay the onset of and manage established weed-resistant biotypes.

Herbicide Classification by Mode of Action (Site of Action)

I. AMINO ACID SYNTHESIS INHIBITORS

- A. (EPSP synthase Inhibitors)
 - 1. Amino acid derivatives
Glyphos/Glyphomax Plus/
Roundup UltraMax/
Roundup WeatherMax/
Roundup Pro/Rodeo/

- B. (ALS Inhibitors)
 - 1. Imidazolinones
 - a. Backdraft¹
 - b. Beyond
 - c. Extreme¹
 - d. Lightning
 - e. Pursuit
 - f. Raptor
 - g. Resolve¹
 - h. Scepter
 - i. Scepter-OT¹
 - j. Squadron¹
 - 2. Sulfonylureas
 - a. Accent
 - b. Accent Gold¹
 - c. Basis Gold¹
 - d. Basis
 - e. Canopy XL¹
 - f. Celebrity B+G¹
 - g. Cimarron
 - h. Classic
 - i. Expert
 - j. Harmony Extra
 - k. Option
 - l. Peak
 - m. Permit

3. Sulfonamides

- a. Accent Gold
- b. Envoke
- c. FirstRate/Amplify
- d. Frontrow
- e. Hornet¹
- f. Python
- g. Suprend

4. Thiopyrimidines

- a. Staple

C. (Glutamine Synthetase)

- 1. Glycines
 - a. Liberty/Finale/Ignite

II. CELL MEMBRANE DISRUPTERS

A. (PPO/protox inhibitors)

- 1. Diphenylethers
 - a. Aim
 - b. Cobra
 - c. Conclude Ultra¹/Xtra¹/Xact¹
 - d. Flexstar
 - e. Goal
 - f. Reflex
 - g. Resource
 - h. Scepter OT¹
 - i. Spartan
 - j. Storm¹
 - k. Typhoon¹
 - l. Ultra Blazer
 - m. Valor

B. (Photosystem I inhibitors)

- 2. Bipyridiliums
 - a. Reward
 - b. Gramoxone Max

III. GROWTH REGULATORS

A. (Site unknown)

- 1. Benzoics

- a. Banvel
- b. Celebrity
- c. Clarity
- d. Distinct
- e. Marksman¹
- f. Resolve¹
- g. Yukon¹

2. Phenoxy

- a. Butyrac 200 (2,4-DB)
- b. Grazon P+D¹
- c. 2,4-D

3. Pyridines

- a. Accent Gold¹
- b. Garlon
- c. Grazon P+D¹
- d. Hornet¹
- e. Redeem R&P
- f. Remedy
- g. Stinger
- h. Tordon

IV. RESPIRATION INHIBITORS

A. (Site unknown)

- 1. Organic Arsenicals
 - 1. DSMA
 - 2. MSMA

V. PHOTOSYNTHETIC INHIBITORS

A. (Photosystem II inhibitors)

- 1. Triazines
 - a. Atrazine; Aatrex;
Bicep II Magnum¹;
Lariat¹; Bullet¹;
Harness Xtra¹;
FulTime¹;
Guardsman Max¹;

- Marksman¹;
 - Contour¹; Steadfast
 - ATZ¹
 - b. Boundary¹
 - c. Caparol/Cotton Pro
 - d. Domain¹
 - e. Lexone/Sencor;
 - Canopy¹;Axiom¹
 - f. Princep
- B. (Photosystem II inhibitors different binding site than triazines)**
- 1. Ureas
 - a. Cotoran/Meturon
 - b. Karmex/Direx
 - c. Lorox/Linex
- C. (Photosystem II inhibitors different binding site than triazines and ureas)**
- 1 Nitriles
 - a. Buctril
 - 2. Miscellaneous
 - a. Basagran
 - b. Conclude Ultra¹/Xtra¹/Xact¹
 - c. Storm¹
 - d. Tough

- VI. LIPID BIOSYNTHESIS**
- A. (ACC'ase inhibitors)**
- 1. Cyclohexanediones (DIMS)
 - a. Achieve
 - b. Conclude Ultra¹/Xtra¹/Xact¹
 - c. Poast/Poast Plus
 - d. Select
 - e. Arrow
 - 2. Arylphenoxypropanoates (FOPS)
 - a. Assure II
 - b. Fusilade
 - c. Fusion
 - d. Hoelon
 - e. Typhoon¹
- VII. ROOT GROWTH INHIBITORS**
- A. (Inhibit microtubule assembly)**
- 1. Dinitroanilines
 - a. Prowl/Pendimax 3.3/Prowl H2O
 - b. Sonalan
 - c. Squadron¹
 - d. Steel¹
 - e. Treflan/Trilin/Tri-4

- VII. SHOOT GROWTH INHIBITORS**
- A. (Inhibit VLCFA synthesis)**
- 2. Substituted Amides
 - a. Axiom¹
 - b. Boundary¹
 - c. Dual Magnum/Dual II Magnum/
Bicep II Magnum¹
 - d. Define
 - e. Domain¹
 - f. Epic¹

- g. Outlook; Guardsman Max¹
 - h. Harness/Harness Xtra¹
 - i. Lasso; Lariat¹; Bullet¹
 - j. FulTime¹/Surpass/TopNotch
- 3. Carbamothioates**
- 1. Eptam
 - 2. Prefar
 - 3. Ro-Neet
 - 4. Sutan+
 - 5. Tillam
- IX. PIGMENT SYNTHESIS INHIBITORS**
- A. (4-HPPD inhibition)**
- 1. Isoxazoles
 - a. Balance Pro
 - b. Callisto
 - c. Epic¹
- B. (Inhibit diterpene synthesis)**
- 1. Isoxazolidinone
 - a. Command
- C. (Inhibit phytoene desaturase)**
- 1. Pyridazinones
 - A. Zorial

¹Some herbicides are listed under more than one mode of action since they contain more than one active ingredient.

Description of Herbicide Modes of Action

I. AMINO ACID SYNTHESIS INHIBITORS

Herbicides with this mode of action reduce or block the production of amino acids, the essential building blocks of proteins. They generally inhibit a key enzyme necessary for production of the particular amino acid(s). **Roundup Weather Max, Touchdown and other glyphosate products** are amino acid derivatives, and they inhibit **EPSP synthase**, an enzyme responsible for production of aromatic amino acids.

The **ALS inhibitors** are composed of four families of herbicide chemistry, the imidazolinones (**Pursuit, Scepter, others**); the sulfonylureas (**Accent, Beacon, Classic, Harmony Extra, others**); the sulfonamides (**FirstRate and Python**); and the thiopyrimidines (**Staple**). Members of these chemical families have the same mode of action, which is inhibition of **ALS** (acetolactate synthase), an enzyme necessary for production of three amino acids. These herbicides, in general, are absorbed readily and move throughout the plant.

The **Glutamine synthetase** inhibitor **glufosinate** (Liberty) inhibits the conversion of glutamic acid and ammonia to glutamine. Ammonia accumulates and glutamine, glutamate and aspartate decrease. This interruption of important nitrogen metabolism and indirect inhibition of electron flow in photosynthesis causes a disruption of membranes.

II. CELL MEMBRANE DISRUPTERS

These herbicides, composed of the diphenylethers (**Ultra Blazer, Cobra, Reflex, others**) and the bipyridiliums (**Gramoxone Max and Reward**), work quickly as contact herbicides to disrupt plant cell membranes. Light is required for herbicide activity. The cell membrane disrupters exhibit very little movement within plants.

III. GROWTH REGULATORS

The benzoic acids (**Banvel/Clarity/Distinct and Marksman**) and the phenoxy acids (**Butyrac 200 and 2,4-D**) work as auxin-like growth regulators in plants, producing the characteristic twisting, curling and cupping in broadleaved plants. They move freely within most plants.

IV. RESPIRATION INHIBITORS

Inhibitors of respiration (the arsenical herbicides **DSMA** and **MSMA**) interfere with the production of ATP, the major source of energy in plants. Also, the arsenicals may act by interfering with enzyme activity and by disrupting cell membranes. These herbicides act mainly on contact, with very little movement occurring in plants.

V. PHOTOSYNTHETIC INHIBITORS

The triazines (**AAtrex, Princep, Sencor and others**), ureas (**Cotoran, Linex/Lorox, and others**), nitriles (**Buctril**), and **Basagran** inhibit the process of photosynthesis in plants. This process in higher green plants and algae converts water and carbon dioxide, in the presence of light, to carbohydrates and oxygen. In general, soil applications of the triazines and ureas move with transpiration water upward in plants, but foliar applications of these same herbicides show little to very limited movement in plants.

Likewise, foliar applications of

Buctril, Basagran, or Storm act mainly on contact.

VI. LIPID BIOSYNTHESIS (ACC'ase) INHIBITORS

Two families of chemistry, the "**DIMS**" (**Achieve, Poast/Poast Plus and Select**) and the "**FOPS**" (**Fusilade, Fusion, Assure II and Hoelon**) comprise the postemergence grass herbicides. These herbicides all have the same mode of action. They inhibit an enzyme ACC'ase which is crucial for the formation of lipids in plants. These

herbicides are quickly absorbed and they move throughout the plant.

VII. ROOT GROWTH INHIBITORS

The dinitroaniline or "yellow" herbicides (**Treflan, Prowl and others**) inhibit lateral root development in plants by interfering with the process of cell division. They exhibit practically no movement in plants.

VIII. SHOOT GROWTH INHIBITORS

Two chemical families of soil-applied herbicides, the substituted amides (**Dual II Magnum, Lasso, Surpass and others**) and the carbamothioates (**Eptam, Sutan + and others**) are thought to work by inhibiting the synthesis of very-long-chain-fatty-acids, and in turn, growth of shoots in weeds immediately following germination. Herbicides in both chemical families tend to move readily from the roots, upward in the plant.

IX. PIGMENT SYNTHESIS INHIBITORS

Four herbicides, **Balance, Command, Epic and Zorial**, inhibit pigment synthesis in plants, hence the characteristic bleached appearance of susceptible weeds. Command inhibits the production of chlorophyll (the green pigment), and carotenoids (the yellow and orange pigments). Zorial inhibits production of carotenoids. Carotenoids serve as "protective" pigments for chlorophyll. Absence of carotenoids allows sunlight to actually destroy chlorophyll. Both herbicides move upward within the plant.

RAINFREE REQUIREMENT FOR POSTEMERGENCE HERBICIDES

Trade Name	Restrictions
Accent	Accent is rainfast in 4 hours.
Accent Gold	Accent Gold is rainfast in 6 hours.
Achieve	Achieve is not affected by rain falling 1 hour or more after application.
Aim	To avoid significant crop response, applications should be made within 6-8 hours of either rain or irrigation.
Amplify	Amplify is rainfast in 2 hours.
Assure II	Assure II is rainfast 1 hour after application.
Atrazine	No information on label.
Authority First	Half inch of rainfall is required for activation.
Backdraft	No information on label.
Banvel	No information on label.
Basagran	Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of Basagran.
Basis Gold	Basis Gold is rainfast in four hours.
Beacon	Rainfall occurring within 4 hours after Beacon application may reduce weed control.
Buctril	No information on label.
Butyrac 200	No information on label.
Callisto	No information on label.
Caparol	No information on label.
Celebrity Plus	For best performance, rainfall or irrigation should not occur for 4 hours after application.
Cimarron	Weed and brush control or suppression may be reduced if rainfall occurs within 4 hours after application.
Clarity	Rainfall or irrigation occurring within 4 hours after postemergence applications may reduce the effectiveness of Clarity.
Classic	Do not apply Classic if rain is expected within 1 hour or weed control may decrease.
Cobra	Under conditions of normal weed growth Cobra is rainfast in 30 minutes after application.
Conclude Xact	Do not apply if rainfall or overhead irrigation is expected soon after application.
Cotoran	No information on label.
Crossbow	No information on label.
Distinct	Distinct is rainfast 4 hours after application when used with the recommended adjuvants.
DSMA	No information on label.
Durango	Heavy rainfall soon after application may wash off product off of the foliage and a repeat application may be required for adequate control.
Envoke	Envoke is rainfast within 3 hours of application.
Equip	Equip is rainfast in 2 hours.
Extreme	Extreme should be applied a minimum of one hour before rainfall or overhead irrigation.
FirstRate	FirstRate is rainfast in 2 hours.
Flexstar	Flexstar requires a 1-hour rainfree period for best results.
Frontrow	Frontrow is rainfast in 2 hours.
Fusilade DX	Do not apply Fusilade DX herbicide if rainfall is expected within 1 hour.

Trade Name	Restrictions
Fusion	Rain occurring 1 hour or more after application will not affect the activity of Fusion.
Gangster FR	Rainfast 2 hours after application.
Gangster V	Rainfast 2 hours after application.
Goal	No information on label.
Gramoxone Max/Inteon	Because Gramoxone Max/Inteon is rapidly absorbed by the weed foliage, rain occurring 30 minutes or more after application will have no effect on the activity of Gramoxone Max/Inteon. Sufficient rainfall or sprinkler irrigation to cause washoff prior to planting may be needed to prevent damage to the crop.
Harmony Extra	Several hours of dry weather are needed to allow Harmony Extra to be sufficiently absorbed by weed foliage.
Hoelon	No information on label.
Hornet	Hornet is rainfast in 2 hours.
Ignite	Ignite is rainfast four hours after application to most weed species, there fore, rainfall within four hours may necessitate retreatment or may result in reduced weed control.
Intrro	Excessive rainfall or excessive irrigation after application may reduce control.
Karmex	Moisture is required to activate the herbicide: Best results occur if rainfall (or sprinkle irrigation) occur within 2 weeks after application.
Lexar	If a significant rainfall does not occur within 7 days after application, weed control may be decreased.
Liberty	Liberty is rainfast four hours after application, there fore, rainfall within four hours may necessitate retreatment.
Lightning	Lightning should be applied a minimum of 1 hour before rainfall or overhead irrigation.
Linex	Since moisture is needed to activate Linex, rainfall or irrigation is needed within 2 weeks of application.
Lumax	If a significant rainfall does not occur within 7 days after application, weed control may be decreased.
Marksman	Rainfall or irrigation occurring within 4 hours after postemergence applications may reduce the effectiveness of Marksman herbicide.
MSMA	No information on label.
Option	Option is rainfast 2 hours after application to most weed species. Rainfall within 2 hours may necessitate retreatment or may result in reduced weed control.
Parrlay	If at least one-half inch of rainfall does not occur within 10 days after application, cultivate with a rolling cultivator or similar implement that provides uniform shallow incorporation of this product.
Permit	Rainfall or irrigation occurring within 4 hours after application may reduce effectiveness.
Poast	Poast is rainfast 1 hour after application.
Poast Plus	Poast Plus is rainfast 1 hour after application.
Prowl H2O	It is most effective in controlling weeds when adequate rainfall or overhead irrigation is received after application.
Pursuit	Pursuit should be applied a minimum of one hour before rainfall or overhead irrigation.
Raptor	Raptor should be applied a minimum of 1 hour before rainfall or overhead irrigation.
Reflex	Reflex herbicide requires a 1-hour rainfree period for best results.
Resource	Resource is rainfast 1 hour after application.
Roundup Ultra/ Roundup WeatherMax/ Glyphos/Glyphomax Plus (Roundup Ready)	Heavy rainfall soon after application may wash this product off of the foliage and a repeat application may be required for adequate control.
Scepter	No information on label.
Select	Do not apply if rain is expected within 1 hour of application as control may be unsatisfactory.
Select Max	Apply under favorable soil moisture and humidity that exist a few days after rainfall or within seven days after irrigation.
Sencor	No information on label.
Sequence	Heavy rainfall or irrigation shortly after application may require re-treatment.

Sonic	Rainfall or irrigation is required to activate the herbicide.
Staple	Rainfall immediately after treatment may wash Staple off the weed foliage and result in reduced weed control. A minimum of 4 hours are needed to allow Staple to be absorbed by weed foliage.
Staple LX	Rainfall (0.5- 1 inch) following the postemergence application is required for residual control.
Steadfast	Steadfast is rainfast in 4 hours.
Steadfast ATZ	Steadfast ATZ is rainfast in 4 hours.
Storm	Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of Storm.
Suprend	Suprend is rainfast within 3 hours.
Touchdown IQ/Total IQ/ Hi Tech	Heavy rainfall or irrigation shortly after application may require retreatment.
Typhoon	Typhoon requires a 4 hour rainfree period for best results.
Ultra Blazer	Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of Ultra Blazer.
Valor XLT	Rainfast 1 hour after application.
Yukon	No information on label.
2,4-D	No information on label.

POSTEMERGENCE HERBICIDE PREHARVEST INTERVALS (PHI)
C- Corn Ct–Cotton S-Soybean GS-Grain Sorghum W-Wheat D-Days

Chemical	C	Ct	S	GS	W	Remarks
AAtrex						No information on label.
Accent						No information on label.
Accent Gold	85 D					
Achieve					60 D	
Aim		7D	**	***	****	** soybeans must have 3 trifoliolate or less, *** grain sorghum<6 collars, **** prior to jointing stage.
Amplify			65 D			
Assure II		80 D	80 D			Do not apply to soybeans after pod set.
Atrazine						No information on label.
Authority First			65 D			Allow 65 days between application and harvest of soybeans.
Backdraft			90 D			Do not apply to soybeans once flowering has initiated.
Banvel						Corn may be harvested or grazed for feed once the crop has reached the ensilage (milk stage) or later in maturity.
Basagran						Do not apply to sorghum that is heading or blooming.
Basis Gold						No information on label.
Beacon	60 D					
Buctril		75 D*				
Butyrac 200			60 D			
Callisto	45 D					
Caparol						No information on label.
Canopy SP						No information on label.
Celebrity Plus	72 D					
Clarity						Corn may be harvested or grazed for feed once the crop has reached the ensilage (milk stage) or later in maturity.
Classic			60 D			Classic may be applied anytime after the first trifoliolate has opened, but no later than 60 days before soybean maturity.
Cobra		70 D	45 D			Do not apply Cobra less than 45 days before harvesting soybeans or after growth stage R6 (full seed).
Conclude Xact			75 D			
Cotoran		60 D				
Cotton Pro						No information on label.
Crossbow						Do not harvest hay for 14 days.
Direx						No information on label.
Distinct	72 D					
DSMA						Apply only as a directed spray when cotton is 3 inches high to first bloom. Do not apply after first bloom.
Durango		7 D	7 D		7 D	Applications must be made at least 7 days prior to planting corn.
Envoke		60 D				

Chemical	C	Ct	S	GS	W	Remarks
Extreme			85 D			Extreme applications should be made before soybean bloom.
FirstRate			65 D			Prior to 50% flowering of soybeans.
Flexstar						Apply Flexstar before soybeans bloom.
Frontrow			70 D			
Fusilade DX		90 D				Make the last Fusilade DX herbicide application to soybeans before bloom. Do not apply to cotton after boll set.
Fusion		90 D				Make the last Fusion herbicide application to soybeans before bloom. Do not apply to cotton after boll set.
Glyfos/Glyphomax Plus (Harvest Aid)	7 D	7 D	7 D	7 D	7 D	Apply after the hard-dough stage of grain (30% or less grain moisture) and at least 7 days prior to harvest.
Glyfos/Glyphomax Plus (Roundup Ready)	7 D	7 D	14 D			
Gangster FR						No Information on label.
Gangster V						No information on label.
Goal		90 D				
Gramoxone Max		3 D	15 D	48 D		
Gramoxone Inteon	7 D	3 D	15 D			Allow 7 days between application and harvest or corn. Allow 3 day between application and harvest of cotton. Allow 15 days between application and harvest of soybeans.
Harmony Extra					45 D	
Hoelon					77 D	
Hornet	85 D					
Ignite		70 D*				
Intrro			70 D	70 D		Allow 70 days between application and harvest of soybeans and grain sorghum.
Karmex						No information on label.
Lexar	60 D					Allow 60 days between application and harvest of corn.
Liberty	70 D*		70 D*			
Lightning	45 D*					
Linex	57 D	76 D				Do not apply within 76 days of harvest.
Lumax	60 D					Allow 60 days between application and harvest of corn.
Marksman						Corn may be harvested or grazed for feed once the crop has reached the ensilage (milk stage) or later maturity.
MSMA						Apply only when cotton is 3 inches high to first bloom. Do not apply after first bloom.
Option	70 D					
Parrlay	90 D	90 D	90 D	90 D		Allow 90 days between application and harvest of soybeans
Permit						No information on label.
Poast		40 D	75 D			
Poast Plus		40 D	75 D			
Prowl/Pendimax 3.3						No information on label.
Prowl H2O	60 D	60 D	60 D	60 D		Allow 60 days between application and harvest of corn, cotton, grain sorghum, and soybeans.
Pursuit			85 D			Pursuit applications should be made before soybean bloom.

Raptor			85 D			Raptor application must be made before soybean bloom.
Reflex						Apply Reflex before soybeans bloom.
Resource			60 D			Do not apply Resource to field corn after the 10-leaf stage.
Roundup PowerMax (Harvest Aid)	7 D	7 D	7 D	7 D	7 D	Apply after the hard-dough stage of grain (30% or less grain moisture) and at least 7 days prior to harvest.
Roundup PowerMax (Roundup Ready)	7 D	7 D	14 D			
Scepter			90 D			
Select		60 D	60 D			
Select Max		30 D	60 D			Allow 60 days between application and harvest of soybeans. Allow 30 days between application and harvest of cotton.
Sencor	60 D		70 D		21 D	
Sequence		100 D				Do not harvest within 100 days of postemergence application of sequence.
Sonic			65 D			Allow 65 days between application and harvest of soybeans.
Staple		60 D				
Staple LX		60 D				Allow 60 days between application and harvest of cotton.
Steadfast						No information on label.
Steadfast ATZ						No information on label.
Storm			50 D			
Suprend		60 D				
Touchdown IQ/ Total IQ/ Hi Tech (Harvest Aid)	7 D	7 D	7 D	7 D	7 D	Must be made at least 7 days before harvest of corn, cotton, soybean, grain sorghum, and wheat.
Touchdown IQ (Roundup Ready)	7 D	7 D	14 D			
Typhoon						Apply Typhoon herbicide before soybeans bloom.
Ultra Blazer			50 D			
Valor XLT			3 D			Can be applied 3 days after planting but before soybean emergence.
Yukon						No information on label.
2,4-D						No information on label.

C-Corn
Ct-Cotton
D-Day
GS-Grain Sorghum

S-Soybeans
W-Wheat
* - Tolerant Varieties

HERBICIDE PRICE LIST

These prices are average for retail and are provided for planning purposes only. They do not reflect dealer or manufacturer rebates. Prices vary location to location and month to month. Consult your supplier for current prices. All rates and costs expressed on a broadcast basis.

Trade Name	Container Price (\$)	Formulation Rate Per Acre	Approx. Cost (\$) Per Acre
AAtrex 90 DF 4L	95.00/25# bag 43.25/2.5 gal.	1.11-2.22 lbs. 1-2 qts.	4.22-8.44 4.33-8.66
Accent DF	411.00/10 oz.	0.67 oz.	27.54
Aim EC	225.00/qt.	0.5 oz.	3.52
Assure II	154.00/gal.	5-10 oz.	6.00-12.00
Atrazine Nine-O DF Atrazine 4L	72.00/25# bag 35.83/2.5 gal.	1.11-2.22 lbs. 1-2 qts.	3.20-6.39 2.50-5.00
Authority MTZ			
Axiom	475.00/25 lbs.	13-22 oz.	15.44 - 26.13
Backdraft	564.00/30 gal.	1.5-2 qts.	7.05-9.40
Balance Pro	319.50/0.35 gal	1.5-3 oz.	10.70-21.40
Banvel	140.00/2.5 gal.	0.25-4 pts.	1.75-28.00
Basagran	245.00/2.5 gal.	1.5-2 pts.	18.38-24.50
Beacon 75 WDG	48.95/1.52 oz. bag	0.76 oz.	24.47
Bicep II Magnum	108.00/2.5 gal.	1.3-2.6 qts.	14.04-28.08
Boundary	193.75/2.5 gal.	1-3 pts.	9.69-29.07
Buctril 4EC	285.00/2.5 gal.	0.5-1 pt.	7.15-14.30
Butyrac 200	31.50/gal.	2 oz.-6 pts.	0.50-23.64
Cadet			
Callisto	640.00/gal.	3 oz.	15.00
Canopy DF 5#	260.00/5 lbs.	4 oz.-6 oz.	13.00-19.50
Canopy EX	584.00/80 oz.	3 oz.	21.90
Caparol*	115.00/2.5 gal.	1 pt.	5.75
Celebrity Plus DF	730.50/7.5 #	4.7 oz.	28.59
Cimarron Plus	115.00/10 oz.	0.25-0.5 oz.	1.44-5.75
Cinch	109.50/gal.	0.66-1.67 pts.	9.03-22.86
Cinch ATZ	108.75/2.5 gal.	1.3-2.6 qts.	14.47-28.29
Clarity 4EC	257.50/2.5 gal.	0.5-1 pt.	6.44-12.88
Classic	77.50/5 oz. jar	0.5-0.75 oz.	7.75-11.63
Cobra	167.00/gal.	12.5 oz.	16.25

Trade Name	Container Price (\$)	Formulation Rate Per Acre	Approx. Cost (\$) Per Acre
Command 3ME	117.50/ gal.	2-2.67 pt.	29.38-39.22
Cotoran 4L	112.25/2.5 gal.	2-4 pts.	11.22-22.44
Cotton Pro	70.50/2.5 gal.	1 pt.	3.50
Crossbow	153.00/2.5 gal.	1-4 qts.	15.30-61.20
Degree	40.00/gal.	1.75-4.25 pts.	8.75-21.25
Degree Xtra	99.55/2.5 gal.	2.9-3.7 qts.	28.87-36.83
Devrinol 2E	93.10/2.5 gal.	2-4 qts.	18.60-37.20
Devrinol 50DF	36.20/4# bag	2-4 lbs.	18.10-36.20
Direx 4L	50.00/2.5 gal.	1 pt.	2.50
Distinct DF	361.50/7.5 lb.	4-6 oz.	12.04-18.06
Domain	324.25/25 # bag	9-16 oz.	7.30-12.97
Dual II Magnum	303.75/2.5 gal.	0.66-1.67 pts.	10.03-25.37
Envoke	110/14 oz.	0.10 oz.-0.15 oz.	7.51-11.30
Eptam	84.50/2.5 gal.	3.5 pts.	14.79
Extreme	125.00/2.5 gal.	3 pts.	18.75
FirstRate	18.84/0.60 oz. bag	0.3 oz.	9.42
Firstshot SG	156.00/20 oz	0.5-0.8 oz	3.90-6.24
Flexstar HL	306.25/2.5 gal.	1-1.5 pts.	15.31-22.97
Forefront R & P	148.50/2.5 gal.	1.5-2.6 pt.	11.14-19.31
Frontrow	46.65/2.1 oz.	0.42 oz.	9.33
FulTime	71.25/2.5 gal.	2.5-4 qts.	17.81-28.50
Fusilade DX	179.00/gal.	6-12 oz.	8.40-16.80
Fusion	387.50/2.5 gal.	8-12 oz.	9.68-14.52
Gly-4 Plus	101.85/2.5 gal. 1057.50/30 gal.	0.75-4 qts.	7.64-40.76 6.61-35.24
Goal 2XL*	246.25/2.5 gal.	1-2 pts.	12.31-24.63
Gramoxone Inteon	82.75/2.5	40-48 oz.	10.28-12.48
Grazon P+D	105.00/2.5 gal	2-3 pts.	10.50-15.75
Guardman Max	124.25/2.5 gal.	1.2-2 qts.	14.91-24.85
Harmony Extra Total Sol	619.20/48 oz.	0.5-0.6 oz.	6.45-7.74
Harness	180.00/2.5 gal.	1.75-2.5 pts.	15.75-22.50
Harness Xtra 5.6	109.88/2.5 gal.	1.4-3 qts.	15.35-32.90
Hoelon 3EC	212.75/2.5 gal.	1.3-2.6 pts.	13.83-27.66
Hornet	40.14/9.6 oz.	1.6-4 oz.	6.69-16.73
Ignite	145.50/2.5 gal.	32-40 oz	14.40-18.00
Intro	62.75/2.5 gal	2-3 qts	12.56-18.84
Karmex* XP	24.90/5#	0.25-0.5 lb.	1.25-2.49
Kerb 50W	107.25/3 lbs.	1.5-2 lbs.	53.63-71.50
Lariat 4L	62.50/2.5 gal.	2.5-4.5 qts.	15.56-28.01
Lasso Micro-Tech 4L	75.00/2.5 gal.	1.75-3 qts.	13.13-22.50

Trade Name	Container Price (\$)	Formulation Rate Per Acre	Approx. Cost (\$) Per Acre
Lightning DG	192.00/12.8 oz.	1.28 ozs	19.20
Marksman	79.25/2.5 gal.	2-3.5 pts.	7.93-13.87
Metribuzin DF (Generic Sencor)	79.90/5#	3 oz.-1 lb.	3.00-15.98
Milestone	92.35/qt.	3-7 oz.	8.65-20.20
MSMA	48.00/2.5 gal.	0.33 gal.	6.34
Option	303.00/30 oz.	1.5-1.75 oz.	15.15-17.68
Oracle	115.00/2.5 gal.	1-4 pt.	5.75-23.00
Outlook	142.25/gal.	12-21 oz.	13.34-23.34
Permit	370.00/20 oz.	0.67-1.33 oz.	12.40-24.61
Poast	190.50/2.5 gal.	1-2.5 pts.	9.53-23.81
Princep 90DF 4L	45.30/10# bag 55.50/2.5 gal.	1.1-1.7 lbs. 2-3 pts.	4.98-7.70 5.56-8.34
Prowl 3.3	88.50/2.5 gal.	1.2-3.6 pts.	5.32-15.95
Prowl H2O	97.50/2.5 gal	2-3 pt.	9.76-14.64
Pursuit	598.00/gal	4 oz.	18.68
Python WPG	465.00/2.5#	0.8-1 oz.	9.30-11.63
Rage D-Tech	59.00/gal.	0.5-2 pt.	3.69-14.75
Rangestar	80.00/2.5 gal.	1-4 pt.	4.00-16.00
PastureGard	67.00/gal	2-8 pt.	16.75-67.00
Raptor	602.00/gal.	4-5 oz.	18.80-23.50
Redeem R&P	66.50/0.5 gal.	2-3 pts.	33.25-49.88
Reflex	292.50/2.5 gal.	1-1.5 pts.	14.63-21.95
Remedy Ultra	103.50/gal.	1-4 qts.	25.88-103.50
Resource	192.35/gal.	4 oz.	6.00
Reward 2L	115.25/gal	0.5-2 gal.	57.63-230.50
Rodeo	147.00/2.5 gal.	not applicable	not applicable

Roundup WeatherMax	210.00/2.5 gal. 2409.00/30 gal.	1.0-2.7 pts.	10.50-28.35 10.04-27.11
Roundup PowerMax	186.75/2.5 gal.	22 oz.-44 oz.	12.76-25.52
Scepter 70DG	96.60/1.75 lbs.	2.1-2.8 oz.	7.25-9.66
Select Max	323.50/2.5 gal	6-16 oz.	6.06-16.16
Sencor DF	79.25/5 lbs.	3 oz.-1 lb.	2.97-15.85
Sodium Chlorate 6 lb. gal. (harvest aid)	12.25/2.5 gal.	0.75-1 gal.	3.68-4.90
Sonar	585.00/qt	not applicable	not applicable
Spartan 4F	118.00/ qt.	8.0-10.1 oz.	29.52-37.27
Squadron	92.25/2.5 gal.	3 pts.	13.84

Staple LX	500.48/0.5 gal.	1.2 oz.	9.38
Steadfast	540.00/20 oz.	0.75 oz.	20.25
Storm	169.75/2.5 gal.	1.5 pts.	12.73
Suprend	220.00/20#	1-1.5 #	11.00-16.50
Surmount	66.00/gal.	1.5-6 pt.	12.38-49.50
Trifluralin 4EC	50.00/2.5 gal	1.5 pts.-2 pts.	3.75-5.00
Touchdown IQ	80.00/2.5 gal. 846.00/30 gal.	0.75-4 qts.	6.00-32.00 5.29-28.20
Treflan	67.50/2.5 gal.	1-2 pts.	3.38-6.75
Typhoon	140.00/2.5 gal.	1.6 qts.	22.40
Ultra Blazer	153.75/2.5 gal.	0.5-1.5 pt.	3.85-11.54
Valor	388.25/5 #	2.0-2.5 oz.	9.70-12.13
Weedmaster	68.25/2.5 gal.	1-4 pts.	3.41-13.65
Yukon	217.00/80 oz.	4-8 oz.	10.85-21.70
Zorial	147.00/10# jug	1.25-2.50 lbs.	18.38-36.75
2,4-D Amine	47.25/2.5 gal.	0.5-4 pt.	1.18-9.45
2,4-D Ester (4 lb./gal. formulation)	55.25/2.5 gal.	0.33-4 qt.	1.82-11.05

CROP ROTATIONAL GUIDELINES FOR HERBICIDES

Chemical	C	Ct	S	GS	T	W	Remarks
Accent	None	10 M	15 D	10 M	10 M	4 M	Grain sorghum 10 months with a pH<7.5. Tobacco 10 months with a pH< 6.5 or 18 months with a pH>6.5.
Accent Gold	None	26 M	10.5 M	12 M	26 M	4 M	For low moisture (less than 15 inches annual rainfall) and low organic matter (less than 2%) areas, dry beans and soybeans should not be planted until 18 months after treatment.
Achieve	106 D	106 D	106 D	106 D	106 D	30 D	Rotational crops of cereal grains and leafy crop groups may be planted 30 days after application. All other rotational crops may be planted 106 days after application.
Aim	None	None	None	None	12 M	None	Following application of Aim, any registered crop may be planted at any time. All other crops may be planted after 12 months after an application of Aim.
Amplify	9 M	9 M	None	9 M	10 M	3 M	Transplanted tobacco may be planted 10 months after application of 0.3 oz/A of Amplify.
Assure II	120 D	None	None	120 D	120 D	120 D	Do not rotate to crops other than canola, cotton, crambe, dry beans, lentils, mint (spearmint and peppermint), peas (dry and succulent), snap beans, soybeans or sugarbeets within 120 days after application.
Atrazine (AAtrex, Bicep II Magnum, Cinch ATZ, Marksman)							Land treated with Atrazine should not be planted to any crop except corn or sorghum until the following year or injury may occur. If Atrazine is applied after June 10, do not rotate with other crops other than corn or sorghum the next year or injury may occur. Do not plant sugarbeets, tobacco, vegetables(including dry beans), spring seeded small grains or small seeded legumes and grasses the year following Atrazine application or injury may occur. Injury may occur to soybeans planted the year following application on soils with a calcareous surface layer.
Axiom	None	12 M	None	12 M	12 M	12 M	
Backdraft	9.5 M	18 M	None	11 M	11 M	4 M	Field corn may be planted in the spring of the year following Backdraft application, unless extreme drought conditions develop (less than 15 inches of rainfall or irrigation is received within 6 months following date of last application). Tobacco may be planted 9.5 months following an application of Backdraft herbicide if Backdraft was applied at labeled rates.
Balance Pro	None	18 M	6 M	6 M	18 M	4 M	Cotton and tobacco 15 inches of cumulative precipitation from application to planting of rotational crop.
Banvel	Spring		Spring	Spring		Fall	Corn, sorghum, and soybeans may be planted in the spring following applications made during the previous year. Soybeans in areas with greater than 30 inches of rainfall, delay planting for 30 days per pint of Banvel per treated acre. In areas with less than 30 inches of rainfall, delay planting for 45 days per pint of Banvel per treated acre. Delay wheat planting for 20 days per pint of Banvel.
Basagran							No information on label.
Basis Gold	None	10 M	10 M	10 M	18 M	10 M	If Basis Gold is applied after July 1, do not rotate with crops other than corn or sorghum the next year or injury may occur.

C-Corn

Ct-Cotton

D-Day

#-Do Not Rotate to This Crop the Year following application

F Y-Year Following Application

M-Months

S-Soybeans

W-Wheat

Wk-Weeks

Y-Years GS-Grain Sorghum

T-Tobacco

Chemical	C	Ct	S	GS	T	W	Remarks
Beacon	14 D	8 M	8 M	8 M	8 M	3 M	Injury may occur to sorghum, alfalfa, winter cereals, or sunflowers if dry weather prevails during much of the time between Beacon application and seeding of these crops. IR or IMR corn hybrid may be planted immediately.
Boundary	8 M	8 M	None	12 M	12 M	4.5 M	
Buctril							Do not plant rotational crops within 30 days following treatment.
Bullet	F Y	#	F Y	F Y	#	F Y	If soybeans or other non-labeled crops are planted the year following, there is the possibility of crop injury due to atrazine carryover. Corn, peanuts, sorghum (milo) or soybeans can be planted the year following the use of this mixture.
Butyrac 200							No information on label.
Callisto	None	Spring	Spring	Spring	Spring	120 D	Small grains may be planted 120 days after application.
Canopy SP	10 M	10 M	None	10 M	10 M	4 M	Rotational intervals based on a soil pH of 7.0 or less. IR corn may be planted 8 months following Canopy SP application. See label for high pH soils.
Canopy XL	10 M	18 M	None	10 M	10 M	4 M	Rotational intervals based on a soil pH of 7.0 or less. Do not use Canopy XL where cotton will be planted the following year.
Caparol		None				X	The cover crop marked may be planted in the fall when Caparol was applied on cotton by no more than one of these methods that year; preplant incorporated, preemergence, or only one chemical hoe treatment. Where layby or multiple applications are made, do not plant rotational crops until the following year as indicated. Cover crops must be plowed down and not used for food or feed.
Celebrity	None	10 M	1 M	10 M	10 M	4 M	Grain sorghum 10 months with a pH<7.5. Tobacco 10 months with a pH<6.5 or 18 months with a pH>6.5.
Celebrity Plus	1 Wk	10 M	4 M	10 M	10 M	4 M	Grain sorghum 10 months with a pH<7.5. Tobacco 10 months with a pH<6.5 or 18 months with a pH>6.5.
Cinch	None	None	None	None	Spring	4.5 M	If crop treated with Cinch alone is lost, any crop on the label may be planted immediately.
Clarity							No rotational cropping restrictions apply at 120 days or more following application. For barley, oats, wheat, and other grass seedlings, the interval between application and planting is 15 days per 8 fluid ounces per acre applied east of the Mississippi River.
Classic	8 M	8 M	None	9 M	9 M	3 M	If Classic is applied after August 1, extend recrop interval 2 months on alfalfa, clover, corn (non-IR), cotton, popcorn, rice, sorghum, tobacco and tomato. Field Corn (IR) - 7.
Cobra							No information on label.
Command	9 M	See Remarks	None	9 M	None	12 M	Cover crops may be planted anytime but stand reduction may occur in some areas. Cotton may be replanted immediately provided Di-Syston safener is used.
Cotoran, Meturon	6 M	None	6 M	6 M	6 M	6 M	Do not make more than 3 applications of this herbicide to the same crops or field in any one year. Do not plant crops other than cotton within 6 months of the last application of this herbicide, or injury may result.

Chemical	C	Ct	S	GS	T	W	Remarks
Define	None	4 M	None	12 M	12 M	12 M	
Degree							Do not rotate to crops other than soybeans, corn (all types including sweet corn), milo (grain sorghum), wheat or tobacco.
Degree Xtra							Do not rotate to crops other than soybeans, corn, milo (grain sorghum), wheat or tobacco.
Devrinol	12 M	12 M	12 M	12 M	None	12 M	After harvest or prior to planting of succeeding crops, a deep moldboard or disc plowing operation must be carried out.
Direx	Spring	Spring	1 Y	Spring	1 Y	1 Y	Broadcast postemergence (Lay-by); Cotton, corn, grain sorghum (not sorgos or forage sorghums nor grass sorghums) the next spring. Do not replant treated area to any other crop within one year after last application as injury to subsequent crops may result.
Distinct		30 D	30 D	30 D	30 D	30 D	
Domain	1 M	18 M	None	18 M	18M	12 M	
DSMA		None					No information on label.
Dual II Magnum	None	None	None	None	Spring	4.5 M	If crop treated with Dual II Magnum alone is lost, any crop on the label may be planted immediately.
Envoke	7 M	7 M	7 M	7 M	7 M	3 M	
Equip		9 M	9 M	9 M	18 M	2 M	
Extreme	8.5 M	18 M	None	18 M	9.5 M	4 M	Clearfield corn no restrictions.
FirstRate	9 M	9 M	None	9 M	3 M	3 M	Transplanted tobacco may be planted 10 months after application of 0.3 oz/A postemergence.
Flexstar	10 M	10 M	None	18 M	18 M	4 M	
Frontrow	9 M	9 M	None	9 M	10 M	3 M	Transplanted tobacco may be planted 10 months after application of 0.42 oz/A of Frontrow.
FulTime	Spring		Spring	Spring	Spring	15 M	Do not rotate to crops other than corn, soybeans, sorghum, tobacco, or wheat the year following application of FulTime. Because of atrazine carryover, injury may occur to tobacco.
Fusilade DX	60 D	None	None	60 D		60 D	Do not plant rotational grass crops such as corn, sorghum, and cereals within 60 days of last application of Fusilade DX .
Fusion	60 D	None	None	60 D		60 D	Do not plant rotational grass crops such as corn, sorghum, and cereals within 60 days of last application of Fusion.
Goal	10 M			10 M		10 M	Do not direct seed any crops, other than labeled crops, within 60 days following a Goal treatment. Do not transplant seedling crops, other than labeled crops , within 30 days following a Goal treatment.
Gramoxone Max	None	None	None	None	None	None	
Guardsman Max	None	F Y	F Y	None	#		Injury may occur to soybeans planted on soils having a calcareous surface layer. If the original treatment was broadcast do not make a second application of Guardsman Max if the combined rate exceeds the maximum rate per season.

Chemical	C	Ct	S	GS	T	W	Remarks
Harmony Extra	45 D	45 D	45 D	45 D	45 D	None	Sugarbeets, winter rape and canola can be planted 60 days after the application of Harmony Extra. Any other crop may be planted 45 days after the application of Harmony Extra.
Harness	None	#	F Y	F Y	F Y	Fall	Do not rotate to crops other than soybeans, corn, milo(sorghum), wheat, or tobacco.
Harness Xtra	None	#	F Y	F Y	#	F Y	
Hoelon						None	No information on label on other crops.
Hornet	None	18 M	10.5 M	12 M	18 M	4 M	For low moisture (less than 15 inches annual rainfall) and low organic matter (less than 2%) areas, dry beans and soybeans should not be planted until 18 months after treatment.
Ignite	None	None	None	70 D		70 D	Do not plant rotational crops in a field treated with Ignite herbicide within 120 days after the last application of this product with the exception of wheat, barley, buckwheat, millet, oats, rye, sorghum, and triticale which may be planted 70 days after the last application of this product. The crops listed on the label may be planted at any time.
Karmex	Spring	Spring	1 Y	Spring	1 Y	1 Y	Broadcast Postemergence (Lay-by): Cotton, corn, grain sorghum (not sorgos or forage sorghums nor grass sorghums) the next spring. Do not replant treated areas to any other crop within one year after last application as injury may result.
Lariat	F Y	#	FY	FY	#	F Y	Corn, peanuts, sorghum (milo) or soybeans can be planted the year following use of this mixture. If soybeans or other non-labeled crops are planted the following year, there is the possibility of crop injury due to atrazine carryover. For replanting grain sorghum, use Screen-treated seed.
Lasso, Intro	None		None	None			Grain sorghum seed must be screen-treated.
Liberty	None		None	70 D		70 D	Do not plant rotational crops in a field treated with Liberty herbicide for 120 days after the last application of this product with the exception of wheat, barley, buckwheat, millet, oats, rye, sorghum, and triticale which may be planted 70 days after the last application of this product. Crops tolerant to the active ingredient in Liberty may be planted at anytime.
Lightning	8.5 M	See Remarks	9 M	18 M	9.5 M	4 M	No restrictions for Clearfield corn. 9.5 months for cotton if greater than 16 inches of rainfall and/or irrigation received following application of Lightning through October of the application year.
Linex							Unless otherwise directed, any crop may be planted after 4 months except for cereals where only barley, oats, rye, wheat and corn (field) may be planted.
MSMA							No information on label.
Option	7 D	60 D	14 D	60 D	60 D	60 D	
Outlook	None	Spring	None	None	Spring	4 M	There are no rotational crop restrictions in the spring following the previous year's application of Outlook. If the original application was broadcast, do not make a second application of Outlook.
Permit	1M	4M	9 M	2M		2 M	
Poast							Do not plant any other crop to be harvested for 120 days following application unless Poast is registered for use in that crop.
Poast Plus							No information on label.
Princep					#		Do not plant any crop except corn until the year following, or injury may occur.

Chemical	C	Ct	S	GS	T	W	Remarks
Prowl/Pendimax 3.3	None	None	None	F Y	None	4 M	Land treated with Prowl may be planted to other crops the following year. Injury may occur when replanting corn due to stand failure. See label.
Pursuit	8.5 M	18 M	None	18 M	9.5 M	4 M	Clearfield corn (resistant/tolerant to Pursuit), no restrictions.
Python	None	18 M	None	12 M	9 M	4 M	
Raptor	8.5 M	9 M	None	9 M	9 M	3 M	
Redeem R&P							Do not plant broadleaf crops such as tobacco, cotton, soybeans, sunflower, clover, alfalfa, and many others in treated areas until an adequately sensitive bioassay shows that clopyralid is no longer detectable in the soil.
Reflex	10 M		None	18 M	18 M	4 M	
Remedy							No information on label.
Resource	None	30 D	None	30 D	30 D	120 D	Do not rotate to crops other than soybeans or field corn within 30 days after last application.
Roundup WeatherMax/ Glyfos/Glyphomax Plus	None	None	None	None	30 D	None	
Scepter	9.5 M	18 M	None	11 M	9.5 M	3 M	Field corn may be planted in the spring of the year following Scepter application, unless extreme drought conditions develop (less than 15 inches of rainfall or irrigation is received within 6 months following date of last application). A minimum of 10 inches of rainfall is needed for a postemergence application if the total amount does not exceed 1.4 ounces per acre. Tobacco may be planted 9.5 months following an application at up to 2.8 ounces per acre and no more than a total of 0.125 pounds of imazaquin applied per acre.
Select							Do not graze treated fields or feed forage or hay to livestock.
Sencor	4 M	8 M	None	12 M	12 M	4 M	If initial seeding fails to produce a stand, crop registered for the rate of Lexone that has been applied maybe replanted into the treated area. Do not retreat during the same crop year as injury to the crop may result.
Sequence	None	None	None	Spring	Spring	4.5 M	
Spartan	10 M	18 M	None	10 M	None	4 M	
Squadron	9.5 M	18 M	None	11 M	9.5 M	4 M	Field corn may be planted in the spring of the year following Squadron application, unless extreme drought conditions develop (less than 15 inches of rainfall or irrigation is received within 6 months following date of last application). Tobacco may be planted 9.5 months following an application of Squadron at 3 pints per acre and no more than a total of 0.125 pounds of imazaquin applied per acre.
Staple	10 M	None	10 M	#	10 M	4 M	Do not rotate to grain sorghum in the season following a Staple application. Field corn grown for grain or silage may be planted at indicated interval provided all the Staple applications made in cotton do not exceed a total of 1.8 oz. broadcast per acre per season. IR corn may be planted 9 months following application.
Steadfast	None	10 M	15 D	10 M	10 M	4 M	Grain sorghum 10 months with a pH<7.5. Tobacco 10 months with a pH<6.5 or 18 months with a pH>6.5.

Chemical	C	Ct	S	GS	T	W	Remarks
Steadfast ATZ	None	10 M	10 M	10 M	18 M	10 M	If Steadfast ATZ is applied after July 1, do not rotate with crops other than corn or sorghum the next year or injury may occur.
Storm			None				In the case of crop failure, only soybeans, rice or peanuts may be replanted immediately. Root crops must not be planted in fields treated with Storm for a period of 18 months.
Suprend	7 M	7 M	7 M	7 M	7 M	3 M	
Surpass	None	#	Spring	Spring	Spring	4 M	Do not rotate to crops other than corn, soybean, sorghum, tobacco, or wheat.
Tillam					None		No information on label.
TopNotch	None	#	Spring	Spring	Spring	4 M	Do not rotate to crops other than corn, soybeans, sorghum, tobacco, or wheat.
Touchdown IQ							There are no rotational crop restrictions following application of this product.
Treflan HFP		None	None	12 M			Unless crop injury is acceptable, do not plant proso millet, sorghum (milo), oats, and annual or perennial grass crops or grass mixtures for 12 months after a spring application or 14 months after a fall application of Treflan.
Typhoon	10 M	10 M	None	10 M	18 M	4 M	
Ultra Blazer			None				In case of crop failure, only peanuts, soybeans, or rice may be immediately replanted. Root crops (such as carrots, turnips, sweet potatoes, etc.) must not be planted in fields treated with Ultra Blazer for a period of 18 months following treatment.
Valor	30 D	30 D	None	30 D	30 D	30 D	Cotton, field corn, rice, sorghum, sunflowers, tobacco and wheat can be planted 30 days after an application, provided no more than 2 oz./A of Valor had been used on the lost crop.
Yukon	1 M	4 M	9 M	2 M		2 M	IR/IMR field corn no restrictions.
Zorial	16 M	None	45 D	16 M	16 M	16 M	Rotate only to alfalfa, cotton, soybeans or peanuts within the first 16 months after the last application.
2,4-D							Do not replant fields treated with this product in the same growing season with crops other than those labeled for 2,4-D use.

C-Corn
Ct-Cotton
D-Day
GS-Grain Sorghum

F Y-Year Following Application
M-Months
S-Soybeans
T-Tobacco

W-Wheat
Wk-Weeks
Y-Years

#-Do Not Rotate to This Crop the Year Following Application

HERBICIDE NAME AND INGREDIENT INDEX

NOTE: This list is provided as a reference only. It includes some herbicides not recommended by The University of Tennessee in addition to those that are recommended in this publication.

Trade Name with Formulation	Common Name	Formulation	EPA Registration Number	Manufacturer
AAtrex 4L AAtrex 9-0 DF	Atrazine	4 lbs ai/gal 90% ai	100-497 100-585	Syngenta
Accent DF	Nicosulfuron	75% ai	352-560	Du Pont
Achieve DG	Tralkoxydim	40 % ai	100-1105	Syngenta
Aim DG	Carfentrazone	40% ai	279-3194	FMC
Ally DF	Metsulfuron	60% ai	352-435	Du Pont
Amplify DF	Cloransulam	84% ai	62719-275-524	Monsanto
Arrow EC	Clethodim	2 lbs ai/gal	66222-60	Makhteshim-Agan
Assure II EC	Quizalofop-P	0.88 lbs ai/gal	352-541	Du Pont
Atrazine FL	Atrazine	4 lbs ai/gal	Various	Various
Authority First DF	Sulfentrazone + Cloransulam-methyl	0.7 lbs ai/gal	279-3246	FMC
Authority MTZ	Sulfentrazone + Metribuzin	18.0% + 27.0% ai	279-3326	FMC
Axiom DF	Flufenacet+Metribuzin	54.4+13.6% ai	3125-488	Bayer
Backdraft SL	Imazaquin+Glyphosate	0.25 lbs ae/gal+1.25 lbs ai/gal	241-407	BASF
Balan DF	Benefin	60% ai	34704-746	UAP
Balance Pro SC	Isoxaflutole	4 lbs ai/gal	264-600	Bayer
Banvel SL	Dicamba	4 lbs ai/gal	51036-289	Micro-Flo
Basagran SL	Bentazon	4 lbs ai/gal	7969-45-51036	Micro-Flo
Beacon DG	Primisulfuron	75% ai	100-705	Syngenta
Bicep II Magnum SC	S-Metolachlor+Atrazine+Benoxacor	2.4+3.1 lbs ai/gal	100-817	Syngenta
Blazer SL	Acifluorfen	2 lbs ai/gal	7969-79	BASF
Boundary SC	S-Metolachlor+Metribuzin	6.3+1.5 lbs ai/gal	100-958	Syngenta
Buctril 2EC Buctril 4EC	Bromoxynil	2 lbs ai/gal 4 lbs ai/gal	264-437 264-540	Bayer
Butyrac 200 SL	2,4-DB	2 lbs ae/gal	42750-38	Agri-star
Cadet				
Callisto	Mesotrione	4 lbs ai/gal	100-1131	Syngenta
Canopy SP DG	Metribuzin+Chlorimuron	50.0+8.3% ai	352-596	Du Pont
Caparol 4L	Prometryn	4 lbs ai/gal	100-620	Syngenta
Celebrity DG	Dicamba+Nicosulfuron	69.3+7.5 % ai	7969-166	BASF
Celebrity Plus	Dicamba+Diflufenzopyr+Nicosulfuron	42.4+17.0+10.6% ai	7969-175	BASF
Cimaron Plus	Metsulfuron + Chlorsulfuron	48 + 15% ai	352-670	DuPont
Cimaron Extra	Metsulfuron + Chlorsulfuron	30.0 + 37.5% ai	352-669	DuPont
Cinch EC	S-Metolachlor	7.64 lbs ai/gal	352-625	Du Pont
Cinch ATZ SC	S-Metolachlor+Atrazine	2.4+3.1 lbs ai/gal	352-624	Du Pont

Clarity SL	Dicamba	4 lbs ae/gal	7969-137	BASF
Classic DG	Chlorimuron	25% ai	352-436	Du Pont
Cobra EC	Lactofen	2 lbs ai/gal	59639-34	Valent
Command 3ME	Clomazone	3 lbs ai/gal	279-3158	FMC
Cotoran 4L	Fluometuron	4 lbs ai/gal	1812-439	Du Pont
Cotoran 80DF		80% ai	1812-323	
Crossbow EC	2,4-D+Triclopyr	2+1 lbs ae/gal	62719-260	Dow AgroSciences
Define DF	Flufenacet	60% ai	3125-487-264	Bayer
Degree ME	Acetochlor	3.8 lbs ai/gal	524-496	Monsanto
Degree Xtra ME	Acetochlor+Atrazine	2.7+1.34 lbs ai/gal	524-511	Monsanto
Devrinol 2E	Napropamide	2 lbs ai/gal	100-1024-70506	United Phosphorus
Devrinol 50DF		50% ai	100-1035-70506	
Diquat SL, Reward	Diquat	2 lbs cation/gal	10182-353	Syngenta
Direx 4L	Diuron	4 lbs ai/gal	1812-257	
Direx 80DF		80% ai	1812-362	
Distinct	Diflufenzopyr+Dicamba	20+50 % ai	7969-150	BASF
Domain DF	Flufenacet+Metribuzin	24+36 % ai	3125-527	Bayer
DSMA SC	DSMA	Various	Various	Various
Dual Magnum	S-Metolachlor	7.64 lbs ai/gal	100-816	Syngenta
Dual II Magnum EC	S-Metolachlor+Benoxacor	7.64 lbs ai/gal	100-818	Syngenta
Durango	Glyphosate	5.4 lbs ae/gal	62719-517	Dow AgroScience
Envive	Chlorimuron + Flumioxazin + Thifensulfuron	9.2 + 29.2 + 2.9% ai	352-756	DuPont
Envoke	trifloxysulfuron-sodium	75% ai	100-1132	Syngenta
Epic DF	Flufenacet+Isoxaflutole	48+10% ai	3125-522	Bayer
Eptam 7-E EC	EPTC	7 lbs ai/gal	100-1025	Syngenta
Escort DF	Metsulfuron	60% ai	352-439	Du Pont
Equip	Foramsulfuron + Iodosulfuron	30.0 + 2.0% ai	264-686	Bayer
Expert	Atrazine+S-Metolachlor+Glyphosate	1.74+2.14+1 lbs ai/gal	100-1161	Syngenta
Express DF	Tribenuron	75% ai	352-509	Du Pont
Extreme SL	Imazethapyr+Glyphosate	0.17 lbs ae/gal+2 lbs ai/gal	241-405	BASF
Field Master	Acetochlor+Atrazine+Glyphosate	2+1.5+0.75 lbs ai/gal	524-497	Monsanto
Finale SL	Glufosinate	1 lb ai/gal	432-1229	Bayer
Finesse DF	Chlorsulfuron+Metsulfuron	62.5+12.5% ai	352-445	Du Pont
FirstRate DF	Cloransulam	84% ai	62719-275	Dow AgroSciences
Flexstar SL	Fomesafen+Adjuvants	1.88 lbs ai/gal	10182-418	Syngenta
ForeFront		6.58 +51.06% ai	62719-524	Dow AgroSciences
Frontier 6.0 SL	Dimethenamid	6.0 lbs ai/gal	7969-147	BASF
Frontrow DF	Cloransulam+Flumetsulam	84+80%ai	62719-299	Dow AgroSciences
Fusilade DX EC	Fluazifop-P	2 lbs ai/gal	100-1070	Syngenta

Gangster V	Flumioxazin	51% ai	59639-131	Valent
Gangster FR	Cloransulam-methyl	84% ai	59639-131	Valent
Garlon EC or SL	Triclopyr	4 or 3 lbs ai/gal	62719-40 or 62719-37	Dow AgroSciences
Glean DF	Chlorsulfuron	75% ai	352-522	Du Pont
Glyfos	Glyphosate	4 lbs ai/gal	4787-31	Chemnova
Glyfos X-TRA	Glyphosate	4 lbs ai/gal	4787-23	Chemnova
Glyphomax Plus	Glyphosate	4 lbs ai/gal	62719-322	Dow AgroSciences
Goal XL EC	Oxyfluorfen	2.0 lbs ai/gal	62719-424	Dow AgroSciences
Gramoxone Extra SL	Paraquat	2.5 lbs cation/gal	10182-280	Syngenta
Gramoxone Inteon	Paraquat	2.0 lbs ai/gal	100-1217	Syngenta
Gramoxone Max SL	Paraquat	3 lbs cation/gal	100-1074	Syngenta
Grazon P+D SL	Picloram+2,4-D	0.54+2 lbs ai/gal	62719-182	Dow AgroSciences
Guardsman SL	Dimethenamid+Atrazine	2.33+2.67 lbs ai/gal	7969-146	BASF
Guardsman Max	Dimethenamid-P+Atrazine	1.7+3.3 lbs ai/gal	7969-192	BASF
Halex GT	S-metolachlor+Glyphosate + Mesotrione	20.50 + 20.50 + 2.05 ai/gal	100-1282	Syngenta
Harmony Extra DF	Tribenuron+Thifensulfuron	25+50% ai	352-538	Du Pont
Harmony GT DF	Thifensulfuron-methyl	75% ai	352-446	Du Pont
Harness EC	Acetochlor+MON-4660	7.0 lbs ai/gal	524-473	Monsanto
Harness Xtra 5.6 SL	Acetochlor+Atrazine+MON-4660	3.1+2.5 lbs ai/gal	524-485	Monsanto
Hoelon EC	Diclofop	3 lbs ai/gal	264-641	Bayer
Hornet DG	Flumetsulam+Clopyralid	18.5+60.0% ai	62719-315	Dow AgroSciences
Intrro	Alachlor	4.0 lbs ai/gal	524-314	Monsanto
Ignite SL	Glufosinate	1.67 lbs ai/gal	264-660	Bayer
Karmex DF	Diuron	80% ai	1812-362	Du Pont
Kerb 50-W WP	Pronamide	51% ai	62719-397	Dow AgroSciences
Lasso EC	Alachlor	4 lbs ai/gal	524-314	Monsanto
Lexar	S-metolachlor+mesotrione+ atrazine	1.74 + 0.224 + 1.74 lbs ai/gal	100-1201	Syngenta
Liberty SL	Glufosinate	1.67 lbs ai/gal	264-660	Bayer
Lightning	Imazethapyr+Imazapyr	52.5+17.5% ai	241-377	BASF
Linex DF	Linuron	50% ai	1812-320	Du Pont
Linex 4L	Linuron	4 lbs ai/gal	1812-245	Du Pont
Lorox DF	Linuron	50% ai	1812-320	Du Pont
Lumax	S-Metolachlor+Atrazine+Mesotrione	2.68+1+0.268 lbs ai/gal	100-1152	Syngenta
Marksman SC	Atrazine+Dicamba	2.1+1.1 lbs ai/gal	7969-136	BASF

Milestone	Triisopropanolammonium	40.6% ai	62719-519	Dow AgroSciences
MSMA SC	MSMA	Various	Various	Various
Option DG	Foramsulfuron	35 % ai	264-685	Bayer
Outlook	Dimethenamid-P	6 lbs ai/gal	7969-156	BASF
Parrlay	Metolachlor	8 lbs ai/gal	60063-24-524	Monsanto
Permit DF	Halosulfuron	75% ai	524-465	Monsanto
Poast EC	Sethoxydim	1.5 lbs ai/gal	7969-58	BASF
Poast Plus EC	Sethoxydim+Adjuvant	1 lb ai/gal	7969-88	BASF
Princep Caliber 90 DF Princep 4L	Simazine	90% ai 4 lbs ai/gal	100-603 100-526	Syngenta
Prowl 3.3 EC	Pendimethalin	3.3 lbs ai/gal	241-337	BASF
Prowl H2O	Pendimethalin	3.8 lbs ai/gal	241-418	BASF
Pursuit DG Pursuit SL	Imazethapyr	70% ae 2 lbs ae/gal	241-350 241-310	BASF
Pursuit Plus EC	Imazethapyr+Pendimethalin	0.2 lbs ae/gal+2.7 lbs ai/gal	241-331	BASF
Python DG	Flumetsulam	80% ai	62719-277	Dow AgroSciences
Rage D-Tech	Carfentrazone + 2,4- Dichlorophenoxyacetic acid	1.44 + 65.52% ai	279-3316	FMC
Raptor	Imazamox	1 lb ai/gal	241-379	BASF
Ready Master ATZ	Atrazine+Glyphosate	2+2 lbs ai/gal	524-509	Monsanto
Redeem R&P EC	Triclopyr+Clopyralid	2.25+0.75 lbs ai/gal	62719-337	Dow AgroSciences
Reflex SL	Fomesafen	2 lbs ai/gal	10182-83	Syngenta
Remedy EC	Triclopyr	4 lbs ai/gal	62719-70	Dow AgroSciences
Resolve DF	Rimsulfuron+safener	25% ai	352-556	Du Pont
Resolve Q	Rimsulfuron + Thifensulfuron	18.4 + 4.0% ai	352-759	DuPont
Resource EC	Flumiclorac	0.86 lbs ai/gal	59639-82	Valent
Require Q	Rimsulfuron + Sodium salt of dicamba	6.25 + 52.94% ai	352-761	DuPont
Rifle SL	dicamba	4 lbs ai/gal	42750-40-34704	UAP-Loveland
Roundup Original Max	Glyphosate+surfactants	5.5 lbs ai/gal	524-539	Monsanto
Roundup Weather Max	Glyphosate+surfactants	5.5 lbs ai/gal	524-537	Monsanto
Scepter DG Scepter SL	Imazaquin	70% ae 1.5 lbs ae/gal	241-306 241-289	BASF
Select EC	Clethodim	2 lbs ai/gal	59639-3	Valent
Select Max EC	Clethodim	0.97 lbs. ai/gal	59639-132	Valent
Sencor DF Sencor FL	Metribuzin	75% ai 4 lbs ai/gal	3125-325 3125-314	Bayer
Sequence EW	Glyphosate + S-metolachlor	2.25 + 3.0 lbs ai/gal	100-1185	Syngenta
Sonic	Sulfentrazone + Cloransulam- methyl	0.7 lbs ai/gal	279-3246-62719	Dow AgroSciences

Spartan F	Sulfentrazone	4 lbs ai/gal	279-3220	FMC
Squadron SC	Pendimethalin+Imazaquin	2+0.33 lbs ai/gal	241-327	BASF
Staple LX	Pyriproxyfen sodium	3.2 lbs ai/gal	352-613	Du Pont
Staple SP	Pyriproxyfen sodium	85% ai	352-576	Du Pont
Status	Sodium salt of diflufenzopyr + Sodium salt of dicamba	17.1 + 44.0% ai	7969-242	BASF
Steadfast DG	Nicosulfuron+Rimsulfuron	50+25 % ai	352-608	Du Pont
Steadfast ATZ DG	Nicosulfuron+Rimsulfuron+Atrazine	2.7+1.3+85.3 % ai	352-619	Du Pont
Steadfast Q				
Stinger EC	Clopyralid	3 lbs ae/gal	62719-73	Dow AgroSciences
Suprend 80 WG	Prometryn+trifloxysulfuron-sodium	79.3 + 0.7 % ai	100-1163	Syngenta
Sutan + EC	Butylate+R-29148	6.7+0.14 lbs ai/gal	73637-3-74530	Helm Agro
Synchrony STS DG	Chlorimuron+Thifensulfuron	31.8+10.2% ai	352-599	Du Pont
Tillam EC	Pebulate	6 lbs ai/gal	10182-158	Monterey Chemical Co.
Touchdown Hi Tech	Glyphosate	5 lbs ae/gal	100-1182	Syngenta
Touchdown IQ	Glyphosate	3 lbs ae/gal	100-1117	Syngenta
Touchdown Total IQ	Glyphosate	4.17 lbs ai/gal	100-1169	Syngenta
Treflan HFP EC	Trifluralin	4 lbs ai/gal	62719-250	Dow AgroSciences
Trifluralin 4 EC	Trifluralin	4 lbs ai/gal	5905-519	Helena
Ultra Blazer	Acifluorfen	2 lbs ai/gal	7969-79	BASF
Valor DG	Flumioxazin	51% ai	59639-99	Valent
Valor XLT	Flumioxazin + Chlorimuron-ethyl	43.3% ai	59639-117	Valent
Vapam SL	Metham	4.26 lbs ai/gal	5481-468	Amvac
Weedar 64 SL	2,4-D amine	3.8 lbs ai/gal	71368-1	Nufarm
Weedmaster SL	2,4-D+Dicamba	2.87+1 lbs ai/gal.	7969-133	BASF
Weedone LV4 EC	2,4-D low volatile ester	3.8 lbs ai/gal	228-139-71368	Nufarm
Zorial DF	Norflurazon	78.6% ai	100-848	Syngenta
2,4-D EC,SL	2,4-D	Various	Various	Various

ai=Active Ingredients
ae=Acid Equivalent
DF=Dry Flowable

DG=Dispersable Granule
EC=Emulsifiable Concentrate
FL=Flowable

ME=Microencapsulated Liquid
SC=Suspension Concentrate
SL=Soluble Liquid

Sending in Plant Samples (Weeds only) for Identification

Each weed specialist at the University of Tennessee yearly identifies several hundred different weeds. In an effort to streamline the weed identification process and to improve turnaround time the weed science faculty at the University of Tennessee has put together a procedure for submitting weed samples for identification. Here are the steps:

1. Submit all weed samples to your County Extension Office. Many times the County Adult Ag Agent can identify the weed in question. If not they will submit it to the Extension Weed Specialists through the diagnostic lab.
2. All photos of weeds should go through the diagnostic lab in Nashville. Do not email them to the specialists!!! Weed pictures from just a few counties quickly overload our email system and can “lock up” specialists email. As would be expected this is counter productive to a quick turn around.
3. Label on the form who should be the primary weed ID personnel. This should be determined by origin of the weed in question. This should help speed up turn around time by dividing the work load.

a.	Field crops	Larry Steckel
b.	Golf Courses, athletic fields or Sod Farms	Jim Brosnan
c.	Horticulture or Lawns	Greg Armel
d.	Pastures and Aquatics	Neil Rhodes
4. Plant samples should be taped flat between two sheets of paper and sent in an envelope to the diagnostic lab as described in step 2.
5. Label samples (Priority or Urgent) from producers that need to know quickly for management considerations.

Some samples we can determine quickly while others will require more time and/or additional information. The samples marked priority or urgent we will try to get back to you quickly, while others just wanting a name may be longer. In a few instances, with the available information, the answer may not be more specific than the family or genus name and on occasion we do not know. Please remember that **only weeds** should be sent to us. Individuals who collect plants while back-packing etc and are just curious about the name would be advised to send the samples to Botany.

FORAGE, FEED, AND GRAZING RESTRICTIONS FOR HERBICIDES

C-Corn Ct – Cotton S-Soybean GS – Grain Sorghum W - Wheat * - Herbicide Tolerant Varieties Only

X = Recommended for use in respective crop in this publication.

Chemical	C	Ct	S	GS	W	Restrictions and Remarks
AAtrex	X			X		Do not graze /feed forage from treated areas for 60 days following application, or illegal residues may result.
Accent	X					Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.
Accent Gold	X					Do not harvest corn or graze or feed forage, hay or straw from treated areas to livestock within 85 days of application.
Achieve					X	Immature crops (forage) maybe grazed or cut for hay 30 days after treatment. Mature straw and grain may be fed to livestock 45 days after treatment.
Aim	X				7D	Barley, oats and wheat (Forage after 7 days).
Amplify			X			Do not harvest soybeans for forage or hay for 14 days after application of Amplify.
Assure II		X	X			Do not graze livestock in treated areas. In addition, do not feed forage, hay, or straw to livestock.
Atrazine	X			X		Do not graze or feed forage from treated areas for 21 days following application.
Axiom	X		X			Do not graze or feed forage, hay or straw to livestock.
Authority First			X			Do not feed treated soybean forage or soybean hay to livestock.
Backdraft			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
Balance Pro	X					No information on label.
Banvel	X			X	X	Corn may be harvested or grazed for feed once the crop has reached the ensilage (milk) stage or later in maturity. Do not graze or feed treated sorghum forage or silage prior to mature grain stage.
Basagran	X		X	X		(Corn and Grain sorghum) Do not graze treated fields for at least 12 days after the last treatment with Basagran. Do not graze or cut treated soybean fields for forage or hay for at least 30 days after the last treatment of Basagran.
Basis Gold	X					Do not graze or feed forage, hay, or straw from treated areas to livestock within 60 days of Basis Gold application.
Beacon	X					Do not graze or feed forage from Beacon treated corn to livestock within 30 days after application. Do not harvest silage within 45 days after application.
Bicep II Magnum	X			X		To avoid possible illegal residues, do not graze or feed forage from treated areas for 30 days following application.
Boundary			X			Treated soybean plants may be grazed or fed to livestock 40 days after the last application of Boundary.
Buctril	X	X*		X	X	Do not cut crop for feed, fodder, or graze within 45 days of application. (BXN cotton only) Do not graze any portion of crop. Do not cut crop for feed or fodder.
Bullet	X			X		(Corn) Do not graze treated area or feed treated forage to livestock for 60 days following application. (Sorghum) Do not graze or harvest forage for 70 days following application of this product.
Butyrac 200			X			Do not graze or feed soybean hay within 60 days after application of a Butyrac 200 tank mixture application.
Callisto	X					Do not harvest forage, grain, or stover within 45 days after application.
Canopy XL			X			Do not feed treated soybean forage or soybean hay to livestock.
Canopy SP			X			Do not feed treated soybean forage or soybean hay to livestock.
Caparol		X				Do not feed treated forage to livestock, or graze treated areas, or illegal residues may result.

Chemical	C	Ct	S	GS	W	Remarks
Celebrity Plus	X					Do not apply within 32 days of forage harvest. Do not apply within 72 days of corn grain and stover harvest.
Cinch	X	X	X	X		For all applications to corn, do not graze or feed forage from treated areas for 30 days following application. To avoid possible illegal residues, do not graze or feed forage or fodder from cotton to livestock.
Cinch ATZ	X			X		To avoid possible illegal residues, do not graze or feed forage from treated areas for 60 days following application.
Clarity	X	X				Corn may be harvested or grazed for feed once the crop has reached the ensilage stage or later in maturity.
Classic			X			Do not graze treated fields or harvest for forage or hay.
Cobra		X	X			Do not graze animals on green forage or stubble. Do not utilize hay or straw for animal feed or bedding. Do not feed treated soybean silage (ensiled soybeans) to cattle.
Command		X	X			Do not allow livestock to graze on, or feed treated cotton forage or trash to livestock. Cover crops, maybe planted anytime but stand reduction may occur in some areas. Do not graze or harvest for food or feed cover crops planted less than 9 months after Command treatment. Do not allow livestock to graze on treated soybean vines or feed treated vine trash to livestock.
Conclude Xact			X			Do not use treated plants for feed or forage.
Cotoran 4L		X				Do not feed foliage from treated cotton plants or gin trash to livestock.
Cotton Pro		X				Do not allow livestock to feed or graze on treated cotton crops.
Crossbow						Except for lactating animals, there are no grazing restrictions.
Define	X					Do not graze or feed to livestock the forage or fodder of cotton.
Degree	X					Do not graze area or feed treated forage for 60 days after application.
Degree Xtra	X					Do not graze area or feed treated forage for 60 days after application.
Direx		X				Do not allow livestock to graze treated cotton.
Distinct	X					Do not apply within 32 days of corn forage harvest. Do not apply within 72 days of corn grain and stover harvest.
Domain			X			Do not graze or feed forage, hay or straw to livestock.
DSMA		X				Do not feed treated foliage to livestock or graze treated areas.
Dual II Magnum	X	X	X	X		For all applications to corn, do not graze or feed forage from treated areas for 30 days following application. To avoid possible illegal residues, do not graze or feed forage or fodder from cotton to livestock.
Durango	X	X	X	X	X	Do not graze or feed corn forage or fodder following applications of this product through hooded sprayers. Do not feed or graze treated areas for 8 weeks following application.
Envoke		X				No information on label.
Equip	X					No information on label.
Extreme			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
FirstRate			X			Do not harvest soybeans for forage or hay for 65 days after application.
Flexstar			X			Do not graze treated areas or harvest for forage or hay.
Frontrow			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
FulTime	X					Do not apply this product within 60 days of harvest for forage use.
Fusilade DX		X	X			Do not graze or harvest for forage or hay.
Fusion		X	X			Do not graze or harvest for forage or hay.
Gangster FR			X			Do not graze treated fields or treated forage or hay to livestock.
Gangster V			X			Do not graze treated fields or treated forage or hay to livestock.

Chemical	C	Ct	S	GS	W	Remarks
Goal		X				Do not use any plants treated with Goal herbicide for feed or forage. Do not feed or allow animals to graze on any areas treated with Goal herbicide.
Gramoxone Max	X	X	X	X	X	Do not graze or harvest for forage or hay before the R3 stage of soybean development (early pod). Sorghum 20 days (forage). (Cotton) Do not pasture livestock in treated fields or feed treated foliage. Do not graze or harvest for forage or hay.
Gramoxone Inteon	X	X	X	X	X	Do not graze treated areas or feed treated forage to livestock.
Guardsman Max	X			X		Corn may be grazed or fed to livestock at 40 or more days after application of Guardsman Max. Sorghum forage may be grazed or fed to livestock 60 days or more after application of Guardsman Max. Grain and fodder may be harvested and fed 80 days or more after application of Guardsman Max.

Chemical	C	Ct	S	GS	W	Remarks
Harmony Extra					X	Do not graze livestock in treated areas. In addition, do not feed forage or hay from treated areas to livestock. (Harvested straw may be used for bedding or feed).
Harness	X					No information on label.
Harness Xtra	X					For field corn forage use, allow 60 days preharvest interval
Hoelon					X	Do not allow livestock to graze treated fields for 28 days after treatment. Do not harvest forage, hay, or straw from treated fields prior to grain harvest.
Hornet	X					No information on label.
Ignite (Liberty Link)		X*				No information on label.
Intrro	X					Do not graze or harvest forage for 70 days following application of this product or tank mixtures of this product.
Karmex		X				Do not allow livestock to graze treated cotton.
Lariat	X			X		(Corn) Do not graze treated area or feed treated forage to livestock for 21 days following application. (Sorghum) Do not graze or harvest forage for 70 days following application of this product.
Lasso	X		X	X		(Sorghum) Do not graze or harvest forage for 70 days following an application of this product.
Lexar	X					To avoid illegal residues, do not graze or feed forage from treated areas for 45 days following last application.
Lexone			X			Treated forage may be grazed or fed to livestock 40 days after application unless specified otherwise on the companion product.
Liberty (Liberty Link)	X*					Do not apply Liberty within 60 days of harvesting corn forage and within 70 days of harvesting corn grain and corn fodder.
Lightning (IR or IT Corn)	X*					Do not graze or feed treated corn forage, silage, fodder, or grain for at least 45 days after application. Only rotational crops harvested at maturity may be used for feed or food.
Linex	X					Do not graze treated fields or feed forage from treated areas to livestock. Do not feed gin trash to livestock.
Lumax	X					To avoid illegal residues, do not graze or feed forage from treated areas for 45 days following application.
Marksman	X			X		Corn may be harvested or grazed for feed after it has reached the ensilage (milk) stage or later maturity.
MSMA		X				Do not feed foliage to livestock or graze treated areas.
Option	X					Do not apply Option within 45 days of harvesting corn forage. Do not graze within 45 days of an Option application.
Outlook	X		X	X		Corn may be grazed or fed to livestock 40 days or more after application. (Soybeans) Do not graze or feed forage, hay, or straw to livestock.
Parrlay	X	X	X	X		Do not graze or feed forage or fodder from cotton to livestock. To avoid possible illegal residues, do not feed treated forage or gin trash to livestock, or graze treated areas.
Permit	X			X		Following application to foliage, allow 30 days before grazing domestic livestock, harvesting forage, or harvesting silage.
Poast		X	X			Processed meal may be fed from cotton. (Soybeans) Only processed meal from seed or hay may be fed to animals. Do not graze treated cotton fields and do not feed forage to livestock.
Poast Plus		X	X			Processed meal may be fed from cotton. (Soybeans) Only processed meal from seed or hay may be fed to animals. Do not graze treated cotton fields and do not feed forage to livestock.
Princep	X					Do not graze treated areas, or illegal residues may result.
Prowl/Pendimax 3.3/ Prowl H2O	X	X	X	X		Do not feed forage or graze livestock in treated cotton fields. Livestock can graze or be fed forage from treated corn or grain sorghum after 21 days following application. Livestock can graze or be fed forage from treated soybean fields. Do not feed forage or graze livestock for 75 days after planting wheat or barley in treated land.

Pursuit			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
Python	X		X			Do not graze or feed treated soybean forage, hay or straw to livestock.
Raptor			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
Reflex			X			Do not graze treated areas or harvest for forage/ hay. Do not graze rotated small grain crops or harvest forage or straw for livestock.

Chemical	C	Ct	S	GS	W	Remarks
Resource	X		X			(Corn) Do not graze animals on green forage or use as feed less than 28 days after Resource application. (Soybeans) Do not graze treated fields or harvest for forage or hay.
Roundup WeatherMax	X	X	X	X	X	For broadcast postemergence treatments do not harvest or feed treated vegetation for 8 weeks following application unless otherwise specified. Preharvest Wheat- Stubble may be grazed immediately after harvest. Allow 7 days between application and grazing. Allow a minimum of 7 days between application and harvest or feeding of treated vegetation. Do not graze or harvest treated hay or fodder for livestock feed within 25 days of last preharvest application.
Roundup WeatherMax (Roundup Ready)	X*	X*	X*			Allow a minimum of 50 days between application and harvest of corn forage. Allow a minimum of 14 days between final application and harvest of soybean grain or feeding of soybean grain, forage or hay.
Scepter			X			Do not graze or feed treated soybean forage, hay or straw to livestock.
Select/Select Max		X	X			Do not graze treated fields or feed treated forage or hay to livestock.
Sencor	X		X		X	Soybean vines or hay treated with Sencor may be grazed or fed to livestock 40 days after application. Do not graze wheat treated fields for 14 days following application. Corn treated with Sencor may be harvested for silage or grain 60 days after treatment.
Sequence		X	X			Do not graze or feed forage or fodder from treated cotton to livestock. Do not feed Sequence-treated soybean forage or hay following a postemergent application.
Sonic			X			Do not feed treated soybean forage or soybean hay to livestock.
Squadron			X			Do not graze or feed treated soybean forage, hay, or straw to livestock.
Staple		X				Do not feed cotton gin by products (trash) to livestock.
Staple LX		X				No information on label
Steadfast	X					Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days.
Steadfast ATZ	X					Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days.
Storm			X			Do not use treated plants for feed or forage.
Suprend		X				Do not feed treated forage to livestock or graze treated fields.
Surpass / Topnotch	X					No information on label.
Touchdown IQ/ Hi Tech	X	X	X	X	X	For broadcast postemergence treatments, do not harvest/feed treated vegetation for 8 weeks following application, unless otherwise specified.(Soybean) Allow at least 25 days before grazing or harvesting for livestock feed following harvest aid application. Do not feed or graze treated cotton forage or hay following preharvest application or following hooded sprayer application.
Touchdown IQ/ Total IQ (Roundup Ready)	X*	X*	X*			(Soybean) Do not graze or harvest for forage or hay. Allow a minimum of 50 days between pos application and harvest of forage. Do not graze or harvest for forage or hay or fodder following hooded sprayer application or preharvest application.
Treflan 4 / Tri-4		X	X			No information on label.
Typhoon			X			Do not graze treated areas or harvest forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.

Ultra Blazer			X			Do not use treated plants for feed or forage.
Valor/Valor XLT			X			Do not graze treated fields or feed treated forage or hay to livestock.
Yukon	X					Following application to foliage, corn may be grazed or harvested for feed after the crop reaches the ensilage (milk) stage, at least 30 days after foliar application.
Zorial		X				Do not graze or feed cotton forage.
2,4-D	X			X	X	Do not forage or feed corn fodder for 7 days following application. Do not forage or graze treated grain fields within 14 days after treatment. Do not feed treated straw to livestock.

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