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2024 Weed Control Manual for Tennessee

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2024 Weed Control Manual for Tennessee

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INTRODUCTION

This manual contains the 2024 University of Tennessee weed control recommendations for corn, grain sorghum, cotton, soybean, burley and dark tobacco, wheat, forage crops, and farm ponds. These recommendations are based on results of research and demonstrations conducted by UT AgResearch and UT Extension. 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.

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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	Liberty 280 SL	Gramoxone SL	2,4-D	Dicamba	Glyphosate + Leadoff + 2,4-D	Glyphosate + Dicamba	Liberty 280 SL + 2,4-D	Liberty 280 SL + Dicamba	Gramoxone SL + 2,4-D	Gramoxone SL + Dicamba	Liberty 280 SL + diuron	Liberty 280 SL + Caparol	Gramoxone SL + diuron	Gramoxone SL + Caparol	Gramoxone SL + Cotoran	Gramoxone SL + Metribuzin	Gramoxone SL + atrazine	Glyphosate + atrazine
Herbicide Site of Action*	9	10	22	4	4	9+4+2	9+4	10+4	10+4	22+4	22+4	10+7	10+5	22+7	22+5	22+7	22+5	22+5	9+5
Annual bluegrass	5	3	8	0	0	7	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	9	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	9	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)	2	8[a]	5	6	8	8	9	8	9	8	8	8	8	8	8	7	8	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	5	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	12M	NR	NR	NR	NR	NR	NR	NR
Cotton	0	0	0	30	15	30	15	30	21	30	15	0	0	0	0	0	12M	8M	8M
Soybean	0	0	0	30	14	30	14	30	21	30	14	12M	12M	NR	12M	12M	0	12M	12M

[a] *Poor performance is possible with this product if day time temperatures are less than 60F.*

GLYPHOSATE-RESISTANT BARNYARDGRASS/JUNGLERICE MANAGEMENT SYSTEMS

Herbicide (site of action)	Rate/Acre Broadcast: Active Ingredient	Rate/Acre Broadcast: Formulated Product	Remarks
SOYBEAN			
Preplant Burndown			
Glufosinate (10)	0.53 – 0.75 lb.	**Liberty 280 SL** 32 - 36 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.**
Glyphosate (9)	1.1 – 1.5 lb (a.e.)	**Roundup Powermax (glyphosate 4.5 ae)** 32- 44 ozs.	**Do not tank mix with dicamba to improve overall grass control**. Glyphosate-resistant junglerice is present in some fields. If glyphosate has failed on barnyardgrass, junglerice and goosegrass in your fields in past years consider tank-mixing clethodim with glyphosate to improve consistency of control.
Clethodim (1)	0.12-0.25 lb.	**Select Max 1 EC** 16-32 ozs.	Do not tank mix with dicamba to improve overall grass control. Always use crop oil concentrate at 1 pt./A. Should be used in fields where glyphosate has failed to control barnyardgrass, junglerice, goosegrass and goosgrass.
Preplant Incorporated			
Pendimethalin (3)	0.5-0.75 lb 0.75-1.0 lb [b] 1.0-1.5 lb. [c]	**Prowl H_20** 1.2-1.8 pts. 1.8-2.4 pts. [b] 2.4-3.6 pts. [c]	Excellent control of most annual grasses. Tank-mix with Cotoran for improved broadleaf control. A compatibility agent may be required in tank mixes.
Trifluralin (3)	0.5 lbs. 0.75 lbs. 1.0 lbs.	**Treflan 4 EC** 1.0 pt. 1.5 pts. 2.0 pts.	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.
Preemergence			
Pyroxasulfone + Sulfentrazone (14 + 15)	0.23-0.30 lbs.	**Authority Edge** 7-9 ozs.	Provides excellent control of grasses and small-seeded broadleaves.
Pyroxasulfone + Fluthiacet-methyl (14 + 15)	0.084-0.0151 lbs.	**Anthem Maxx** 2.5-4.5 ozs.	Do not graze or feed treated soybean forage/hay to livestock. The last application for soybean should be made no later than 60 days before harvest.
Clomazone (13)	0.5 lbs.	**Command** 1.3 pts	Very effective on weeds becoming more problematic in dicamba/glyphosate-based systems including barnyardgrass/junglerice, goosegrass, velvetleaf, spurred anoda, etc.)
S-metolachlor + metribuzin (15+5)	1.31 lbs + 0.31 lb	**Boundary** 2 pts.	Applied PRE provides good barnyardgrass, junglerice, goosegrass and pigweed control**.**

Herbicide (site of action)	Rate/Acre Broadcast: Active Ingredient	Rate/Acre Broadcast: Formulated Product	Remarks
S-metolachlor / Dimethenamid-P (15)	1.27 lbs. / 0.75-0.99 lbs.	**Dual Magnum / Outlook** 1.33pt / 16-21 ozs.	Good to excellent control of annual grasses, nutsedge and seedling johnsongrass. Apply alone or in combination with other layby materials. May be purchased as a packaged mix with glyphosate as Sequence.
fomesafen + S-metolachlor (14+15)	1.33 lb	**Prefix** 2 pts.	Provides good control of grasses and small-seeded broadleaves.
pyroxasulfone (15)	0.08-0.18 lb	**Zidua SC** 3.2 oz.	Apply PRE to control pigweed/annual grasses.
pyroxasulfone + saflufenacil + imazethapyr (15+14+2)	0.08+0.04+0.009 lb - 0.10+0.06+0.02 lb	**Zidua Pro** 4.5-6oz.	Apply PRE to control pigweed/annual grasses.
Postemergence			
Quizalofop / Fluazifop (1)	0.0034-0.069 lbs. / 0.094-0.188 lbs.	**Assure II / Fusilade DX 2E** 5-10 ozs. / 6-12 ozs.	**Assure II -** The higher rates may be needed to control **annual grasses or bermudagrass**. See label. Add oil concentrate at 1 gal. (for ground application) or 1 qt. nonionic surfactant per 100 gals. of spray mixture. **Fusilade -** Apply lower rate for most **annual grasses** before they exceed 4" tall. Make a second application (8 ozs.) when regrowth is 6-12" tall. Add oil concentrate (1 gal.) or nonionic surfactant (2 pts.) per 100 gal of spray mixture.
Glyphosate (9)	1.1- 1.5 lb (a.e.)	**Roundup Powermax (glyphosate 4.5 ae)** 32 - 44 ozs.	**Do not tank mix with dicamba to improve overall grass control**. Glyphosate-resistant junglerice is present in some fields. If glyphosate has failed on barnyardgrass, junglerice and goosegrass in your fields in past years consider tank-mixing clethodim with glyphosate to improve consistency of control.
Clethodim (1)	0.12-0.25 lb.	**Select Max 1 EC** 16-32 ozs.	Do not tank mix with dicamba to improve overall grass control. Always use crop oil concentrate at 1 pt./A. Should be used in fields where glyphosate has failed to control barnyardgrass, junglerice and goosegrass. Clethodim not as effective on Johnsongrass as Assure or Fusilade.
Glufosinate (10)	0.53 – 0.75 lb.	**Liberty 280 SL** 32 - 36 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.**

*(u)- **Restricted Use Herbicide***

COTTON			
	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
Preplant Incorporated			
Pendimethalin (3)	0.5-0.75 lb [a] 0.75-1.0 lb [b] 1.0-1.5 lb. [c]	**Prowl H_20** 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 for improved broadleaf control. A compatibility agent may be required in tank mixes.
Trifluralin (3)	0.5 lbs. 0.75 lbs. 1.0 lbs.	**Treflan 4 EC** 1.0 pt. 1.5 pts. 2.0 pts.	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.
Preemergence			
Clomazone + Fluometuron (13 + 7)	0.5 lbs. + 0.5 lbs.	**Command + Cotoran** 1.3 pts + 16 ozs.	**Command -** Many trees, bushes, ornamentals and vegetables are sensitive to drift of this herbicide. See label for drift reduction directions and restrictions. **Note: Thimet insecticide must be used in-furrow or severe crop injury may occur.** Tank-mixing these products provide a good preemerge option on control of most annual grasses.
Fluridone + Fluometuron (12 + 7)	0.15-0.3 lbs. + 1.0 lb.	**Brake + Cotoran** 1 pt. + 32 ozs.	**Brake -** Corn and sorghum rotation restriction is 10 months and soybean is 4 months. This herbicide provides good residual control on sand and silt loam soils. Avoid use on clay soils. It needs a good rain or irrigation to become activated. Also sold as a premix with Cotoran (Brake FX). Good to excellent control of most annual grasses and broadleaf weeds.
Postemergence			
Glyphosate (9)	0.75-1.1 lb (a.e.)	**Roundup Powermax (glyphosate 4.5 ae)** 32-44 ozs.	**Do not tank mix with dicamba to improve overall grass control**. Glyphosate-resistant junglerice is present in some fields. If glyphosate has failed on barnyardgrass, junglerice and goosegrass in your fields in past years consider tank-mixing clethodim with glyphosate to improve consistency of control.
Clethodim (1)	0.12-0.25 lb.	**Select Max 1 EC** 16-32 ozs.	Do not tank mix with dicamba to improve overall grass control. Always use crop oil concentrate at 1 pt./A. Should be used in fields where glyphosate has failed to control barnyardgrass, junglerice and goosegrass. Clethodim not as effective on Johnsongrass as Assure or Fusilade.
Glufosinate (10)	0.53 – 0.75 lb.	**Liberty 280 SL** 32 - 36 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.**
S-metolachlor / Dimethenamid-P (15)	1.27 lbs. / 0.75-0.99 lbs.	**Dual Magnum / Outlook** 1.33pt / 16-21 ozs.	Good to excellent control of annual grasses, nutsedge and seedling johnsongrass. Apply alone or in combination with other layby materials. May be purchased as a packaged mix with glyphosate as Sequence. Outlook may be applied post emergence to cotton for residual weed control from first true leaf stage to the mid-bloom stage.

Post-directed			
S-metolachlor / Dimethenamid-P (15)	1.27 lbs. / 0.75-0.99 lbs.	**Dual Magnum / Outlook** 1.33pt / 16-21 ozs.	Good to excellent control of annual grasses, nutsedge and seedling johnsongrass. Apply alone or in combination with other layby materials. May be purchased as a packaged mix with glyphosate as Sequence. Outlook may be applied post emergence to cotton for residual weed control from first true leaf stage to the mid-bloom stage.
MSMA (17)	2.0 lbs.	**MSMA** 42 ozs.	Apply 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.**
Prometryn + MSMA (5 + 17)	0.75 lbs. + 2.0 lbs.	**Caparol + MSMA** 32 ozs. + 42 ozs.	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.
Fluometuron + MSMA (7 + 17)	1.0 lb.+ 2.0 lbs.	**Cotoran + MSMA** 32 ozs + 42 ozs.	May be applied to cotton at least 6 inches tall until bloom. Precise application is necessary to avoid cotton injury.
Diuron + MSMA (7 + 17)	0.8 -1.2 lbs.+ 2.0 lbs.	**Direx + MSMA** 1.6 - 2.4 pts. + 42 ozs.	May be applied after cotton reaches 12 inches tall until bloom. May injure fall-seeded cover crops.

*(u)- **Restricted Use Herbicide***

GLYPHOSATE-RESISTANT PALMER AMARANTH MANAGEMENT SYSTEMS

Control of Palmer amaranth will center on PRE applied herbicides. This is particularly the case for Palmer amaranth that is PPO and glyphosate resistant. Liberty, Engenia, XtendiMax or Enlist One are very effective

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
SOYBEAN			
Preplant Incorporated			
trifluralin (3)	0.5 lb 0.75 lb 1.0 lb	**Treflan 4 EC** 1 pt. 1.5 pt 2 pt.	Must be incorporated.
Preemergence			
sulfentrazone+*S*-metolachlor (14+15)	1.36-1.75 lb	**Authority Elite** 25-32 oz	Soil applied herbicide. Do not apply more than 38.7 oz /ac per crop year.
sulfentrazone + chloransulam (14+2)	0.282 – 0.35 lb	**Authority First - Sonic** 6.45 – 8 oz/A	
sulfentrazone + metribuzin (14+5)	0.096 + 0.16 lb ai/A	**Authority MTZ** 12 – 18 ozs	Applied PRE provides good horseweed and pigweed control. Plant back restriction to cotton is 12 months.
pyroxasulfone + sulfentrazone (14+15)	0.23 – 0.30 lb.	**Authority Edge** 7-9 oz	Provides excellent control of grasses and small-seeded broadleaves.
S-metolachlor +metribuzin (15+5)	1.31 lbs + 0.31 lb ai/A	**Boundary** 2 pts.	Provides excellent control of grasses and small-seeded broadleaves.
flumioxazin + chlorimuron + thifensulfuron (2+ 2+14)	0.077 lb	**Envive** 3 ozs.	Apply PRE or with burndown program for residual control of glyphosate-resistant Palmer pigweed, horseweed, morningglories and other broadleaf weeds. Crop oil is preferred adjuvant with burndown program at 1 gal/100 gals. for better performance.
pyroxasulfone + flumioxazin (15+14)	0.14 lb	**Fierce** 3 ozs.	Provides excellent control of small seeded broadleaf weeds. Expect soybean injury, in some cases severe, under wet and/or cool environments.
fomesafen + S-metolachlor (14+15)	1.33 lb	**Prefix** 2 pts.	Provides good control of grasses and small-seeded broadleaves.
Postemergence			
lactofen (14)	0.2 lb	**Cobra 2E** 12.5 ozs.	Will not be effective on PPO-resistant Palmer amaranth. Add 2 pts. nonionic surfactant, or 2 to 4 pts. crop oil concentrate, per 100 gals.. Will control Palmer up to 3" tall. Soybean foliar burn which is usually of short duration.
glufosinate 280 SL (10)	0.4 – 0.53 lb	**Liberty 280 SL** 22 - 29 ozs.	Thorough spray coverage is essential for optimal performance. Will control Palmer up to 4 to 6" tall. A follow up application of Liberty 7 to 10 days after the first application may be needed to control Palmer that is over 5" tall. 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.
fomesafen (14)	0.24-0.35 lb	**Flexstar 1.88SC** 1.0-1.5 pts.	Will not be effective on PPO-resistant Palmer amaranth. Always add 1 gal. MSO per 100 gals. of spray mix.
acifluorfen (14)	0.13-0.38 lb	**Ultra Blazer 2L** 0.5-1.5 pts.	See label regarding the use of surfactant. Will not be effective on PPO-resistant Palmer amaranth.

Herbicide(site of action)	Rate/Acre Broadcast Active Ingredient	 Formulated Product	Remarks
Cotton			
Preplant Incorporated			
trifluralin (3)	0.5 lb 0.75 lb 1.0 lb	**Trifluralin** 1 pt. 1.5 pt 2 pt.	Must be incorporated. Refer to label for use rates based on soil texture. OR Refer to label for soil type specific rates.
Preemergence			
prometryn (5)	0.75-1.0 lb[a] 2.4 lb[bc]	**Caparol** 1.5-2.0 pts.[a] 4.8 pts.[bc]	Refer to label for use rates based on soil texture.
fluridone (5)	0.15 lb.	**Brake** 1 pt.	This herbicide provides good residual Palmer control on sand and siltloam soils. Avoid use on clay soils. It needs a good rain or irrigation to become activaded. As such, most consistent residual control is tankmixed with another product that is more water soluble like Cotoran. Also sold as a premix with Cotoran (Brake FX).
fluometuron (7)	1.0 lb[a]	**Cotoran 4L or 85DF** 2 pts. 4L, or 1.2 lbs. 85DF, or 1.25 lbs. 80DF	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: Refer to label for use rates based on soil texture.
	1.5 lb[b]	3 pts. 4L, or 1.8 lbs. 85DF, or 1.88 lbs. 80DF	
	2.0 lb[c]	4 pts. 4L, or 2.4 lbs. 85DF, or 2.5 lbs. 80DF	
Postemergence			
glufosinate 280 SL (10)	0.53 lb	**Liberty 280** 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.
Hooded Sprayer Applications			
paraquat (22)	0.31-0.62 lb	**Gramoxone SL** (u) 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 SL is labeled for tank-mix applications with residual herbicides (Cotoran, Caparol, Direx). See labels for rates and precautions.
glufosinate 280 SL (10)	0.4-0.53 lb	**Liberty 280 SL** 22 - 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.

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.

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.

*BURNDOWN HERBICIDES RECOMMENDED FOR NO-TILL CORN**

Burndown Herbicide(site of action)	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulated Product	
paraquat (u) (22)	0.5-0.75 lb	**Gramoxone SL** (u) 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.
glufosinate 280 SL (10)	0.4 – 0.53 lb 0.66 lbs	**Liberty 280 SL** 22 – 29 ozs. Up to 36 oz	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**.
glyphosate (9)	0.75-1.5 lb (a.e.)	**Roundup PowerMax 4.5 ae** 22-43 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.
dicamba, 2,4-D (4)	0.25-0.75 lb 0.5-1.0 lb	**Clarity, 2,4-D** 8-12 ozs. 1-2 pts.	Add if glyphosate-resistant horseweed is present. Can be applied prior to, at planting, or immediately after planting.
saflufenacil + dimethenamid (14+15)	0.435 – 0.78 lb	**Verdict 5.57EC** 10-18 oz	If crop lost, replant to soybeans 1-4 months, **see label for specifics**.

*(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 HERBICIDE TANK MIXTURES OR PACKAGE MIXES FOR NO-TILL OR CONVENTIONAL CORN

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient (lbs.)**	**Formulated Product**	**Remarks**
atrazine+bicyclopyrone+mesotrione+*S*-metolachlor) (5+15+27)	1.30 -1.73 lb	**Acuron (u)** 1.5 – 2 qt	Do not apply more than 3 qt of Acuron per acre per growing year. Do not apply to corn that is greater than 12 inches.
Pyroxasulfone + carfentrazone (15+14)	0.094-0.6172 lb	**Anthem Flex 3-5.5 fl oz.**	Corn must be planted a minimum of 1.5 inches deep.
pyroxasulfone + fluthiacet - methyl) (14+15)	0.084 – 0.134 lb	**Anthem Maxx** 2.5-4.0 ozs.	Apply preemergence to control susceptible grass and broadleaf weeds. Do not make more than 1 preemergence application.
atrazine (u) (5)	1.6-2.0 lb	**Aatrex** (u) 1.6-2.0 qts. 4L or 1.8-2.2 lbs. 90 DF	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. Use with a two pass program — not recommended alone.
thiencarbazone-methyl + isoxaflutole (2+27)	0.84-1.4 oz	**Corvus** 3.3-5.6 ozs.	Use the higher rate on fine-textured soils. 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.
acetochlor+ atrazine (u) (15+5)	0.83-2.0 + 1.25-2.0 lb	**Degree+Aatrex** 1.75-4.25 pts. 3.8ME + 1.25-2.0 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.
S-metolachlor + atrazine (u) (15+5)	sandy loam: do not use silt loam: 0.95- 1.5 lb silty clay loam: 0.95-1.5 lb	**Bicep II Magnum** (u) sandy loam: do not use silt loam:1.3-2.1 qts. silty clay loam: 1.3-2.1 qts.	
acetochlor+atrazine(u) (15+5)	2.97 – 3.78 lb	**FulTime NXT** 2.9 – 3.7 qts	Do not apply more than 4.4 quarts of FulTime NXT per acre.
acetochlor+atrazine(u) (15+5)	1.5-2.2 + 1.25-2.0 lb	**Harness ATZ** 1-2.5 pts. 7E + 1.25-2.0 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.
acetochlor+atrazine (15+5)	2.38 – 3.36 lb ai	**Keystone NXT** (u) 1.7 – 2.4 qts	
rimsulfuron + thifensulfuron-methyl (2)	0.0313 – 0.0564 lb	**Leadoff** 1.5 – 2.7 oz	Apply up to 14 days before planting. Add surfactant when mixing with paraquat, Liberty or glyphosate which does not contain an adjuvant.

Herbicide(site of action)	Rate/Acre Broadcast		Remarks
	Active Ingredient (lbs.)	Formulated Product	
S-metolachlor+mesotrione + atrazine(u) (5+27+5)	2.78 – 3.34 lb	**Lexar EZ** 3.0 – 3.5 qts.	Apply preplant with burndown program or PRE. Add a surfactant to enhance burndown activity when mixing with paraquat, Liberty or glyphosate with no surfactants.
dimethenamid-P+atrazine (u) (15+5)	0.56-0.99 + 1.0-2.0 lb	**Outlook+Aatrex** (u) 12-21 ozs. 6E + 1.0-2.0 qts. 4L	
flumetsulam (2)	0.05 lb	**Python 80WDG** 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 soybean 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.**
glyphosate + *S*-metolachlor (9+15)	1.64-1.96 lb	**Sequence** 2.5-3.0 pts.	Can be used PRE on any corn hybrid. Can be applied POST on glyphosate-tolerant hybrids up to 50 days before harvest.
Acetochlor + mesotrione + Clopyralid (15+27+4)	1.85-2.05 lb 2.05-2.26 lb 2.26-2.47 lb	**Resicore** 2.25-2.50 qts 2.50-2.75 qts 2.75-3.00 qts	Do not apply more than 28 days before planting.
acetochlor + flumetsulam + clopyralid (15+2+4)	0.8 – 1.32 lb	**SureStart II** 1.5 – 2.5 pts	
saflufenacil + dimethenamid-P (14+15)	0.435- 0.52 lb 0.566 – 0.65 lb 0.696 – 0.78 lb	**Verdict 5.57 EC** 10-12 fl oz[a] 13-15 fl oz[b] 16-18 fl oz[c]	Use MSO 1%v/v. **See Label for Tank mixing**.
acetochlor (15)	1.10 -2.02 lb	**Warrant** 1.5 – 2.75 qts	
pyroxasulfone (15)	0.10 lb	**Zidua SC** 3.2 ozs	Do not apply more than one application to corn in the spring.

*(u)- **Restricted Use Herbicide***

POSTEMERGENCE HERBICIDES RECOMMENDED FOR CORN

	Rate/Acre Broadcast		Remarks **Note: To determine corn height, measure to highest leaf surface on free standing plants.**
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	
nicosulfuron (2)	0.48 oz.	**Accent Q** 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. Add nonionic surfactant at 1 qt./100 gal., or crop oil concentrate at 1 gal./100 gal. of spray mix. 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.**
atrazine+bicyclopyrone+mesotrione+*S*-metolachlor) (5,15,27)	1.30 -1.73lb	**Acuron** 2.5 qt	Best results are a split application with 1.5 qts PRE fb/ 1 qt POST with a qt of atrazine. Do not apply to corn that is greater than 12 inches.
bicyclopyrone+glyphosate+ mesotrione+s-metolachlor (27+9+27+15)	1.63 lb	**Acuron GT** 3.75 pt	Apply from corn emergence up to 30 inches in height or no later than the 8-leaf stage of corn growth.
pyroxasulfone + fluthiacet - methyl) (14+15)	0.084 – 0.134 lb	**Anthem Maxx** 2.5-4.5 ozs.	May be applied to corn through the V4 stage.
fluthiacet-methyl (14)	0.008 lb	**Aim** 0.5 oz.	Apply overtop corn up to the 8 leaf collar stage to control velvetleaf, eastern 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.
topramezone (27)	0.016 lb	**Armezon or Impact** 0.75 oz	Apply overtop corn up to 45 day PHI. Add MSO 1 to 1.5% v/v and AMS at 8.5 lbs/100 gal.
topramezone + dimethenamid (15+27)	0.65-0.82 lb	**Armezon Pro** 16-20 ozs	Add MSO 1 to 1.5% v/v or NIS 0.25 to 0.5% v/v and AMS at 8.5 lbs/100 gal.
atrazine (u) + Crop Oil Concentrate (5)	2.0 lb + 1 gal./100 gal	**Aatrex** 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.
bentazon (6)	0.75-1.0 lb	**Basagran** 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.
fluthiacet-methyl (14)	0.0042-0.006 lb	**Cadet** 0.6 to 0.9 ozs	For control of velvetleaf, morningglory and lambsquarters. Can be applied to corn from V2 to 48" tall. Use ¼% NIS or COC 1-2 pts.

Herbicide(site of action)	Rate/Acre Broadcast Active Ingredient	 Formulated Product	Remarks Note: To determine corn height, measure to highest leaf surface on free standing plants.
mesotrione + atrazine (27+5)	0.094 + 0.25 lb	**Callisto 4L + Aatrex** 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). 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.
tembotrione + thiencarbazone) + atrazine. (27+2+5)	1.0 oz	**Capreno + Aatrexx** 3.0 ozs. + 32 ozs	Apply overtop corn up to 12 inches tall. (Note: Without atrazine, Capreno may be applied to corn up to V7 corn stage). Good control of broad spectrum of weeds including pigweeds. Always add crop oil concentrate at 1.25 pts/100 gal. of spray mix and UAN at a rate of 1.5 qt/A or AMS at a rate of 8.5 lbs/100 gal.
dicamba (4)	0.25-0.5 lb	**Clarity** 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.
thiencarbazone-methyl + isoxaflutole (2+27)	0.84-1.4 oz	**Corvus** 3.3-5.6 ozs	Use the higher rate on fine-textured soils. 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.
dicamba +diflufenzopyer (19)	0.175-0.25 lb	**Distinct 70G** 4-6 ozs	Apply overtop of 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 COC 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.
S-metolachlor + glyphosate + mesotrione) (15+9+27)	2.0-2.2 lb	**Halex GT** 3.6-4 pts/A	Can be used POST only on glyphosate-tolerant corn hybrids. For best palmer amaranth control consider tankmixing in atrazine or Status. **DO NOT** add nitrogen to this treatment as plant phyto has been observed.
flumetsulam + clopyralid (19)	1.9-4.7 oz	**Hornet** 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).
tembotrione (27)	0.082 lb	**Laudis** 3 ozs.	Apply up to the V8 stage for field corn and V7 for sweet corn.
atrazine + mesotrione +*S*-metolachlor)(u) (5+27+15)	2.78 – 3.24 lb	**Lexar EZ** (u) 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.
glufosinate **For glufosinate-tolerant hybrids** (10)	0.4 lb	**Liberty 280 SL** 22 ozs.	Can be applied to Herculex hybrids. 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. Apply up to 44 ozs. on corn with sequential applications made 10-14 days apart.
halosulfuron (2)	0.5-1 oz	**Permit** 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).
rimsulfuron + mesotrione (2+27)	0.097 oz	**Realm Q** 4 oz.	Include an adjuvant as recommended on label.

	Rate/Acre Broadcast		Remarks **Note: To determine corn height, measure to highest leaf surface on free standing plants.**
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	
flumiclorac (14)	0.03 lb	**Resource** 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.
nicosulfuron + mesotrione (2+27)	0.036 + 0.089 lb	**Revulin Q** 4 ozs.	Apply overtop corn until it reaches a height of 30" or V8. Also labeled for sweet corn.
glyphosate (9)	0.56-0.75 lb (a.e.)	**Roundup PowerMax** 16-22 ozs. 4.5ae	Can be used POST only on glyphosate-tolerant corn hybrids.
acetochlor + mesotrione + clopyralid (15+27+4)	1.85-2.05 lb 2.05-2.26 lb 2.26-2.47 lb	**Resicore** 2.25-2.50 qts 2.50-2.75 qts 2.75-3.00 qts	Do not apply after corn is 11" tall. Refer to label for use rates based on soil texture.
glyphosate + S-metolachor (2+15)	0.75 ae + 0.94 lb	**Sequence** 5.25L 2.5 pints	Add 0.25% NIS plus 1.25% UAN or 5 to 17 lbs AMS. Apply to corn from 4" tall or V2 to 30" tall or V8.
Tolpyralate (27)	0.026-0.035 lb	**ShieldEx** 1 to 1.35 oz	Apply emergence through V8 or 30" tall corn. Tankmixing with atrazine will improve control.
dicamba + diflufenzopyr (4+19)		**Status** 2.5 to 5 ozs.	Add 0.25% NIS. Apply up to 36" tall corn.
nicosulfuron + rimsulfuron (2)	0.035 lb	**Steadfast Q** 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).
acetochlor (15)	1.10-2.02 lb ai	**Warrant** 1.5-2.75 qts	
2,4,-D amine or low volatile ester (4)	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 dirift onto nearby, sensitive crops.
paraquat (22)	0.25-0.5lb	**Gramoxone SL** 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.

CORN HARVEST AIDS

Harvest aid products 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).

	Rate/Acre Broadcast		
Harvest Aid(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
carfentrazone	0.016-0.031 lb	**Aim** 1-2 ozs.	Apply to mature corn to help desiccate morningglory vines at harvest. Add NIS at 2 pt/100 gal or MSO or COC at 1 to 2 gal/100 gal.
paraquat (u) (22)	0.50 lb	**Gramoxone** 21 ozs. 3 lb ae 32 ozs. 2 lb ae	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.
Glyphosate (9)	0.75-1.5 lb (a.e.)	**Roundup PowerMax*** 22-44 ozs. 4.5 lb ae 32-64 ozs. 3 lb ae	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.
sodium chlorate	5 -7.5.lb	**Defol 5** 4.8 qts for 5 lb./gal. formulation or 3.2 qts for a 7.5lb./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 are 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)	Corvus+ Atrazine (u)	Bicep II Magnum (u) or	Acetochlor (u)+ Atrazine (u)	Resicore+ Atrazine (u)	Acuron (u) + Atrazine (u)
Herbicide Site of Action	5	15+29+2	15+5	15+5	27+15+4	5+15+29
Barnyardgrass	6	9	9	9	9	8
Broadleaf Signalgrass	4	9	8	8	8	9
Burcucumber	4	5	4	4	5	5
Cocklebur	7	9	7	7	9	9
Common Ragweed	7	9	9	9	9	9
Fall Panicum	3	9	9	9	9	9
Foxtail	5	9	9	9	9	9
Giant Ragweed	5	9	6	6	9	8
Goosegrass	5	9	9	9	9	9
Horsenettle	2	3	3	3	3	3
Jimsonweed	7	9	8	8	8	9
Lambsquarters	7	9	9	9	9	9
Large Crabgrass	7	9	9	9	9	9
Morningglory	7	8	8	8	8	8
Nutsedge	4	7	7	7	4	7
Pigweed, Palmer	7	9	9	9	9	9
Pigweed, Smooth	7	9	9	9	9	9
Rhizome Johnsongrass	0	2	2	2	2	3
Seedling Johnsongrass	1	8	8	8	8	8
Sicklepod	6	7	7	7	7	7
Smartweed	7	9	9	9	9	9
Smooth Crabgrass	3	9	9	9	9	9
Velvetleaf	6	8	6	6	8	8

KEY TO RESPONSE RATINGS**: **0**=No control; **10**=100% control; -----=Data not available; **(U) Restricted Use Pesticide

EXPECTED WEED RESPONSE TO POSTEMERGENCE CORN HERBICIDES

	Atrazine (u)+Oil	Armezon Impact + Atrazine (u)	Capreno + Atrazine (u)	Resicor	Basagran	Steadfast Q	Buctril	Acuron GT	Status	Halex GT	2,4-D	Accent Q	Liberty 280 SL	Laudis + Atrazine (u)	Impact + Atrazine (u)	Glyphosate
Herbicide Site of Action	5	27+5	27+2+5	27+4+15	6	2	6	27+15+9	4	9+27+5	4	2	10	27+5	27+5	9
Barnyardgrass/Junglerice	4	9	8	8	0	-----	0	8	1	9	0	-----	5	9	9	7
Broadleaf Signalgrass	6	8	9	8	0	9	0	7	1	9	0	8	5	8	8	9
Burcucumber	4	7	7	7	3	7	7	7	8	7	3	7	9	-----	----	-----
Cocklebur	7	9	9	9	9	6	9	9	9	9	9	6	8	9	9	10
Common Ragweed	8	9	9	9	5	-----	7	9	9	8	8	-----	9	9	9	8
Fall Panicum	6	9	8	9	0	8	0	9	1	9	0	-----	5	7	8	9
Foxtail	7	9	9	9	0	9	0	9	1	9	0	9	7	7	9	9
Giant Ragweed	6	8	9	9	5	3	7	8	9	7	9	2	9	8	8	6
Goosegrass	7	9	9	8	0	8	0	8	1	9	0	-----	5	7	8	9
Horsenettle	4	6	6	6	0	2	4	6	6	-----	4	2	4	----	4	-----
Horseweed (glyphosate-tolerant)	5	8	9	9	0	2	2	8	8	7	8	2	8	9	8	2
Lambsquarters	8	7	9	9	6	-----	8	7	9	8	8	2	8	8	8	8
Large Crabgrass	6	9	8	8	0	6	0	7	1	9	0	5	6	7	8	9
Morningglory	7	7	9	9	4	7	9	7	9	8	9	7	9	8	9	7
Nutsedge	6	4	6	2	8	2	0	4-	0	-----	0	4	0	3	1	7
Pigweed, Palmer	9	9	9	8	7	4	4	9	8	9	8	3	8	9	9	2
Pigweed, Smooth	9	9	9	9	9	9	4	9	9	9	9	9	8	9	9	8
Rhizome Johnsongrass	0	1	8	5	0	9	0	1	0	7	0	9	2	5	4	6
Ryegrass	5	7	8	6	0	8	0	6	1	7	0	8	2	----	----	7
Seedling Johnsongrass	0	8	9	9	0	9	0	5	1	9	0	9	5	8	6	8
Sicklepod	6	7	9	8	0	6	2	7	8	9	8	6	8	----	----	9
Smartweed	8	8	9	8	7	-----	8	8	8	8	6	-----	7	8	8	8
Smooth Crabgrass	4	8	9	8	0	2	0	6	1	9	0	5	6	6	8	9
Velvetleaf	7	9	9	8	8	7	8	9	8	9	8	7	7	9	9	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

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 yield, 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 that 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.

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.

*BURNDOWN HERBICIDES RECOMMENDED FOR NO-TILL GRAIN SORGHUM**

Burndown Herbicide(site of action)	**Rate/Acre Broadcast**		**Remarks**
	Active Ingredient	**Formulated Product**	
dicamba (4)	0.25 lb	**Clarity** 8 ozs.	May be applied at least 15 days before sorghum planting. See label.
paraquat (u) (22)	0.5-0.75 lb	**Gramoxone 3SL** 24 – 32 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.
saflufenacil (14)	0.02 lb	**Sharpen SG** 1- 2 ozs.	Tank-mix with glyphosate or Gramoxone SL for best burndown results. Add 1.0% MSO v/v. Apply preplant or pre anytime before sorghum emerges.
glyphosate (9)	1.1-1.5 lb (**a.e.**)	**Roundup PowerMax*** 32-43 ozs. 4.5ae	Better control of smartweed than Gramoxone SL. 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.
saflufenacil + dimethenamid (14 +15)	0.218 – 0.436 lb	**Verdict 5.57 EC** 5-10 ozs.	Apply preplant or pre to grain sorghum that has been treated with an approved chloroacetamide seed safener such as Concep III. Tank mix with glyphosate or paraquat for best burndown results.

*(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**

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
S-metolachlor + atrazine (u) (15+5)	sandy loam: do not use silt loam: 0.95- 1.5 lb silty clay loam: 0.95-1.5 lb	**Bicep II Magnum** (u) 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 seed safener.**
S-metolachlor (15)	sandy loam: 0.96-1.27 lb silt loam: 1.27-1.43 lb silty clay loam: 1.27-1.6 lb	**Dual II Magnum** 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.
S-metolachlor + glyphosate + mesotrione (15+9+27)	2.0-2.2 lb	**Halex GT** 3.6-4 pts/A	Can be used Pre plant or Pre emergence.
S-metolachlor+ mesotrione + atrazine (u) (15+27+5)	2.78 lb	**Lexar EZ** (u) 3.0 qts.	Cannot be used on coarse textured soils. Applying Lexar EZ less than 7 days before sorghum planting will increase the risk of crop injury, especially if irrigation or rainfall is received following the application. Applying Lexar EZ more than 7 days (but not more than 21) prior to sorghum planting will reduce the risk of crop injury. **Use only with Concep safened seed**.
dimethenamid (15)	0.56-0.75 lb	**Outlook** 12 to 16 ozs	Can be used Pre plant or Pre emergence.
saflufenacil (14)	0.067 lb	**Sharpen SG** 3 ozs.	Before applying Sharpen to sorghum, verify with your local seed company the selectivity of Sharpen on your hybrid to help avoid potential injury.
saflufenacil + dimethenamid-P (14 +15)	0.218 – 0.436 lb	**Verdict 5.57 EC** 5-10 ozs	Apply preplant or pre to grain sorghum that has been treated with an approved chloroacetamide seed safener such as Concep III. Tank mix with glyphosate or paraquat for best burndown results.
acetochlor (15)	1.10 – 1.65lb	**Warrant** 1.5 – 2.25 qts	Apply only to sorghum planted with seed that has been properly treated with seed protectant or safener.

**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

	Rate/Acre Broadcast		
Herbicide	**Active Ingredient**	**Product**	**Remarks**
carfentrazone-ethyl (14)	0.008 lb	**Aim** 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. 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.
atrazine (u)* (5)	2.0 lb	**Aatrex** 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.
bentazon (6)	0.75-1.0 lb	**Basagran** 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.
bromoxynil (6)	0.25-0.38 lb	**Buctril 4E** 0.5-0.75 pt.	Apply overtop grain sorghum from the 3-leaf stage 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.
dicamba (4)	0.125-0.25 lb	**Banvel** 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.**
pyrasulfotole + bromoxynil (27+6)	0.20-0.25 lb	**Huskie** 12.8-16 ozs.	Apply overtop grain sorghum between 3 leaf stage of growth up to 12 inches.
prosulfuron (2)	0.023-0.035 lb	**Peak 75WG** 0.5-0.75 ozs.	Soybean can be planted 10 months after a Peak application. Refer to label for other zone designations.
halosulfuron (2)	0.32-0.047 lb	**Permit 75WSG** 0.67-1.0 oz.	Good option for broadleaf weed control where adjacent sensitive crops such as cotton or soybean 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.
2,4-D (4)	0.25-0.5 lb.	**2,4-D** 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.

[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.*

GRAIN SORGHUM HARVEST AIDS

Harvest aid products 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 products 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. Be sure to read labels thoroughly and follow required preharvest intervals (PHI).

	Rate/Acre Broadcast		
Harvest Aid	**Active Ingredient**	**Product**	**Remarks**
Aim 2EC (14)	0.016-0.031 lb	1.0-2.0ozs.	3 days PHI. Excellent on morningglory spp.
Roundup PowerMax (glyphosate 4.5ae) (9)	0.75-1.5 lbs. (**a.e.**)	22-43 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. See labels for additional directions.
Sodium Chlorate, Defol 5, other trade names (sodium chlorate)	5 -7.5 lbs.	4.8 qts. of a 5 lb./gal. formulation or 3.2 qts of a 7.5 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. Sodium Chlorate has not proven beneficial in Tennessee research for reducing the moisture content of the grain itself.

* NOTE: *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)	**Atrazine (u) + Warrant**	**Aim**	**Atrazine (u)**	**2,4-D**	**Banvel**	**Basagran**	**Buctril**	**Huskie**
Herbicide Site of Action	15 + 5	15+5	14	5	4	4	6	6	27+6
Bermudagrass	0	0	0	1	0	0	0	0	0
Black Nightshade	8	8	-	7	8	9	3	8	8
Broadleaf Signalgrass	8	8	0	6	0	0	0	0	7
Cocklebur	7	6	6	7	9	9	9	9	9
Common Ragweed	9	9	-	8	8	9	5	7	9
Fall Panicum	9	8	0	6	0	0	0	0	7
Foxtail	9	9	0	7	0	0	0	0	7
Giant Ragweed	6	5	2	6	9	9	5	7	7
Goosegrass	9	9	0	7	0	0	0	0	7
Groundcherries	8	8	-	7	8	9	3	8	8
Lambsquarters	9	9	8	9	8	9	6	8	8
Large Crabgrass	9	9	0	6	0	0	0	0	7
Morningglories	8	8	8	7	9	9	4	7	8
Palmer amaranth	9	9	6	9	4	4	0	6	8
Prickly Sida	7	7	4	8	4	4	8	6	7
Rhizome Johnsongrass	0	0	0	0	0	0	0	0	2
Seedling Johnsongrass	8	8	0	0	0	0	0	0	6
Sicklepod	7	7	1	6	8	8	0	5	7
Smartweed	9	9	7	8	6	8	7	7	7
Smooth Crabgrass	9	9	0	4	0	0	0	0	7
Velvetleaf	6	5	9	7	8	8	8	7	8
Yellow Nutsedge	7	6	0	5	0	0	8	0	1
Sorghum Tolerance	2*	2*	3	3	3	2	0	1	3

**Rating refers to herbicide safened seed.*

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

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 burndown 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 burndown of Gramoxone SL or Liberty 280 SL 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. 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 SL, Liberty 280 SL, 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 applications in that cotton should be >12 inches tall and generally higher application rates are used.

PREPLANT HERBICIDES FOR BURNDOWN AND RESIDUAL WEED CONTROL — COTTON

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
fluridone (12)	0.15 lb. -0.3 lb	**Brake** 1 pt.	Corn and sorghum rotation restriction is 10 months and soybean is 4 months.
trifloxysulfuron (2)	0.005 lb	**Envoke** 0.10 ozs.	Use after November 15 and treated fields MUST be planted back to cotton. Safe on wheat cover crop. Some plant residue should remain on the field to reduce soil erosion on highly erodible soils. Tank mix with 2,4-D or dicamba to increase weed spectrum on winter annuals.
dicamba + glyphosate (4+9)	0.25 lb. + 0.75 - 1.5 lb (a.e)	**Clarity + Roundup PowerMax** 8 ozs. + 22 - 43 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 15 day waiting period after rainfall/irrigation is required per 8 ounces applied, before planting cotton. No waiting period for Xtend varieties with approved dicamba formulations.** May be tank-mixed with Caparol, Cotoran, or Gramoxone SL for control of additional grasses and broadleaf weeds.
2,4-D + glyphosate (4+9)	0.5 - 1.0 lb. + 0.75 - 1.5 lb(a.e.)	**2,4-D + Roundup PowerMax** 1.0-2.0 pt. of a 4 lb. /gal. formulation + 22 - 43 ozs.	Apply 2,4-D before cotton planting for control of existing horseweed. **With 2,4-D apply 30 days prior to cotton planting. Do not use 2,4-D on light, sandy soils. No waiting period for Enlist varieties for Enlist Duo applications.** Higher 2,4-D rates (1.5 to 2 pts/A) have provided consistently better control of glyphosate-resistant horseweed.
flumioxazin + burndown herbicide (14)	0.5 - 1 oz	**Valor 51% WDG** 1 - 2 ozs.	**Use after November 15 in combination with labeled burndown herbicides to control emerged weeds and provide residual control of horseweed up to cotton planting. DO NOT apply to soils prone to erosion unless adequate crop residue is present to reduce erosion.** 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.

[a] *Sandy loam (coarse-textured soils)* [b] *Silt loam (medium-textured soils)* [c] *Silty clay loam (fine-textured soils)*

PREPLANT INCORPORATED HERBICIDES FOR CONVENTIONAL TILLAGE — COTTON

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Fromulated Product**	**Remarks**
pendimethalin (3)	0.5-0.75 lb [a] 0.75-1.0 lb [b] 1.0-1.5 lb [c]	**Prowl 3.3 EC** 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.
trifluralin (3)	0.5 lb [a] 0.75 lb [b] 1.0 lb [c]	**Treflan 4 EC** 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

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
paraquat (u) (22)	0.5-0.75 lb	**Gramoxone SL** 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.
glufosinate (10)	1.67-2.09 lb	**Liberty 280 SL** 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.
glyphosate (9)	0.75-1.1 lb (a.e.)	**Roundup PowerMax*** 22-32 ozs. Of a 4.5 lb ae	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 SL will be needed at 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 HERBICIDES FOR CONVENTIONAL OR NO-TILL COTTON

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
Fluridone + fluometuron (12+7)	0.15 lb.	**Brake + Cotoran** 1 pt. + 24 ozs.	This herbicide provides good residual Palmer control on sand and siltloam soils. Avoid use on clay soils. It needs a good rain or irrigation to become activated. As such, most consistent residual control is tankmixed with another product that is more water soluble like Cotoran. Also sold as a premix with Cotoran (Brake FX).
prometryn (5)	0.75-1.25 lb[a]	**Caparol 4L** 1.5-2.5 pts.[a]	Good to excellent control of most annual grasses and broadleaf weeds, particularly residual pigweed control.
clomazone (13)	0.75 lb	**Command 3ME** 32 ozs.	For use where junglerice, barnyardgrass, goosegrass and sida species are problematic. Many trees, bushes, ornamentals and vegetables are sensitive to drift of this herbicide. See label for drift reduction directions and restrictions. **Note: Thimet insecticide must be used in-furrow or severe crop injury may occur.**
fluometuron (7)	1.0 lb[a]	**Cotoran 4L or 85DF** 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. 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: 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. A follow-up postemergence application of 1.2 oz. can be made for control of cocklebur, morningglory and other escapes. See label.
	1.5 lb[b]	3 pts. 4L, or 1.8 lbs. 85DF, or 1.88 lbs. 80DF[b]	
	2.0 lb[c]	4 pts. 4L, or 2.4 lbs. 85DF, or 2.5 lbs. 80DF[c]	
fluometuron + prometryn (7+5)	0.5 lb + 0.5 lb	**Cotoran 4L + Caparol 4L** 16 ozs. + 16 ozs.	Adjust rates to labeled soil texture requirements.
fluometuron + pendimethalin (7+3)	1.0 lb + 0.75 lb	**Cotoran 4L + Prowl H_20** 32 ozs. + 26 ozs.	Provides two modes of action to control Palmer amaranth and provide barnyardgrass/junglrice and goosegrass control.
Pendimethalin (3)	0.5-0.75 lb [a] 0.75-1.0 lb [b] 1.0-1.5 lb. [c]	**Prowl H_20** 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 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

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
2,4-D (4) **Enlist Cotton Only**	0.71- 0.95 lb	**Enlist One** 1.5-2.0 pts.	Do not apply if sensitive crops or plants are down wind. Also, labels must be followed with great attention to detail. Spraying near twilight or at night, wrong nozzles, off-label wind speed, excessive boom height, the addition of AMS to spray mixture, etc. could increase chances for off target movement. Can also be purchased as premix with glyphosate (Enlist Duo). Refer to the label or websites for more information.
quizalofop (1)	0.034-0.069 lb	**Assure II** 0.88E 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.
dicamba (4) **Xtend Cotton Only**	0.5 lb	**Engenia** 12.8 ozs. **XtendiMax** 22 ozs. **Tavium** 56.5 ozs	Applicators must take dicamba-specific training and be a certified applicator. The federal labeled cutoff for dicamba applications in Xtend cotton is July 30 or 60 days after planting. In addition to label requirements the following best management practices are recommended to minimize off-target movement. UT research suggests that dicamba-based herbicides are more prone to off-target movement as temperature increases. Therefore **best management practices to minimize drift are to only apply if the expected high air temperature of the day is less than 85 F or before June 15 whichever is more restrictive.** UT research also indicates that tankmixing glyphosate with these low-volatile dicamba formulations will lower the solution pH which can result in increased dicamba emissions. Despite many applicators' best efforts with applications, drift has apparently occurred with these products in multiple directions from treated fields independent of wind direction. Do not apply if sensitive crops or plants are in adjacent fields. Also, labels must be followed with great attention to detail. Spraying at night, wrong nozzles, off-label wind speed, excessive boom height, the addition of AMS to spray mixture, etc. could increase chances for off-target movement. Tavium a premix of XtendiMax and Dual Magnum has a more restrictive label than XtendiMax. Refer to the label or websites for more restrictions and information.
S-metolachlor (15)	0.96-1.27 lbs	**Dual Magnum** 1.0-1.33 pts.	100 day PHI when applied. Application in environmentally stressful conditions can increase crop injury.
trifloxysulfuron (2)	0.0046-0.0069 lb	**Envoke 75DF** 0.1-0.15 ozs.	Apply overtop of 5 leaf until 60 day PHI cotton for control of smooth pigweed, morninglories, 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 as substantial cotton injury will result.**

Herbicide(site of action)	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulated Product	
fluazifop (1)	0.094-0.188 lb	**Fusilade DX 2E** 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.
glufosinate (10) **Glufosinate-tolerant Cotton Only**	1.67-2.09 lb	**Liberty 280 SL** 23-29 ozs.	**Apply over the top to glufosinate-tolerant cotton varieties.** No more than 29 ozs./A may be applied per application and no more than 87 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 gallons per acre. Use only flat-fan or hollow-cone nozzles. Read label for further application instructions.
dimethenamid-P (15)	0.75-0.99 lb	**Outlook** 16 -21 oz	Outlook may be applied postemergence to cotton for residual weed control from first true leaf stage to the mid-bloom stage.
sethoxydim (1)	0.19 lb	**Poast 1.5E or Poast Plus 1E 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 and glufosinate-tolerant corn in cotton.
glyphosate (9) **Glyphosate-tolerant Varieties Only**	0.75-1.1 lb (**a.e.**)	**Roundup PowerMax (glyphosate 4.5 ae)** 22-32 ozs.	**Roundup Ready Flex** Over-the-top or post-directed as needed for weed coverage. No restrictions on timing of sequential applications.
clethodim (1)	0.12-0.25 lb.	**Select Max 1 EC** 16-32 ozs.	Do not tank mix with dicamba to improve overall grass control. Always use crop oil concentrate at 1 pt./A. Should be used in fields where glyphosate has failed to control barnyardgrass, junglerice and goosegrass. Clethodim not as effective on Johnsongrass as Assure or Fusilade.
glyphosate + *S*-metolachor (9+15)	0.75 ae + 0.94 ai lb	**Sequence 5.25L** 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. Applied in environmentally stressful conditions can increase crop injury.
pyrithiobac (2)	0.043-0.095 lb	**Staple LX** 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. The 6 lb/gal formulation used as an example below usually contains surfactant. Rates are expressed on a broadcast basis. Use the conversion table, later in this section, to determine band rates.

	Rate/Acre Broadcast*		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
For Cotton at Least 3" Tall			
MSMA 6 (17)	2.0	**MSMA 6** 2.67 pts. 6L	Apply 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.**
fluometuron + MSMA (7 +17)	1.0 lb. + 2.0 lb.	**Cotoran 4L+MSMA6** 1 qt. 4L+ 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).
S-metolachlor (15)	1.27 lbs	**Dual Magnum** 1.33pt	Good to excellent control of annual grasses, nutsedge and seedling johnsongrass. Apply alone or in combination with other layby materials. May be purchased as a packaged mix with glyphosate as Sequence.
For Cotton at Least 6" Tall			
pyroxasulfone+Carfentrazone (14+15)	0.085-0.119	**Anthem Flex** 2.73 – 3.8 oz	Apply as a directed spray when cotton is at least 6" tall.
prometryn + MSMA (7+17)	0.5-0.65 lb. + 2.0 lbs.	**Caparol 4L+MSMA6** 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.
lactofen (14+17)	0.2 lb. + 2.0 lbs.	**Cobra+ MSMA 6** 12.5 oz.+ 2.67 pts. 6L	Apply as a directed spray when cotton is at least 6" tall. Do not allow spray to contact any green non-barked parts of the cotton plant or foliage.
diuron + MSMA 6 (7+17)	0.2-0.4 lb. + 2.0 lbs.	**Direx 4L + MSMA 6** 0.4-0.8 pt. 4L + 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).
trifloxysulfuron (2)	0.025 – 0.063 lb.	**Envoke 25DF** 0.10 - 0.25 ozs.	For contact and residual control of morningglories and nutsedge.
oxyfluorfen (14+17)	0.25-0.5 lbs. + 2.0 lbs.	**Goal 2XL+ MSMA 6** 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).
fomesafen (14)	0.25-0.375 lbs.	**Reflex** 1-1.5 pts.	Reflex may be applied to cotton at least 6" 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. Apply Reflex at 1-1.5 pts./A in a minimum of 10 gallons spray solution per acre.
prometryn + trifloxysulfuron (5+2)	1.25 lbs.	**Suprend** 1.56 lbs	May be applied to cotton from 6" tall until bloom. Precise application is necessary to avoid cotton injury.
linuron+ MSMA 6 (7 +17)	0.5-0.75 lb. + 2.0 lb	**Linex 4L+ MSMA 6** 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.

Herbicide(site of action)	Rate/Acre Broadcast* Active Ingredient	Formulated Product	Remarks
For Cotton at Least 12" Tall			
carfentrazone-ethyl (14)	0.013-0.025 lb	**Aim 2EC** 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.** Use a crop oil concentrate at 1% v/v (1 gallon per 100 gallons of spray solution).
prometryn + MSMA (5 + 17)	0.75 – 1.25 lb	**Caparol+ MSMA 6** 1.5 – 2.5 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.
For Cotton at Least 15" Tall			
linuron + diuron (7 + 7)	0.4-0.6 + 0.4-0.6 lb	**Layby Pro** 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.**
fomesafen (14)	0.25-0.375 lb	**Reflex** 1-1.5 pts.	Reflex may be applied to cotton at least 6" 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. Crop rotation is restricted to 4 months for wheat and 10 months for corn.
flumioxazin (14)	0.5-1.0 oz	**Valor SX 51 DF** 1.0-2.0 ozs.	**Apply after cotton is 15" tall with a woody stem**. Do not allow herbicide spray to contact green foliage. Apply no more than 4.0 ozs. of Valor per acre per year.

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

HERBICIDES RECOMMENDED FOR USE IN HOODED SPRAYERS

	Rate/Acre Broadcast*		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
paraquat (u) (22)	0.31-0.62 lb	**Gramoxone SL** (u) 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 SL is labeled for tank-mix applications with residual herbicides (Cotoran, Caparol, Direx). See labels for rates and precautions.
glufosinate (10)	1.67-2.09 lb	**Liberty 280 SL** 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.
glyphosate (9)	0.75-1.1 lb (**a.e.**)	**Roundup PowerMax** 4.5 32 ozs.	
fomesafen (14)	0.25-0.375 lb	**Reflex** 1-1.5 pts.	Use only hooded or shielded spray equipment to apply Reflex in cotton that is 6" to 12" in height. Adjust nozzles to provide full coverage of emerged target weeds. Crop rotation is restricted to 4 months for wheat and 10 months for corn.
flumioxazin (14)	0.5 - 1 oz	**Valor 51% SX** 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***

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(site of action)	Rate/Acre Broadcast*		Remarks
	Active Ingredient	Formulated Product	
prometryn (5)	1.2-1.6 lb	**Caparol 4L** 2.4-3.2 pts.	Apply when cotton is at least 12" 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.
fluometuron (7)	1-2 lb	**Cotoran 4L** 2-4 pts.	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.
diuron (7)	0.8-1.2 lb	**Direx 4L** 1.6-2.4 pts.	Apply when cotton is at least 12" 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.
linuron (7)	1-1.5 lb	**Linex 4L** 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.
linuron + diuron (7+7)	0.4-0.6 + 0.4-0.6 lb	**Layby Pro** 1.6-2.4 pts.	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.**
fomesafen (14)	0.25-0.375 lb	**Reflex** 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" of brown bark through lay-by. Application equipment should be configured to provide full coverage of emerged target weeds. Crop rotation is restricted to 4 months for wheat and 10 months for corn.
flumioxazin (14)	0.5-1.0 oz	**Valor SX 51 DF** 1-2 oz.	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

	Valor	Reflex	Treflan	Prowl	Cotoran	Command+ Cotoran	Dual Magnum/Outlook	MSMA	Cotoran +MSMA	Direx + MSMA	Caparol + MSMA	Brake+Cotoran	Engenia/XtendiMax	Enlist One	Roundup PowerMax/ others**	Envoke	Liberty 280 SL***	Staple LX	Select Max	AssureII/Fusilade
	EPP	EPP	PPI	PPI/PRE	PRE	PRE	PRE	EPD	EPD	LPD	LPD	LPD	OT	OT	OT/LPD	OT	OT	OT	OT	OT
Herbicide Site of Action	14	14	3	3	7	13+7	15	17	7+17	7+17	5+17	12+7	5	4	9	2	10	2	1	1
Broadleaf Signalgrass	0	0	8	8	7	8	8	7	7	8	7	8	0	0	9	---	6	0	9	8
Cocklebur	5	6	1	1	8	8	1	8	8	9	9	8	9	9	9	9	8	8	0	0
Common Ragweed	8	8	0	0	9	9	0	8	8	8	8	9	9	8	8	---	9	-----	0	0
Crabgrass	4	3	9	9	8	8	8	8	8	9	8	8	0	0	9	2	6	0	9	7
Fall Panicum	0	0	9	9	8	8	8	8	8	9	8	8	0	0	9	0	6	0	9	7
Foxtail	0	0	9	9	8	8	8	8	8	9	8	8	0	0	9	0	7	0	9	7
Goosegrass	2	2	9	9	8	8	8	7	8	9	8	8	0	0	9	0	5	0	9	6
Barnyardgrass/Junglerice	0	0	9	9	7	9	9	8	8	9	9	9	0	0	7	5	6	2	9	5
Johnsongrass (rhizome)	0	0	2	2	0	1	0	5	3	4	3	2	0	0	9	0	2	0	7	8
Johnsongrass (seedling)	2	2	9	8	6	6	8	8	8	8	8	8	0	0	9	5	7	0	7	9
Lambsquarters	9	9	7	7	9	9	7	7	8	9	9	9	8	8	8	---	8	-----	0	0
Morningglory, Entireleaf/Ivy	8	8	5	5	7	7	0	6	8	8	6	9	9	9	8	9	9	8	0	0
Morningglory, Pitted	8	8	7	7	8	8	0	6	9	9	9	9	9	9	7	9	9	7	0	0
Morningglory, Tall	8	8	4	4	6	6	0	5	8	8	7	9	9	9	8	9	9	3	0	0
Pigweed, Palmer	8	9	9	6	6	6	6	4	5	4	8	9	6	7	2	2	8	2	0	0
Pigweed, smooth	9	9	9	8	9	9	8	6	8	8	8	9	8	8	9	8	8	9	0	0
Prickly Sida	---	---	0	0	6	8	0	4	7	6	4	8	4	4	6	0	3	2	0	0
Sicklepod	4	3	0	0	8	8	2	6	8	7	7	6	8	8	8	9	8	3	0	0
Smartweed	5	5	0	0	8	8	1	6	7	8	8	7	7	6	8	---	8	7	0	0
Nodding Spurge	---	---	0	0	6	7	6	5	7	7	7	6	3	3	9	---	5	3	0	0
Spurred Anoda	---	---	0	0	4	8	0	2	3	5	4	7	6	8	7	5	6	8	0	0
Velvetleaf	---	---	0	3	5	9	0	4	5	5	6	6	6	8	7	---	6	9	0	0
Volunteer DT Soybeans/Non DT Soybeans	0	0	0	0	9	9	0	4	6	8	7	9	0/9	9/9	0	8	9	6	0	0
Yellow Nutsedge	0	2	0	0	0	1	8	7	7	7	7	3	1	1	7	9	3	1	0	0
Cotton Tolerance	3	3	1	1	1	1*	1	1	1	2	2	1	0	0	0**	2	0***	1	0	0

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

***Cotton variety must be Roundup Ready and applications properly timed. ***Cotton variety must be glufosinate-tolerant.* ¶*- 8 for PPI; 6 for PRE*

SOYBEAN WEED CONTROL

BURNDOWN HERBICIDES FOR NO-TILL SOYBEAN

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
halauxifen-methyl (4)	0.004 lb	**Elevore 1 oz**	Apply prior to 8" tall horseweed for most consistent control. Add 1% MSO for best results.
paraquat (u) (22)	0.75 lb	**Gramoxone 3 SL** (u) 32 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 ensure 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.
rimsulfuron + thifensulfuron-methyl (2 +2)	0.0313 – 0.0564 lb	**Crusher/Leadoff** 1.0 oz./1.5 - 2.7 ozs.	Applied 30 days or more preplant to cotton or soybean for winter vegetation management. Crop injury may occur if there is a prolonged period of cold weather and/or in conjunction with wet soils. Apply with 1% COC or 0.5% MSO or 0.25% NIS.
glufosinate (10)	0.4 – 0.53 lb Up to 0.66 lb	**Liberty 280 SL** 22 – 29 ozs. Up to 36 ozs.	Thorough spray coverage is essential for optimal performance. Will control Palmer up to 4 to 6" tall. A follow up application of Ignite 7 to 10 days after the first application may be needed to control regrowth of Palmer that is over 5" tall. 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. If 36 oz is used at burndown, only 29 oz can be used POST.
Clethodim (1)	0.12 - .25 lb	**Select 2EC** 16 - 32 oz	Always use a crop oil concentrate at listed rate (but not less than 1 pt/A)
saflufenacil (14)	0.02 lb	**Sharpen SG** 1 ozs.	30 day plant back restriction to soybean on coarse soils with O.M. less than 2. Tank-mix with glyphosate or Gramoxone SL for best burndown results. 1.0% MSO. Do not tank-mix with Valor.
glyphosate (9)	1.1 – 1.5 lb (**a.e.**)	**Roundup PowerMax 4.5ae** 32 – 44 ozs.	Apply in 10-20 gallons of water per acre. More effective than Gramoxone SL on weeds such as smartweed and fall panicum. Apply lower rates to control many annual weeds less than 6" tall. Increase the rate on barnyardgrass species, larger annual weeds and perennials. (See label).
saflufenacil + dimethenmid (14+15)	0.22 – 0.435 lb	**Verdict** 5 – 10 oz	Minimum preplant interval of 30 days is required for coarse (sand, loamy sand, and sandy loam) soils with ≤ 2.0% organic matter. Tank-mix with glyphosate or Gramoxone SL for best burndown results. 1.0% MSO. Do not tank-mix with Valor. Verdict contains product that will give some residual control of grasses.

(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 SOYBEAN

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
trifluralin (3)	sandy loam: 0.5 lb silt loam: 0.75 lb silty clay loam: 1.0 lb	**Treflan** 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.*

PREPLANT/PREEMERGENCE HERBICIDES FOR SOYBEAN

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
pyroxasulfone +fluthiacet-methyl (15+14)	0.084-0.151 lb	**Anthem Maxx** 2.5-4.75 oz	Apply from planting until V6 for residual weed control.
sulfentrazone + *S*-metolachlor (14+15)	1.19 – 1.5 lb	**Authority Elite** 22-28 oz	Do not apply more than 38.7 oz fl oz per acre of Authority Elite per crop year.
sulfentrazone + cloransulam-methyl (14+2)	0.282 – 0.35 lb	**Authority First/Sonic** 6.45 – 8 oz	The 4.5 oz/A rate is the typical ues rate and allows for a 12-month plant back to cotton.
sulfentrazone + metribuzin (14+5)	0.39 + 0.51 lb	**Authority MTZ** 12-16 oz	Applied PRE provides good horseweed and pigweed control**.**
pyroxasulfone + sulfentrazone (14+15)	0.193 – 0.372 lb	**Authority Supreme** 6.0 – 11.5 oz	Provides excellent control of grasses and small-seeded broadleaves.
	0.23 – 0.30 lb	**Authority Edge** 7-9 oz	
sulfentrazone + chlorimuron (2 +14)	0.022 – 0.33 lb	**Authority XL** 4-6 ozs	Do not follow Authority XL with a post-emergence application of another chlorimuron containing herbicide the same cropping season.
S-metolachlor + metribuzin (15+5)	1.31 lbs + 0.31 lb	**Boundary** 2 pts.	Applied PRE provides good barnyardgrass, junglerice, goosegrass and pigweed control**.**
chlorimuron + metribuzin (2 + 5)	0.188 - 0.28 lb	**Canopy 75DG** 4 – 6 oz.	May be applied at planting or up to 45 days prior to planting.
sulfentrazone + *S*-metolachlor (14 + 15)	1.09-1.37	**Broadaxe** 20-25 oz.	
chlorimuron + tribenuron (2+ 2)	0.028-0.037 lb	**Canopy EX** 1.5-2.0 oz.	May be applied up to 7 days before planting.
clomazone (13)	0.5-1.25 lb	**Command 3ME** 1.3-3.3 pts.	Apply as a surface application. Very effective on weeds becoming more problomatic in dicamba/glyphosate-based systems including barnyardgrass/junglerice, goosegrass, velvetleaf, spurred anoda ,etc)

	Rate/Acre Broadcast		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
S-metolachlor (15)	sandy loam: 0.96-1.27 lb. silt loam: 1.27-1.59 lb silty clay loam: 1.27-1.59 lb	**Dual Magnum** 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.
flumioxazin + chlorimuron + thifensulfuron (2+ 2+14)	0.077 lb	**Envive** 3 ozs.	Apply PRE or with burndown program for residual control of glyphosate-resistant Palmer pigweed, horseweed, morningglories and other broadleaf weeds. Crop oil is preferred adjuvant with burndown program at 1 gallon/100 gallons spray mix for better performance.
pyroxasulfone + flumioxazin (15+14)	0.14 lb	**Fierce** 3 ozs.	Provides excellent control of small seeded broadleaf weeds. Expect soybean injury, in some cases severe, under wet and/or cool environments.
S-metolachlor+metribuzin+fomesafen (15+5+14)	1.7 – 1.95 lb ai	**Intimidator** 2.8 – 3.2 pts	Do not exceed the maximum application rate of 4.48 pts of Intimidator per acre per use season.
metribuzin 75DF (5)	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 soybean. For control of emerged cotton, metribuzin can be tank mixed with Gramoxone.
flumiclorac+pyroxasulfone (14+15)	0.1 – 0.18 lb ai	**Perpetuo** 6-10 oz	
fomesafen + *S*-metolachlor (14+15)	sandy loam: 1.33 lb silt loam: 1.33-1.66 lb silty clay loam: 1.82-1.99 lb	**Prefix** 2 pts. 2-2.5 pts. 2.75-3 pts.	Requires rainfall to be activated. Provides good small-seeded broadleaf weed control. Can be applied up to 90 days PHI.
pendimethalin (3)	sandy loam: 0.5-0.75 lb silt loam: 0.75-1.0 lb silty clay loam: 0.75-1.5 lb	**Prowl H_20** 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.
S-metolachlor + glyphosate (15+9)	1.64 lb	**Sequence** 2.5- 3.0 pts.	Apply up to 3 trifoliate. Can be applied up to 90 days PHI.
saflufenacil (14)	0.22 lb	**Sharpen** 1 ozs.	30-day plant back restriction to soybean on coarse soils with less than 2% O.M. Tank-mix with glyphosate or Gramoxone SL for best burndown results. Add 1.0% MSO.
cloransulam-methyl+flumioxazin (2+14)	0.1- 0.126 lb	**Surveil** 2.8 oz	Surveil may be applied to soybean preplant or preemergence, but prior to soybean emergence. The 2.8 oz rate will provide 0.4 oz of FirstRate and 2 oz of Valor.
Cloransulam-methyl+metribuzin+ s-metolachlor (2+5+15)	0.02+ 0.24+1.3 lbs – 0.03+0.32+1.7 lbs	**Tendovo** 48-64 oz	
chlorimuron ethyl+ flumioxazin+metribuzin) (2+5+14)	0.228 – 0.342 lb ai	**Trivence** 6 – 9 oz	Trivence may be applied any time from fall through spring, up to 3 days after planting.

Herbicide(site of action)	Rate/Acre Broadcast		Remarks
	Active Ingredient	Formulated Product	
flumioxazin (14)	0.063-0.078 lb.	**Valor 51WDG** 2-2.5 oz.	Apply preemergence to control pigweed, lambsquarters, hophornbeam copperleaf, morninglories 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.
flumioxazin + chlorimuron (14+2)	0.9+0.3 lbs-1.2+0.4lb	**Valor XLT** 3-4 ozs.	Apply PRE to control pigweeds, horseweed, hophornbeam copperleaf and morningglory spp. Mix with grass herbicide for better broad-spectrum grass control.
pyroxasulfone (15)	0.10 lb	**Zidua** 3.2oz.	Apply PRE to control pigweed/annual grasses.
pyroxasulfone + saflufenacil + imazethapyr (15+14+2)	0.10+0.06+0.02 lb	**Zidua Pro** 6.0 oz.	Apply PRE to control pigweed/annual grasses.

Postemergence Weed Control in Soybean: 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 SOYBEAN

Herbicide(site of action)	Rate/Acre Broadcast*		Remarks**
	Active Ingredient	Formulated Product	
carfentrazone (14)	0.008-0.025 lb.	**Aim** 0.25-0.5 ozs.	Apply post-direct/hooded in soybean from V3 to V10 to control velvetleaf and morninglories. 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 morninglories.
pyroxasulfone + fluthiacet-methyl (14,15)	0.084-0.0151 lbs.	**Anthem Maxx** 2.5-4.5 ozs.	Do not graze or feed treated soybean forage/hay to livestock. The last application for soybean should be made no later than 60 days before harvest.
quizalofop (1)	0.034-0.069 lb.	**Assure II 0.88E** 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 soybean.
bentazon (6)	0.75-1.0 lb.	**Basagran 4SC** 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 morninglory. Do not add oil or surfactant when mixing with 2,4-DB.
chlorimuron (2)	0.008-0.012 lb.	**Classic 25DF** 0.5-0.75 oz.	Apply to control cocklebur, pigweed, burcucumber and other broadleaf weeds. Can be applied after the first trifoliate until 60 days before harvest. **Weak on prickly sida and lambsquarters.** Add 1 qt. of nonionic surfactant (80 percent active) per 100 gal. spray mix. See label for information concerning the use of crop oil concentrate and liquid fertilizer. Classic may be tank-mixed with glyphosate (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.

	Rate/Acre Broadcast*		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks****
dicamba (4) **Xtend Soybean Only**	0.5 lb	**Engenia** 12.8 ozs. **XtendiMax** 22 ozs. **Tavium** 56.5 ozs	Applicators must take dicamba-specific training and be a certified applicator. In addition to label requirements, the following best management practices are recommended by UT to minimize off-target movement. UT research suggests that dicamba-based herbicides are more prone to off-target movement as temperature increases. **Best management practices to minimize drift are to only apply if the expected high air temperature of the day is less than 85 F or before June 15 whichever is more restrictive.** UT research also suggests that tankmixing glyphosate with these low-volatile dicamba formulations will lower the solution pH which can result in increased dicamba emissions. Despite many applicators' best efforts with applications, drift has apparently occurred with these products in multiple directions from treated fields independent of wind direction. Do not apply if sensitive crops or plants are in adjacent fields. Also, labels must be followed with great attention to detail. Spraying at night, wrong nozzles, off-label wind speed, excessive boom height, the addition of AMS to spray mixture, etc. could increase chances for off-target movement. The current labeled cutoff for dicamba applications in Xtend soybean is June 30 or R1 growth stage. Tavium a premix of XtendiMax and Dual Magnum has a more restrictive label than XtendiMax. Refer to the label or websites for more restrictions and information. Tankmixes with these three herbicides may antagonize glyphosate and/or clethodim grass control.
2,4-D (4) **Enlist Soybean Only**	0.71- 0.95 lb	**Enlist One** 1.5-2.0 pts.	Do not apply if sensitive crops or plants are down wind. Also, labels must be followed with great attention to detail. Spraying near twilight or at night, wrong nozzles, off-label wind speed, excessive boom height, the addition of AMS to spray mixture, etc. could increase chances for off target movement. Can also be purchased as premix with glyphosate (Enlist Duo). Refer to the label or websites for more information.
lactofen (14)	0.2 lb.	**Cobra 2E** 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.
cloransulam-methyl (2)	0.016-0.032 lb.	**FirstRate 84DG** 0.3-0.6 oz.	Apply overtop prior to 50% flowering stage of soybeans. Application prior to full emergence of the first soybean trifoliate 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 PowerMax (Roundup Ready soybeans only), and several other herbicides (see label). For FirstRate tank mixes with Roundup WeatherMax or PowerMax, 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.
fomesafen (14)	0.24-0.35 lb.	**Flexstar** 1.0-1.5 pts.	Contains same active ingredient as Reflex, but is formulated with an adjuvant system. 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. Less incompatibility problems with glyphosate. Also sold premix as Flexstar GT 3.5. Other generic formulations available.
fluazifop (1)	0.094-0.188 lb	**Fusilade DX 2E** 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.

	Rate/Acre Broadcast*		
Herbicide(site of action)	**Active Ingredient**	**Formulated Product**	**Remarks****
glufosinate **FOR USE ON GLUFOSINATE-TOLERANT SOYBEAN VARIETES ONLY (10)**	0.4 – 0.66lb	**Liberty 280 SL** 22-36 ozs. 36 fb 29 29 fb 29	For control of glyphosate-resistant Palmer pigweed, horseweed and other weeds, apply early to small-sized weeds for best control. Will control Palmer up to 4 to 6" tall. A follow-up application of Liberty 7 to 10 days after the first application may be needed to control Palmer that is over 5" tall. Use at least 15 gallons/acre of water for more effective coverage. Apply up to a maximum of 65 oz/A prior to first bloom (R1) if no Liberty was used as a burndown treatment. R1 occurs approx. 40 days after planting for MG4 soybeans.
sethoxydim (1)	0.19 lb	**Poast 1.5E or Poast Plus 1.0E** 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.
fomesafen + S-metolachlor (14+15)	1.32 lb (0.24 +1.09 lb)	**Prefix** 32 ozs	May be applied from cracking through the third trifoliate.
imazethapyr (2)	0.063 lb	**Pursuit 2AS or 70DG** 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.
flumetsulam (2)	sandy loam: 0.04-0.045 lb silt loam:silty clay loam: 0.045-0.05 lb	**Python 80WDG** 0.8-0.89 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. A nonionic surfactant at 0.25% must be included in all postemergence applications. Do not plant cotton within 18 months or grain sorghum within 12 months of application. See label for other rotational crops.
imazamox (2)	0.03-0.04 lb	**Raptor 1AS** 4-5 ozs.	Apply overtop prior to soybean bloom and before most weeds exceed 5" 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.
fomesafen (14)	0.25-0.38 lb	**Reflex** 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 glyphosate (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 10 months of application.** Has controlled volunteer Roundup Ready cotton that is 6" or smaller in research and demonstration trials in soybean. May be less compatible when tank-mixed with glyphosate. Other generic formulations available.
flumiclorac (14)	0.03 lb	**Resource 0.86E** 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.
glyphosate (9)	1.1 lbs. (**a.e.**)	**Roundup PowerMax4.5ae** 32 ozs.	See product labels for specific tank-mix directions. Applications can be made from the cracking stage up to R3 (1/4" pod visible on at least one of top 4 nodes on main stem). Dry conditions will reduce weed control.

Herbicide(site of action)	Rate/Acre Broadcast* Active Ingredient	Formulated Product	Remarks**
imazaquin (2)	0.063-0.125 lb	**Scepter 1.5AS or 70DG** 0.33-0.67 pt. or 1.4-2.8 ozs.	Add 1 qt. nonionic surfactant (80 percent active) per 100 gals. of spray mix. 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.
clethodim (1)	0.094-0.125 lb	**Select Max 1EC** 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 or glufosinate-tolerant corn in soybeans.
S-metolachlor + glyphosate (15+9)	1.64 lb	**Sequence** 2.5-3 pts.	Apply up to 3 trifoliate.
bentazon + aciflurofen (6+14)	0.75 lb	**Storm**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.
acifluorfen (14)	0.13-0.38 lb.	**Ultra Blazer 2L** 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.
chlorimuron + thifensulfuron (2+2)	0.0067 lbs.	**Synchrony XP** 0.375 oz.	May be tank-mixed at a reduced rate with glyphosate to provide residual control. BOLT and STS varieties have tolerance.

**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.*

SOYBEAN HARVEST AIDS

Harvest aid products 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 products 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).

	Rate/Acre Broadcast		
Harvest Aid(site of action)	**Active Ingredient**	**Product**	**Remarks**
Carfentrazone (14)	0.023 lbs.	**Aim EC** 1 - 2 ozs.	Aim has a 3 day pre-harvest interval.
gyphosate (9)	0.75-1.5 lbs. (**a.e.**)	**Roundup PowerMax4.5ae** 22-43 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 soybean grown for seed as a reduction in germination or vigor may occur. Avoid spraying during conditions which favor drift.
Generic glyphosate (glyphosate 4.0 ae)		32-48 ozs.	
sodium chlorate, Defol 5, other tradenames (sodium chlorate)	5.0 - 7.5 lbs.	4.8 qt of a 5 lb/gal formulation or 3.2 qt of a 7.5 lb/gal formulation	Make application 7 to 10 days before anticipated harvesting date when soybean 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.
paraquat (u)	0.13-0.26 lb.	**Gramoxone 3 SL** 6-11 ozs.	For indeterminate 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.
saflufenacil (14)	0.044 lb	**Sharpen SG** 2 ozs.	Sharpen has a 3 day pre-harvest interval.

(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 75DG	Prowl	Metribuzin	Authority Elite	Authority MTZ	Command	Dual Magnum	Fierce	Prefix	Surveil	Verdict	Zidua/Anthem Max
Herbicide Site of Action	3	15+5	2+5	3	5	14+15	5+14	13	15	14+15	14+15	2+14	14+15	15
Annual Morningglories	6	5	9	6	5	8	8	3	2	6	6	9	5	2
Broadleaf Signalgrass	8	8	8	8	6	8	6	9	8	8	8	4	9	9
Cocklebur	0	5	8	0	5	5	6	5	0	6	6	9	2	2
Common Ragweed	0	7	8	0	8	6	8	6	0	6	6	8	2	2
Crabgrass, Foxtails, Goosegrass	9	9	8	9	8	9	8	9	9	9	9	4	9	9
Groundcherries/Black Nightshade	0	7	8	0	6	7	6	3	7	7	7	6	7	7
Hophornbeam Copperleaf	0	6	9	0	6	4	6	2	4	5	4	9	4	4
Jimsonweed	0	7	-----	0	8	-	8	5	0	-	-	9	-----	0
Lambsquarters	7	8	-----	8	8	9	8	7	6	9	9	9	9	9
Pigweed, Palmer	8	7	7	8/6[tt]	7	8	8	0	6	9	9	8	9	9
Pigweed, Smooth or Redroot	8	9	9	7	9	9	9	2	8	9	9	9	9	9
Prickly Sida	0	8	8	0	8	7	8	9	0	5	5	7	5	5
Seedling Johnsongrass	9	8	6	8	4	8	4	8	8	8	8	2	8	8
Sicklepod	0	6	5	0	6	4	8	0	3	4	4	8	4	4
Smartweed	4	7	-----	3	7	5	9	6	0	5	5	8	5	5
Spotted Spurge	0	7	-----	0	8	7	9	8	7	7	7	8	7	7
Spurred Anoda	0	6	-----	0	7	6	9	9	0	--	--	8	0	0
Velvetleaf	2	6	-----	2	7	6	8	9	0	6	6	8	0	0
Yellow Nutsedge	0	7	9	0	0	8	2	0	8	4	8	2	4	4
Soybean Tolerance	1	2	T	2	3	2	3	0	1	3	1	2	2	2

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

	Engenia/XtendiMax	Enlist One	Basagran	Classic	Cobra/Ultra Blazer	FirstRate	Flexstar	Roundup PowerMax/others	Liberty	AssureII/Fusilade	Select Max
Herbicide Site of Action	5	4	6	2	14	2	14	9	10	1	1
Annual grasses	0	0	0	1	4	-----	5	9	4	8	9
Burcucumber	7	3	3	8	6	-----	5	4	8	0	0
Junglerice/Barnyardgrass	0	0	0	1	4	1	4	7*	6	5	9
Goosegrass	0	0	0	1	1	1	1	7*	4	6	9
Cocklebur	9	9	9	9	7	9	8	9	9	0	0
Common Ragweed	9	8	5	7	7	9	7	9	9	0	0
Giant Ragweed	9	7	3	5	7/6	8	7	6	9	0	0
Groundcherry/Nightshade	7	4	1	2	8	-----	8	6	5	0	0
Hemp Sesbania	7	9	0	9	9	2	9	4	9	0	0
Hophornbeam Copperleaf	6	8	2	2	9	-----	9	7	9	0	0
Jimsonweed	9	9	8	5	7	5	7	8	8	0	0
Johnsongrass (rhizome)	0	0	0	1	1	0	2	6	2	9	7
Johnsongrass (seedling)	0	0	0	1	4	2	5	8	6	9	9
Lambsquarters	8	8	7	0	6/5	-----	5	8	8	0	0
Morningglory Entireleaf/Ivy [a]	9	9	2	8	8	8	8	8	9	0	0
Morningglory Pitted [b]	9	9	5	8	9	8	9	7	9	0	0
Morningglory Tall [c]	9	9	3	7	9	5	9	8	9	0	0
Pigweed, Palmer	6	7	0	4	3	4	3	2	8	0	0
Pigweed, Smooth or Redroot	8	8	0	8	8	4	8	9	8	0	0
Prickly Sida	4	4	7	0	6/2	3	2	6	3	0	0
Sicklepod	8	8	0	8	1	8	1	9	8	0	0
Smartweed	7	6	8	5	7	-----	7	8	7	0	0
Spotted Spurge	3	3	0	3	7	-----	7	9	5	0	0
Velvetleaf	6	8	9	8	3	6	4	7	6	0	0
Yellow Nutsedge	0	0	8	7	1	-----	6	7	3	0	0
Soybean Tolerance	0	0	0	2	3	0	1	0	0	0	0

Glyphosate susceptible Junglerice/Barnyardgrass/Goosegrass/Johnsongrass also expect poor control of susceptible species when tankmixed with dicamba.

[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, DARK, AND CIGAR WRAPPER TOBACCO WEED CONTROL

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Weeds can impact tobacco production by reducing yield, interfering with crop harvest, and contaminating cured leaf as Non-Tobacco Related Material (NTRM). Many of the common weed problems in tobacco are summer annuals such as foxtails, pigweeds, lambsquarters and annual morningglories. In addition, some perennials such as Johnsongrass, honeyvine milkweed and yellow nutsedge can be particularly troublesome in some tobacco fields. In locations where troublesome weeds are difficult to control it may become necessary to choose an alternative field site to grow tobacco. Table 1 is a guide to the relative response of selected weeds to various herbicides available for use in tobacco.

Land preparation practices such as moldboard plowing and disking provide initial weed control by destroying early season weeds that emerge before transplanting. Field cultivation and hand-hoeing are also traditional methods to maintain good weed control post-transplant, but effective herbicide control options decrease the need for mechanical control methods. A foliar burn-down herbicide also allows production of tobacco by conservation tillage methods. Specific herbicide options that are currently recommended for use on tobacco fields are discussed in Table 1.

Use of certain herbicides on a previous crop can limit the rotational crops that can be planted in treated fields. For example, when atrazine is applied for weed control in corn during the previous growing season, there is a possibility that tobacco could be injured the year following application. Residual carryover from some pasture or forage crop herbicides can also severely damage tobacco planted in treated fields, sometimes for many years after the original application. Therefore, consult the herbicide labels to determine whether there is a risk to planting tobacco in fields that were used to grow other grain or forage crops. General rotational crop guidelines for herbicides available in grain crops can be found in the University of Tennessee Extension bulletin *Weed Control Manual for Tennessee* (PB 1580), the University of Kentucky Extension bulletin *Weed Control Recommendations for Kentucky Grain Crops* (AGR-6), the North Carolina Agricultural Chemicals Manual, or the Virginia Cooperative Extension Pest Management Guide for Field Crops (456-016).

Be familiar with label guidelines and rotational restrictions when applying tobacco herbicides. Limitations for some rotational crops are highlighted within the remarks for each herbicide listed in Table 1.

Conservation tillage (no-till, minimum till and strip till) tobacco production systems have greatly increased in popularity in recent years in Tennessee. Helpful information about these systems can be found in Publication 1782 *– 2021-2022 Burley and Dark Tobacco Production Guide.*

Table 1. Herbicides recommended for use in tobacco fields.

Herbicide	Weeds Controlled	Remarks and Limitations
Before Transplanting—Burndown Herbicides for Use in Conservation Tillage		
Gramoxone 3 SL 2.0 pt/A (*paraquat* 0.94 lb ai/A) + nonionic surfactant 2 pt/100 gal or Crop Oil Concentrate 1gal/100 gal [Supplemental label for use in KY, TN, and NC only]	Annual grasses and broadleaf weeds that have emerged or for burndown of cover crops. Apply when weeds and cover crop are actively growing and between 1 to 6 inches in height. Vegetation 6 inches or taller may not be effectively controlled.	***A copy of the supplemental label should be in the hands of the applicator at time of application***. Apply as a broadcast treatment during the early spring but prior to transplanting tobacco. Use the higher rate on dense populations and/or on larger or harder to control weeds. Weeds and grasses emerging after application will not be controlled. A maximum of 2 applications may be made. Gramoxone may be tank-mixed with other registered tobacco herbicides for improved burndown. Do not graze treated areas or feed treated cover crops to livestock. **Gramoxone 3.0 SL is a restricted use herbicide. Supplemental label for use in TN, KY and NC only.**

Table 1. Herbicides recommended for use in tobacco fields.		
Herbicide	**Weeds Controlled**	**Remarks and Limitations**
Before Transplanting—Soil-applied Herbicides		
Devrinol 50DF 2-4 lb/A or **Devrinol DF-XT** 2-4 lb/A or **Devrinol 2-XT** 2-4 qt/A (*napropamide* 1-2 lb ai/A)	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, purslane	Apply to a weed-free surface before transplanting and incorporate immediately, preferably in the same operation. Follow incorporation directions on label. The XT formulations include a UV-light protectant which can be surface applied or incorporated. Small grain may be seeded in rotation in the fall to prevent soil erosion, but may be stunted. Small grains used as rotation crops must be plowed under or otherwise destroyed. To avoid injury to crops not specified on the label, do not plant other rotational crops until 12 months after the last DEVRINOL application.
Prowl 3.3EC 3 to 3.6 pt/A [medium soil texture] (*pendimethalin* 1.25 to 1.5 lb ai/A) [Use maximum 2.4 pt/A (1 lb ai/A) on course texture soils NC & VA] or **Prowl H2O** 3 pt/A [medium soil texture] (*pendimethalin* 1.4 lb ai/A) [Use maximum 2 pt/A (0.95 lb ai/A) on course texture soils NC & VA]	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, lambsquarters, pigweeds, purslane	Apply to prepared soil surface up to 60 days prior to transplanting. Incorporate within 7 days after application within the top 1 to 2 inches of soil. Consult incorporation directions on label. Emerged weeds will not be controlled. Tobacco plants growing under stress conditions (cold/wet or hot/dry weather) may be injured where PROWL is used. Wheat or barley may be planted 120 days after application unless small grains will be planted in a no-tillage system. Similar pendimethalin products include ACUMEN, FRAMEWORK 3.3EC, PENDIMETHALIN, SATELLITE and STEALTH.
Command 3ME 2 to 2.67 pt/A (*clomazone* 0.75 to 1 lb ai/A) Other products containing clomazone labeled for tobacco include: Caravel, Willowood clomazone 3ME. See labels.	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, jimsonweed, lambsquarters, prickly sida, purslane, common ragweed, velvetleaf	Apply COMMAND 3ME as a soil-applied, pre-emergent treatment prior to transplanting. Off-site movement of spray drift or vapors of COMMAND 3ME can cause foliar whitening or yellowing of nearby sensitive plants. Consult label for spray drift precautions and required setbacks when applied near sensitive crops and other plants. Tobacco plants growing under stressed conditions (cold/wet weather) may show temporary symptoms of whitening or yellowing. COMMAND 3ME may be tank-mixed with other herbicides registered for use in tobacco to broaden the weed control spectrum or with other tobacco pesticides. Cover crops may be planted anytime, but foliar whitening, yellowing, and/or stand reductions may occur in some areas. Do not graze or harvest for food or feed cover crops planted less than 9 months after treatment. When COMMAND 3ME is applied alone, rotational crops that may be planted include soybeans, peppers, or pumpkins anytime; field corn, popcorn, sorghum, cucurbits, or tomatoes (transplanted) after 9 months; sweet corn, cabbage, or wheat after 12 months; and barley, alfalfa, or forage grasses after 16 months following application. See label for rotation guidelines for other crops and when tank-mixed with other herbicides. Do not exceed more than 2.67 pt/A (42.7 fl. oz./A; 1 lb ai/A) per application or per year.

Table 1. Herbicides recommended for use in tobacco fields.		
Herbicide	**Weeds Controlled**	**Remarks and Limitations**
Before Transplanting—Soil-Applied Herbicides		
Spartan 4F 8 to 12 fl.oz/A [medium soil texture] (*sulfentrazone* 0.25 to 0.375 lb ai/A) [Use 4.5 to 6 fl.oz/A (0.14 to 0.19 lb ai/A) for soils with course texture, <1.5% OM]	Black nightshade, jimsonweed, lambsquarters, morningglories, pigweeds, prickly sida, purslane, smartweed	Use the higher rate of SPARTAN 4F when weed pressure is heavy with morningglory or yellow nutsedge. Apply from 14 days before up to 12 hours prior to transplanting tobacco as a soil-surface treatment or preplant incorporated (less than 2 inches deep). Perform all cultural practices for land preparation, fertilizer/fungicide incorporation, etc. prior to application of SPARTAN 4F. If the soil must be worked after application but prior to transplanting, do not disturb the soil to a depth greater than 2 inches. Temporary stunting or yellowing of tobacco and localized leaf burns may be observed under some conditions with this treatment. Unacceptable crop injury can occur if applied post-transplant. Spartan may be impregnated on dry bulk fertilizers (consult label). Proper mixing and uniform spreading of the impregnated fertilizer mixture on the soil surface is required for good weed control and to avoid crop injury. Rotational crops which may be planted include soybeans or sunflowers anytime; wheat, barley, or rye after 4 months; field corn after 10 months; alfalfa and oats after 12 months; and popcorn, sweet corn, and sorghum (for rates above 8 oz/A) after 18 months. See label for rotation guidelines with other crops. Similar sulfentrazone products include BLANKET, Willowood SULFENTRAZONE 4SC, and Helm SULFENTRAZONE 4F.
Spartan Charge 10.2 to 15.2 fl.oz/A [medium soil textures] (*carfentrazone* 0.028 to 0.042 lb ai/A + *sulfentrazone* 0.25 to 0.38 lb ai/A) [Use 5.7 to 7.6 fl.oz/A (0.16 to 0.21 lb ai/A) for soils with course texture, <1.5% OM]	Black nightshade, jimsonweed, lambsquarters, morningglories, pigweeds, prickly sida, purslane, smartweed	Use the higher rate of SPARTAN CHARGE when weed pressure is heavy with morningglory or yellow nutsedge. Apply from 14 days before up to 12 hours prior to transplanting tobacco as a soil surface treatment or preplant incorporated (less than 2 inches deep). Perform all cultural practices for land preparation, fertilizer/fungicide incorporation, etc. prior to application of SPARTAN CHARGE. If the soil must be worked after application but prior to transplanting, do not disturb the soil to a depth greater than 2 inches. Temporary stunting or yellowing of tobacco and localized leaf burns may be observed under some conditions with this treatment. Unacceptable crop injury can occur if applied post-transplant. Rotational crops that may be planted include soybeans or sunflowers anytime; field corn, wheat, barley, or rye after 4 months; alfalfa, popcorn, sweet corn, and oats after 12 months; and sorghum (for rates above 10.2 fl.oz/A) after 18 months. See label for rotation guidelines with other crops.
At Transplanting—Soil-Applied Herbicides		
Command 3ME 2.0-2.67 pt/A (*clomazone* 0.75-1.0 lb ai/A)	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, hairy galinsoga, jimsonweed, lambsquarters, prickly sida, purslane, common ragweed, velvetleaf	Apply COMMAND 3ME as a soil-applied treatment over-the-top of tobacco plants immediately or up to 7 days after transplanting but prior to emergence of weeds. Off-site movement of spray drift or vapors of COMMAND 3ME can cause foliar whitening or yellowing of nearby sensitive plants. Consult label for spray drift precautions and required setbacks when applied near sensitive crops and other plants. Tobacco plants growing under stressed conditions (cold/wet weather) may show temporary symptoms of whitening or yellowing. COMMAND 3ME may be tank-mixed with other herbicides registered for use in tobacco to broaden the weed control spectrum or with other tobacco pesticides. Cover crops may be planted anytime, but foliar whitening, yellowing, and/or stand reductions may occur in some areas. Do not graze or harvest for food or feed cover crops planted less than 9 months after treatment. When COMMAND 3ME is applied alone, rotational crops that may be planted include soybeans, peppers, or pumpkins anytime; field corn, popcorn, sorghum, cucurbits, or tomatoes (transplanted) after 9 months; sweet corn, cabbage, or wheat after 12 months; and barley, alfalfa, or forage grasses after 16 months following application. See label for rotation guidelines for other crops and when tank-mixed with other

Table 1. Herbicides recommended for use in tobacco fields.		
Herbicide	**Weeds Controlled**	**Remarks and Limitations**
		herbicides. Do not exceed more than 2.67 pt/A (42.7 fl. oz./A; 1 lb ai/A) per application or per year.
Devrinol 50DF 2-4 lb/A or **Devrinol DF-XT** 2-4 lb/A or **Devrinol 2-XT** 2-4 qt/A (*napropamide* 1-2 lb ai/A) [For use in Kentucky, Maryland, Virginia and Southeast Region only]	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, purslane	May be applied over the top of transplants. Apply to a weed-free soil surface immediately after transplanting. If rainfall does not occur within 5 days after application, the treatment must be shallowly incorporated or irrigated-in. DEVRINOL may also be applied as a directed layby application to the row middles. (consult label). Small grains may be seeded in rotation in the fall to prevent soil erosion, but may be stunted. Small grains used as rotation crops must be plowed under or otherwise destroyed. To avoid injury to other crops not specified on the label, do not plant rotational crops until 12 months after the last DEVRINOL application.
After Transplanting—Postemergence Herbicides		
Poast 1.5E 1.5 pt/A (*sethoxydim* 0.28 lb ai/A) + Crop Oil Concentrate 2 pt/A [NOTE: *Consult labels for lower use rates if using other additives such as High Surfactant Oil Concentrates*]	Barnyardgrass, broadleaf signalgrass, crabgrass, fall panicum, foxtails, johnsongrass, volunteer wheat	POAST herbicide provides selective postemergence control of annual and perennial grasses. Apply any time from transplanting up to 7 weeks after transplanting tobacco, but avoid applications within 42 days of harvest. For adequate control, ensure good spray coverage using a spray volume from 5 to 20 GPA (gallons per acre). *Use of spray additives such as High Surfactant Oil Concentrates may result in increased risk of crop injury*. Do not cultivate within 5 days before or 7days after applying POAST. For rhizome Johnsongrass, more than one application may be needed. Make the first application of POAST (1.5 pt/A) when johnsongrass plants are 20 to 25 inches, followed by a second application of POAST (1 pt/A) when regrowth is 12 inches. As a spot treatment, prepare a 1% to 1.5% solution (1.3 oz/gal to 2 oz/gal) of POAST plus a 1% solution of Oil Concentrate (1.3 oz/gal) and apply to the grass foliage on a spray-to-wet basis. Do not apply more than 4 pt/A per season to tobacco, including POAST applied to seedbeds.

Table 2. Expected Herbicide Response fo Common Weeds in Tobacco

	Barnyardgrass	Braodleaf Signalgrass	Crabgrass	Fall Panicum	Foxtails	Johnsongrass (seedling)	Johnsongrass (rhizome)	Yellow Nutsedge	Black Nightshade	Cocklebur	Galinsoga, Hairy	Jimsonweed	Lambsquarters	Morningglory	Pigweeds	Prickly Sida	Purslane	Common Ragweed	Ragweed, Giant	Smartweed	Velvetleaf
Command	9	9	9	9	2	8	2	0	2	5	7	5	7	2	2	7	7	5	4	5	8
Devrinol	7	7	7	7	7	6	2	0	2	4	6	4	6	0	6	2	8	6	0	3	3
Prowl, Acumen, Satellite	8	8	8	8	8	7	2	0	0	0	2	0	7	5	7	2	7	1	0	5	4
Spartan, Blanket	7	7	7	7	7	7	1	8	8	6	6	8	9	9	9	8	8	8	3	8	6
Spartan Charge	7	7	7	7	7	7	1	8	8	6	6	8	9	9	9	8	8	8	3	8	6
Spartan + Command	9	9	9	9	9	8	2	8	8	7	7	7	9	9	9	8	8	8	5	8	8
Poast	9	9	9	9	9	9	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[1] *This table should be used only as a guide for comparing the relative effectiveness of herbicides to a particular weed. Under extreme environmental conditions, the herbicide may perform better or worse than indicated in the table. If a grower is getting satisfactory results under their own conditions, products should not necessarily be changed as a result of the information in the table.*

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 SG with TotalSol per acre.
2. Apply at least 15 gallons spray volume per acre to ensure coverage.
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 growth 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 SL 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 SL 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/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 SL.

Fall applications of Harmony Extra Total Sol have performed very well in no-till wheat on weeds such as wild garlic and dock. Harmony Extra Total Sol 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

Roundup PowerMax (22 ozs./A) or Generics (32 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

	Rate/Acre Broadcast		
Herbicide (site of action)	**Active Ingredient**	**Formulated Product**	**Remarks**
pyroxasulfone +carfentrazone (14+15)	0.070 - 0.087 lb ai/a	**Anthem Flex** 2.8 – 3.0 ozs	There is now a 24C PRE label in TN. Provides residual control of ryegrass and annual bluegrass. Also can provide some residual control of small seeded broadleaf winter annuals. **Watchouts:** 1) Can not use anthem flex as a PRE or DPRE on broadcast wheat due to increased potential crop injury. 2) If rain is predicted within a few days after planting consider applying POST to 3 tiller wheat.
fenoxaprop+pinoxaden (1)	0.08 lb	**Axial Bold** 15.0 ozs	Can be applied anytime regardless of nitrogen fertilizer applications. Do not run carrier volume above 10 gpa.
flufenacet+metribuzin (5+15)	0.255 – 0.34 lb	**Axiom DF** 6 – 8 ozs	Axiom DF may be used to control certain annual grass and broadleaf weeds when applied after the crop has fully germinated to early postemergence in winter wheat.
chlorsulfuron + metsulfuron methyl (2+2)	0.0313 lb	**Finesse Cereal and Fallow** 0.5 oz	Finesse controls weeds by both preemergence and postemergence activity. Plant STS or Bolt soybeans double crop.
thifensulfuron + tribenuron (2+2)	0.014-0.028 lb	**Harmony Extra SG with TotalSol 50 DF** 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.
thifensulfuron (2)	0.014 -0.028 lb	**Harmony SG with TotalSol** 0.45-0.9 oz	Apply 0.75 oz to wheat for postemergence broadleaf weed control. Use 0.9 oz/A when weed infestation is heavy.
Pyrasulfotole + Bromoxynil (6+ 27)	0.176 – 0.24 lb	**Huskie** 11- 15 ozs	Postemergence herbicide, best results are obtained when applications are made to young, actively growing broadleaf weeds. Common rate used is 13.5 ozs.
mesosulfuron-methyl (2)	0.013 lb	**Osprey** 4.75 ozs	**For control of Hoelon-resistant ryegrass** and other annual grass and broadleaf weeds in winter wheat. Applications may be made from 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.**
pyroxsulam (2)	0.0166lb	**PowerFlex HL** 2 ozs	Apply with NIS at 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 1.5 pts/A in 100 gallons or more of water carrier per acre may be substituted for the NIS and nitrogen additives. **Do not apply within 7 days before or after nitrogen fertilizer application, or crop injury may result.**

Herbicide (site of action)	Rate/Acre Broadcast: Active Ingredient	Rate/Acre Broadcast: Formulated Product	Remarks
metribuzin (5)	0.14-0.19 lb.[A] 0.19-0.23 lb.[B] 0.23-0.28 lb.[C]	**Metribuzin 75DF** 3-4 oz.[A] 4-5 oz.[B] 5-6 oz.[C]	Apply after the wheat plants have developed 3 to 4 tillers and have at least 4 secondary roots, 2" 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 Metribuzin. Various degrees of injury have been observed. **Correct timing is critical or increased crop injury should be expected.** Decisions regarding Metribuzin use on sensitive wheat varieties should be made by comparing expected yield loss from Metribuzin injury with yield loss from expected weed competition. See label for further instructions. Do not apply Metribuzin to wheat which has begun to joint. Alternative low rate program: Reduced rates of Metribuzin (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.
pyroxasulfone (15)	0.08 lb ai	**Zidua** 2.5 ozs	Apply Zidua at the use rates as a broadcast spray to the soil surface following wheat planting when 80% of germinated wheat seeds have a shoot at least ½ inch long until wheat spiking.
halauxifen+florasulam (2 + 4)	0.0125 lb ai	**Quelex** 0.75 ozs	Can be applied in the spring or fall on wheat from the 2-leaf stage to flag leaf emergence (Zadoks scale 39). See label for specific adjuvant recommendations.
2,4-D (4)	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

	DELAYED PRE[a]			POSTEMERGENCE						
	Axiom	Metribuzin	Axial XL	2,4-D	Anthem Flex/Zidua	Harmony Extra	Huskie	Osprey	Powerflex HL	Quelex
Herbicide Site of Action	15+5	5	1	4	14,15/15	2	6,27	2	2	2,4
Buttercup	-	-	0	9	-	9	-	0	3	7
Cheat	9	9	--	0	8	0	0	0	6	0
Chickweed	9	9	0	2	-	8	9	0	3	9
Cornflower	6	6	0	5	-	5	9	0	0	7
Dock, curly/broadleaf	3	3	0	7	-	9	8	0	2	9
Downy brome	8	5	-	0	8	0	0	-	-	0
Eveningprimrose (Cutleaf)	-	-	0	8	-	5	8	0	2	9
Garlic (onion), wild	4	4	0	7	2	9	0	0	7	8
Geranium, Carolina	8	8	0	9	-	5	9	0	3	9
Henbit/deadnettle	7	7	0	1	-	7	8	0	3	8
Horseweed (marestail)	8	8	0	9	7	6	9	0	3	9
Mayweed	7	7	0	6	-	9	9	0	-	8
Mustard, wild	6	6	0	8	-	9	9	0	-	9
Pepperweed, Virginia	9	9	0	9	-	8	9	0	1	9
Poa (annual bluegrass)	9	7	1	0	8	0	0	6	2	0
Ragweed, common	9	9	0	9	0	-	9	0	-	9
Ryegrass, annual	8	4	8	0	8	0	8	8	8	0
Shepherdspurse	5	4	0	7	-	9	8	0	-	9
Turnip, wild	6	6	0	8	-	9	-	0	-	9
Vetch	5	5	0	8	-	7	-	0	-	9

[a] ***After emergence but before 3rd true leaf***

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.

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.*

	Rate/Acre Broadcast		
Herbicide	**Active Ingredient**	**Formulated Product**	**Remarks**
S-metolachlor (15)	 sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam: 1.27-1.59 lbs.	**Dual Magnum** 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.
Pendimethalin (3)	 sandy loam: 0.5-0.74 lbs. silt loam: 0.74-1.0 lbs. silty clay loam: 1.0-1.5 lbs.	**Prowl 3.3 EC** 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.
Ethalfluralin (3)	 sandy loam: 0.56-0.75 lbs. silt loam: 0.75-0.9375 lbs. silty clay loam: 0.9375-1.125 lbs.	**Sonalan** 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.
Trifluralin (3)	sandy loam: 0.5 lbs.	**Treflan** 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

	Rate/Acre Broadcast		Remarks
Herbicide	**Active Ingredient**	**Formulated Product**	
pyroxasulfone+ Sulfentrazone (15+14)	0.133-0.232	**Authority Edge** 4.0 – 7.0 oz	Rate is dependent on soil texture and organic matter. A 4.25 lb pyroxasulfone product. See label.
pyroxasulfone+ Sulfentrazone (15+14	0.161-0.258	**Authority Supreme** 5.0 – 8.7 oz	Rate is dependent on soil texture and organic matter. A 4.16 lb pyroxasulfone product. Alows more pyroxasulfone to be applied POST in a 2 pass progarm. See label.
sulfentrazone + *S*-metolachlor (14 + 15)	1.09-1.37	**Broadaxe** 20-25 oz.	Excellent control of broadleaf and grass weeds.
S-metolachlor (15)	sandy loam: 0.96-1.27 lbs. silt loam: 1.27-1.59 lbs. silty clay loam: 1.27-1.59 lbs.	**Dual Magnum** 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 (pendimethalin) (3)	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.
Sulfentrazone (14)	0.125 lbs.	**Spartan4F** 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.
Sulfentrazone+ carfentrazone (14+14)	0.16 – 0.25 lbs	**Spartan Charge** 3.75 – 5.75 oz	Apply Spartan Charge alone or with other herbicides or liquid fertilizers as a burndown or preemergence treatment prior to planting or up to 3 days after planting sunflowers to control or suppress weeds.

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

	Rate/Acre Broadcast*		
Herbicide	**Active Ingredient**	**Product**	**Remarks****
Clethodim (1)	0.094-.25 lbs.	**Select 2 EC** 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			
Imazamox (2)	0.031 lbs.	**Beyond** 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.

Notes:

EXPECTED WEED RESPONSE TO SUNFLOWER HERBICIDES

	Preplant Incorporated				Preemergence			Postemergence	
	Treflan	Prowl	Dual Magnum	Sonalan	Prowl	Dual Magnum	Spartan	Select	Beyond
Herbicide Site of Action	3	3	15	3	3	15	14	1	2
Annual Morninglories	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	7	--	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

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.)

FORAGE CROP AND PASTURE WEED CONTROL

*HERBICIDES FOR ALFALFA AND OTHER LEGUME HAY CROPS**

		Rate/Acre Broadcast		
Crop and Application Timing	**Herbicide**	**Active Ingredient**	**Formulation**	**Weeds Controlled, Remarks and Precautions**
Alfalfa-Preplant, No-Till	Gramoxone 3SL (Paraquat)	1.0 lb.	2.0 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.
	Cornerstone/others** (Glyphosate 3ae)	0.75-2.25 lb. (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 PowerMax or 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 lb.	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, SEEDLING or ESTABLISHED <u>Roundup Ready Varieties Only</u>	Roundup WeatherMax (Glyphosate 4.5ae)	0.75-1.5 lb.	22-44 ozs.	**Seedling alfalfa:** Due to the biology and breeding constraints of alfalfa, up tp 10 percent of the seedlings may not contain a Roundup Ready gene and will not survive the first application of this product. To eliminate the undesirable effects of stand gaps created by this loss of plants, a single application of a least 22 ozs./A should be applied at or before the 4 trifoliate growth stage. Later applications may be made at up to 44 ozs./A. **In established stands**, apply up to 44 ozs./A. Do not apply within 5 days of cutting of first-year or established stands. Do not apply more than a total of 4.1 qts/A for in-crop applications.
Alfalfa- Established	Butyrac 200 2SC (2,4-DB)	1-1.5 lb.	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.

		Rate/Acre Broadcast		
Crop and Application Timing	**Herbicide**	**Active Ingredient**	**Formulation**	**Weeds Controlled, Remarks and Precautions**
Alfalfa - Dormant	Gramoxone 3SL (Paraquat)			Apply to dormant, pure alfalfa during late fall or winter months for control of chickweed, henbit, bluegrass and downy brome, and suppression of perennial grasses including orchardgrass, timothy, and smooth brome. Use a minimum of 10 gallons of water by ground, or 5 gallons of water by air. Always add a nonionic surfactant at 0.25% (1 qt. per 100 gallons of spray mix.) Application to alfalfa that is not dormant, or has broken dormancy, may result in stand and/or yield reductions. Replanting may be necessary. Green alfalfa foliage present at the time of application will be burned. Make only one application per season.
Fall-Seeded		0.31 lb.	13.2 ozs.	
Established		0.25-0.5 lb.	6-10.7 ozs.	
Alfalfa - Dormant Established	Sencor or Lexone 4 L or 75 DF (Metribuzin)	0.5-0.75 lb.	1-1.5 pts. 4L, or 0.67-1 lb. 75 DF	Apply to dormant pure alfalfa or alfalfa-grass mixtures to control chickweed, henbit and several other broadleaf weeds. A partial reduction in grass stand may occur. Do not apply after new growth starts.
Alfalfa – Established or First-Year Between Cuttings	Gramoxone 3SL (Paraquat)	0.25 lb.	10.7 ozs.	Apply immediately after alfalfa hay is removed for control of many seedling broadleaf and annual grass weeds. Do not treat more than 5 days after cutting. Add surfactant at 1 pt./100 gal. of spray mix. Alfalfa foliage present at time of application will be burned. First year alfalfa stands and yields may be reduced if alfalfa is allowed to regrow more than 2 inches.

[a]*Coarse-textured soils*
[b]*Medium-textured soils*
[c]*Fine-textured soils*
**See Table for Grazing and Hay Cutting Restrictions*
**NOTE: *Several brands of glyphosate have become available in recent years. Products differ in terms of concentration, rates and addition of surfactant. Always read the label before application.*

Grazing and Cutting Restrictions for Alfalfa Herbicides - Lactating Dairy Animals (Days to Wait)

Herbicide	**Grazing**	**Hay Cutting**
Butyrac 200		
Seedling	60	60
Established	30	30
Gramoxone		
Between cuttings	30	30
Dormant	60	60
Kerb	120	120
Poast	7	14
Pursuit	30	30
Roundup WeatherMax and other glyphosate formulations (burndown)	56	56
Roundup Weathermax In-crop, Roundup Ready Alfalfa	5	5
Select Max	15	15
Sencor/Lexone	28	28

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 GRASS PASTURES AND HAY FIELDS**

		Rate/Acre Broadcast		
Crop and Application Timing	**Herbicide**	**Active Ingredient**	**Formulation**	**Weeds Controlled, Remarks and Precautions**
Bermudagrass only Established, Dormant	Gramoxone 3SL (Paraquat)	0.25-0.5 lb.	12-24 ozs.	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.
Bermudagrass only Established, Dormant	Roundup PowerMax 4.5 ae or Roundup WeatherMax 4.5 ae (glyphosate)	0.28-0.39 lb.	8-11 oz.	Apply 8-11 oz./A to dormant bermudagrass in late winter to early spring. Higher rates may be used, but injury will occur if bermudagrass has broken dormancy. Applications may be made in late fall, also, if bermudagrass is dormant.
Bermudagrass only First-year or Established	Cimarron Plus 63WG (metsulfuron+ chlorsulfuron)	0.06 + 0.019 oz. to 0.3+0.094 oz.	0.125-0.625 oz.	Bermudagrass should be established at least 60 days prior to application. Apply before weeds are 4 inches tall or in diameter. Rate depends upone target weeds. See label. Add nonionic surfactant at 1 to 2 pts./100 gal. of spray mix.
Bermudagrass only Established	Rezilon 1.67L (Indaziflam)	0.039-0.065 lb.	3-5 oz.	Apply preemergence for control of several annual grasses and small seeded broadleaves. **Does not control emerged weeds.** Apply 3 to 5 oz./A in early fall for control of **ryegrass before it emerges**. Apply 3 to 5 oz./A in late spring for control of crabgrass, barnyardgrass, annual foxtails and several other summer annual grasses. Do not exceed 6 oz./A of Rezilon in a 12-month period. Do not harvest hay withing 40 days of any single application of Rezilon that exceeds 3 oz./A. **Do not apply to tall fescue, orchardgrass or other cool-season forage grasses or severe injury will result.**
Bermudagrass only Established	Outrider 75 DF (sulfosulfuron)	0.56-1.5 oz.	0.75-2 oz.	Apply overtop for control of johnsongrass and nutsedge. Does not control summer annual grasses nor most broadleaves. Always add nonionic surfactant at 1 qt./100 gal. of spray mix. Applications of 1.25 oz./A have performed well on 18-24 in. johnsongrass. Temporary bermudagrass stunting may occur. Grass may be grazed immediately; do not harvest for hay for 14 days.
Bermudagrass only Established	Pastora 71.2 WG (Nicosulfuron + metsulfuron)	0.56+0.15 oz. To 0.84+0.23 oz.	1-1.5 oz.	Pastora is a premixture of the active ingredients in Accent and Escort herbicides. Apply overtop to control johnsongrass, broadleaf signalgrass, barnyardgrass, fall panicum, foxtails and many broadleaf weeds. **Does not control crabgrass or dallisgrass.** Always add nonionic surfactant at 1 qt./100 gal. of spray mix. Noticeable growth reduction and discoloration following application usually occurs, but bermudagrass will recover. Injury may be reduced by applying when bermudagrass has less than 2 in. of new growth following green-up, or within 7 days following hay harvest. Pastora has no grazing or hay cutting restrictions.
Seedling Forage Grasses	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.
Seedling Forage Grasses	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.

		Rate/Acre Broadcast		
Crop and Application Timing	**Herbicide**	**Active Ingredient**	**Formulation**	**Weeds Controlled, Remarks and Precautions**
First-Year and Established Forage Grasses	DuraCor (Aminopyralid + florpyrauxifen - benzyl)	0.063 + 0.00004	12 oz.	During year of establishment, apply after grasses have developed a good secondary root system and at least 3 collared leaves. Use postemergence to control the same weeds a GrazonNext HL, plus buckhorn plantain and wild carrot. Will kill pasture legumes, but reseeding may be possible one year later (see label). Always add a nonionic surfactant at the rate of 1qt./100 gal. of spray mix. **Do not use grasses treated with DuraCor in the preceeding 18 months for hay intended for export outside the United States. Do not use hay or straw from areas treated with DuraCor withing the preceeding 18 months, or manure from animals feeding on hay treated with DuraCor, in compost. Do not use grasses treated within the preceeding 18 montns for seed production.**
First-Year and Established Forage Grasses	GrazonNext HL (Aminopyralid + 2,4-D)	0.06 + 0.5 – 0.11 + 0.87 lb.	1.2-2.1 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. **Do not use grasses treated with GrazonNext HL in the preceeding 18 months for hay intended for export outside the United States. Do not use hay or straw from areas treated with GrazonNext HL within the preceeding 18 months, or maure from animals feeding on hay treated with GrazonNext HL, in compost. Do not use grasses treated within the preceeding 18 months for seed production.**
First-Year and Established Forage Grasses	Grazon P+D (picloram + 2,4-D) **For use only in approved TN counties.**	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.
Established Grass and White Clover Mixtures	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.
Established, Grass and Annual Lespedeza Mixtures	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.
Established Forage Grasses	2,4-D Ester 4EC	2.0 lb.	2 qts.	For wild garlic control, apply in October to mid-December or March to mid-April when daytime temperature is at least 65 F. Repeact twice annually for 2 years to eliminate wild garlic. This same program 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.

		Rate/Acre Broadcast		
Crop and Application Timing	**Herbicide**	**Active Ingredient**	**Formulation**	**Weeds Controlled, Remarks and Precautions**
Established Forage Grasses	PastureGard HL (triclopyr + fluroxypyr)	0.38 + 0.13 - 1.5 + 0.5 lb.	1-4 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. 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.
Established Forage Grasses	Surmount (picloram + fluroxypyr) **For use only in approved TN counties.**	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.
Established Forage Grasses	Brash/Range Star/ Weedmaster 3.87SL (Dicamba + 2,4-D Amine)	(0.125 + 0.36) to (0.5 + 1.4 lb.)	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. **Note: In late 2017 the United States Environmental Protection Agency reclassified dicamba as a Restricted-Use Pesticide.**
Established Tall Fescue	Outrider 75WDG (sulfosulfuron)	0.04 lb.	0.75 oz.	**For use only in established tall fescue. Do not apply to orchardgrass, timothy and other forage grasses (Except for established bermudagrass).** Apply 0.75 oz./A to well-established tall fescue for johnsongrass control. To minimize yellowing and stunting, do not exceed 0.75 oz./A and apply during summer when fescue is dormant or growth has slowed. Always add nonionic surfactant at 0.25% v/v (1 qt./100 gal. of spray mix). See label for directions and precautions and allowable tank mix partners.
Sorghum-Sudangrass Hybrids - Postemergence	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 (DuraCor, GrazonNext HL, Grazon P+D, 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. T**hese 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 DuraCor and for GrazonNext HL, 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 DuraCor and GrazonNext HL, 7 days for Grazon P+D and Surmount).

For more information on how to avoid these problems, please go to our website: herbicidestewardship.com

EXPECTED WEED RESPONSE TO PASTURE HERBICIDES

	LATE WINTER (MARCH) TO EARLY SPRING APPLICATIONS						FALL (NOVEMBER TO DECEMBER) APPLICATIONS					
	2,4-D Ester	2,4-D Amine	DuraCor	GrazonNext HL	Grazon P+D*	Brash/ Range Star/ Weedmaster	2,4-D Ester	2,4-D Amine	DuraCor	GrazonNext HL	Grazon P+D*	Brash/ Range Star/ Weedmaster
Bedstraw	3	3	9	9	9	3	2	2	9	9	9	2
Broadleaf plantain	8	7	9	7	8	9	8	7	9	7	8	9
Buckhorn plantain	7	6	9	7	7	8	7	6	9	7	8	8
Bull thistle	8	7	9	9	9	8	9	7	9	9	9	9
Buttercups (annual)	9	8	9	9	9	9	9	8	9	9	9	9
Carolina geranium	5	4	9	9	9	7	4	3	9	9	9	6
Common chickweed	2	1	8	8	8	5	3	2	8	-----	9	8
Curly dock	4	3	8	9	9	4	5	3	8	9	9	6
Dandelion	9	8	8	9	9	8	9	8	8	9	9	8
Henbit	2	1	8	-----	8	4	3	2	8	-----	8	7
Horseweed	9	8	8	9	9	9	9	8	8	9	9	9
Musk thistle	8	7	9	9	9	7	9	8	9	9	9	8
Prickly lettuce	8	7	8	9	9	8	8	6	8	9	9	8
Red sorrel	3	3	-----	-----	8	5	3	3	-----	-----	8	6
Sowthistle	8	8	-----	9	9	9	7	7	-----	9	9	8
Wild carrot	5	4	9	6	6	6	5	4	9	6	6	6
Wild garlic	8	6	6	6	5	6	8	6	6	6	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.

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

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

Spurge Control in Tall Fescue Pastures and Hay Fields

Problems with nodding spurge (Chamaesyce nutans) in tall fescue pastures and hay fields have increased dramaticlaly across Tennessee in recent years. The recent dry summers and their impact on grass stands have certainly helped creat this situation. Nodding spurge is a summer annual broadleaf weed which generally appears in June in pastures or after first hay cutting in hay fields. Unfortuantly, most all of our herbicides commonly used (2,4-D, GrazonNext HL, Grazon P+D, Brash/Range Star/Weedmaster, etc.) are ineffective on nodding spurge. Cimmarron Plus (metsulfuron+cholorsulfuron) and other products which contain metsulfuron, such as Chaparral (aminopyralid + metsulfuron), provide excellent control. While metsulfuon is safe on bermudagrass and established orchardgrass, it causes noticeable temporary yellowing, stunting and seedhead suppression in tall fescue. Producers who are experiencing problems with nodding spurge and who are willing to accept the injury to tall fexcue may want to consider applying Cimarron Plus (0.2 to 0.3 oz/A) or Chaparral (1.5 to 2 oz/A). Add nonionic surfactant at the rate of 1 qt/100 gal of spray mixture. Tall fescue must be established for at least 24 months before applying metsulfuron-containing products.

*SPOT TREATMENTS FOR SPECIFIC WEEDS IN PASTURES**

Weed	Herbicide	Amount of Formulation Per 1 gal.	100 gal.	Remarks
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 will likely required. See labels for other glyphosate formulations.
Brambles	PastureGard HL (triclopyr + fluroxypyr) + surfactant	0.67 to 1 oz. + 4 tsp.	2 to 3 qt. + 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 Ultra 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.
Honeysuckle	PastureGard HL (triclopyr + fluroxypyr) + surfactant	0.67 to 1 oz. + 4 tsp.	2 to 3 qt. + 2 qt	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 Ultra 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	PastureGard HL (triclopyr + fluroxypyr) + surfactant	0.67 to 1 oz. + 4 tsp.	2 to 3 qt. + 2 qt.	Apply as a foliar spraying late spring through summer when plants are actively growing.

Weed	Herbicide	Amount of Formulation Per 1 gal.	100 gal.	Remarks
Multiflora Rose	PastureGard HL (triclopyr + fluroxypyr) + surfactant	0.67 to 1 oz. + 4 tsp.	2 to 3 qt. + 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 Ultra 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	PastureGard HL (triclopyr + fluroxypyr) + surfactant	0.67 to 1 oz. + 4 tsp.	2 to 3 qt. + 2 qt.	Apply as a foliar spray following full leaf development. Thorough coverage of all foliage is necessary for control. Sweetgum is difficult to control and will require re-treatment.
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 qt.	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 (Beargrass)	Remedy Ultra 4EC (Triclopyr) in basal or crop oil	5 Tbsp.	2 gal.	Prepare a 2% (by volume) solution of Remedy Ultra in basal or crop 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.

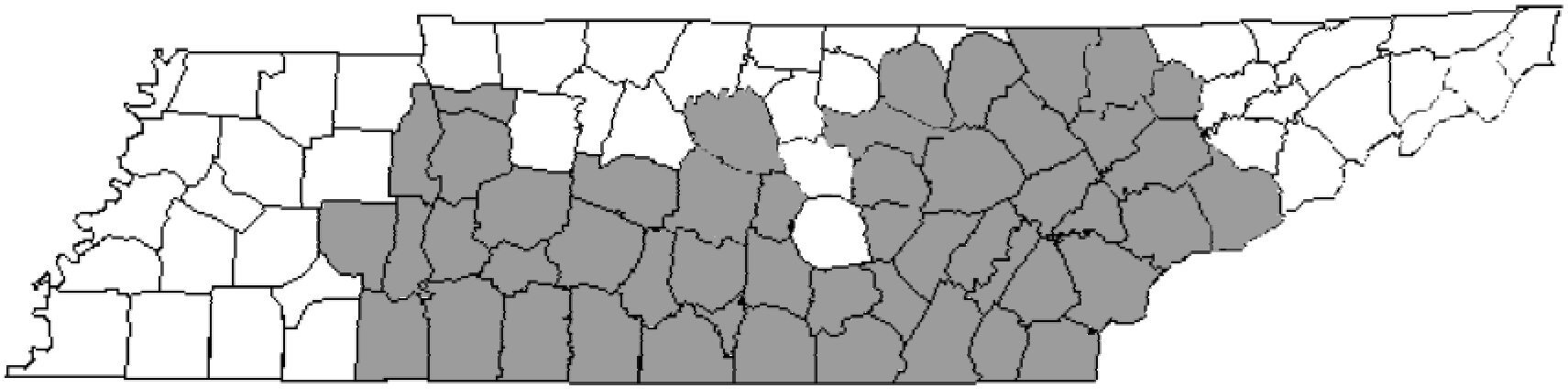
Grazon P+D and Surmount are safe on established cool-and warm-season grasses used for pasture and hay production. They provide good control of a number of broadleaf weeds. Both provide some residual control. The residual effect will depend on temperature, soil type, moisture and plant sensitivity. These 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.

1. Is the site located within one of the approved counties for this herbicide?
2. Does the applicator have a restricted use applicator certification or use a custom applicator?
3. Is the site properly buffered from sensitive crops and other off-target species, including ornamentals?
4. Is there surface water (ponds or streams) on site? If so, does the applicator know to keep a 50 foot buffer?
5. Has the required personal protective equipment been prepared?
6. Are the wind conditions calm enough to prevent drift?
7. Is rain in the forecast? If so, the application should be delayed.
8. Does the applicator / land manager understand the grazing, haying and manure restrictions (see label)?
9. 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.
10. 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.)
11. 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)

	Beef cattle, Non-lactating dairy cattle and other livestock			Lactating Dairy Cattle		
Herbicide	**Grazing**	**Hay Cutting**	**Slaughter**	**Grazing**	**Hay Cutting**	**Slaughter**
Aim	0	0	*N	0	0	*N
Metsulfuron	0	0	0	0	0	0
GrazonNext HL/Duracor	0	7/14***	3	0	7	*N
Gramoxone SL (dorm. bermuda)	40	40	*N	40	40	*N
Grazon P+D (picloram + 2,4-D)	0	30	3	7	30	3
Outrider	0	14	*N	0	14	*N
Pastora	0	0	*N	0	0	*N
Remedy Ultra	0**	7**	3	14**	1 yr.	3
Roundup PowerMax or WeatherMax	0	0	*N	0	0	*N
Surmount (picloram + fluroxypyr)	0	30	3	Next growing season	30	3
2,4-D	0	7	3	7	7	3
Brash/Range Star/ Weedmaster	0	37	30	7	37	30

**N = no information on label*
*** = 2 qt./A or less*
**** = For maximum control with DuraCor*

Estimated Pasture Herbicide Prices

Trade Name	Container Price ($)	Formulation Rate Per Acre	Approx. Cost ($) Per Acre
Aim	205.00/qt.	1 - 2 oz.	6.40 – 12.80
Brash	95.00/2.5 gal.	1 – 4 pt.	9.50 – 38.00
Cimarron Plus	90.00/10 oz.	0.125 – 0.5 oz.	1.13 – 4.5
DuraCor	94.00/gal.	12 oz.	8.81
GrazonNext HL	118.00/2 gal.	1.2 - 2.1 pt.	8.85 – 15.50
Grazon P+D	88.00/2.5 gal.	2 – 3 pt.	8.60 – 13.20
Outrider	350.00/20 oz.	0.75 – 2.0 oz.	13.13 – 35.00
Pastora	355.00/20 oz.	1 – 1.5 oz.	17.75 – 26.60
PastureGard HL	336.00/2.5 gal.	1 – 4 pt.	16.80 – 67.00
Remedy Ultra	79.00/gal.	-----	------
Rezilon	291.00/qt.	3-5 oz.	27.00 – 45.50
Surmount	172.00/2.5 gal.	1.5 – 6 pt.	12.90 – 51.00
2, 4-D Amine	65.00/2.5 gal.	1 – 4 pt.	3.25 – 13.00
2, 4-D Ester	96.00/2.5 gal.	1 – 4 pt.	4.80 – 19.00
2, 4-DB 200	93.00/2.5 gal.	4 – 6 pt.	18.60 – 27.90

Note: These are estimates of retail prices of commonly-used pasture herbicides and they are intended for use for planning purposes only. They do not include any volume discounts, rebates, etc. Consult your agricultural chemical supplier for current, local prices.

WEED MANAGEMENT IN FARM PONDS

G. Neil Rhodes, Jr., Professor and Extension Weed Management Specialist

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 emergent or marginal weeds (cattail, water lillies, grasses, arrowhead, etc.). Proper identification of weeds is critical before attempting a management strategy.

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 emergent or floating weeds. Information on grass carp and stocking rates may be found also in *Managing Small Fishing Ponds and Lakes in Tennessee* by the Tennessee Wildlife Resources Agency (http://www.tn.gov/twra/fish/pond/pondmang.html). Also, consider contacting the Southern Regional Aquaculture Center (http://srac.tamu.edu) for a complete listing of current aquatic weed control fact sheets.

Biological Control Methods

Triploid Grass Carp

Grass carp, also known as white amur, must be triploid (sterile) in order to be sold and stocked in private lakes and ponds in Tennessee. 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.

Tilapia

Three tilapia species are legal to stock into private lakes and ponds in Tennessee: blue tilapia, Nile tilapia, and Mozambique tilapia. Tilapia are non-native tropical fish that will not overwinter in Tennessee and will require restocking. After water temperatures reach 60-65 F in the spring, stock tilapia at 15-20 pounds per acre for control of watermeal and filamentous algae. Tilapia should be at least three inches long to deter predation, but often will not provide adequate weed control if the pond has a robust bass population.

Cultural and Physical Control Methods

Prevention

Aquatic weed management begins with pond construction. The depth at the shoreline should be about 3 feet to reduce aquatic weed and algae growth at the pond edge. 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 sometimes recommended. Fertilization must, however, be done properly. For information on farm pond fertilization, please refer to *Managing Small Fishing Ponds and Lakes in Tennessee*. Excess nutrients from farming and landscaping practices support the growth of unwanted vegetation. It is important to reduce nutrient loading near the pond and consider planting buffer strips of desirable vegetation to intercept excess nutrients.

Dyes

Several non-toxic dyes are available that control filamentous algae and some submersed species by blocking light penetration for up to six weeks after application. They may be used in lakes, ponds, ornamental ponds and fountains, and commercial fish ponds that have little or no outflow. Apply labeled rates 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 throughout the year. These dyes are non-toxic to livestock, but must not be applied in water supplies that will be used for human consumption or any body of water not under total control of the user.

Chemical Control Methods – 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 ditchbanks, 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 decay. **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.**

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.

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.

Algicides containing sodium carbonate peroxyhydrate as the active ingredient are becoming increasingly popular. After application to water, it forms hydrogen peroxide that rapidly attacks algal cells. Applications should be made with at least 8-10 hours of sunlight remaining to enhance efficacy. There are no water use restrictions associated with these products. However, rapid decay of algae can decrease the amount of dissolved oxygen available to fish. Applicators should follow the same precautions as other aquatic herbicides when treating ponds to reduce the risk of oxygen depletion.

Specific Weeds

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. Fluridone (Sonar, Avast) can be applied as an in-water treatment in ponds with little or no outflow. Flumioxazin (Clipper) may be applied at a rate of 8 to 12 oz per surface acre or as an in-water treatment at a rate of 1 to 2 lbs per acre foot of water. Flumioxazin will rapidly degrade and lose effectiveness in water with pH>8.5. Applications made early in the morning before the pH begins to rise have shown the best results. Other methods for watermeal control include reducing nutrient loading and stocking 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. The algae usually begin along edges or in the bottom, often attached to underwater structures. Proper identification of filamentous algae is critical, as species have different susceptibilities to control options. The use of copper complexes, such as chelated coppers, has given excellent control to most species when applied to the area in early spring. It is important to break up thick mats of filamentous algae to increase the surface area contact with algicides.

Watershield

Watershield, or dollarbonnet, is a perennial floating-leaved plant common throughout much of Tennessee. Plants can quickly spread around the perimeter of ponds. Mechanical control is difficult because plants can reestablish from seeds and rhizomes. Applications of granular 2,4-D (Navigate) should be made early in the growing season at a rate of 150 to 200 lbs per acre. Glyphosate, imazapyr, or triclopyr can be applied as a foliar treatment to leaves floating on the surface. Use of non-ionic surfactants approved for aquatic use is recommended. Also, avoid disturbing surface water after application so that herbicides have enough time to absorb into the plant.

AQUATIC HERBICIDES FOR WEED CONTROL IN FARM PONDS

Weed	Herbicide	Amount of Formulation	Precautions and Remarks*
ALGAE, blue-green	Copper sulfate (various)	1-5.4 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.**
	Copper complexes (various)	Varies by product, see label	Apply as a diluted surface spray when water temperatures are above 60F. For best results, apply on a clear day. **Warning: Copper is toxic to fish.**
	Sodium carbonate peroxyhydrate (various)	3-100 lb/acre foot see label	Apply early on a clear day when water temperatures are above 60F. Apply with 8 to 10 hours of daylight remaining. Wait at least 48 hours before retreatment.
ALGAE, filamentous, planktonic, chara, etc.	Copper sulfate (various)	1-5.4 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.**
	Copper complexes (various)	Varies by product, 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.**
	Reward (Diquat)	2 gal/surface acre see label	For suppression of certain filamentous algae - *Pithophora* spp. and *Spirogyra* spp. Check label for application instructions. For best results, break up floating mats before treatment.
Submersed Weeds	Navigate (2,4-D granular)	100-200 lb/surface acre 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.
	Reward (Diquat)	1-2 gal/surface acre see label	Weeds controlled: bladderwort, coontail, elodea, hydrilla, milfoils, 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.
	Aquathol K, Aquathol Super K (Endothall-dipotassium salt)	Varies by product, see label	Weeds controlled: coontail, hydrilla, milfoils, naiads, pondweeds. Rate depends upon weed to be controlled, depth of water, and type of treatment. Spot treatments require higher rates. Check labels for species and rates.
	Clipper (Flumioxazin)	0.53-2.1 lb/acre foot	Apply early in season to young, actively growing plants. Apply in waters with pH less than 8.5 and with high light penetration. Ponds will tend to have lower pH in the early morning.
	Sonar, Avast, Whitecap (Fluridone)	Varies by product, see label	Weeds controlled: bladderwort, coontail, Egeria, common elodea, hydrilla, milfoils, naiads, pondweeds. Requires long contact time to be effective (minimum 45 days). Do not apply when there is substantial outflow from the pond. Not effective as a spot treatment.
	Renovate 3, Renovate OTF (Triclopyr amine)	Varies by product, see label	Rate depends on weed to be controlled and depth of water. Check labels for species and rates.
Floating Weeds (except watermeal)	Reward (Diquat)	0.5-0.75 gal/surface acre see label	Weeds controlled: pennywort, salvinia, waterhyacinth, waterlettuce. 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)	Clipper (Flumioxazin)	8-12 oz/surface acre OR 1-2 lbs/acre foot	Apply in waters with pH less than 8.5. Ponds will tend to have lower pH in the early morning. Buffer spray solution to pH less than 7.
	Sonar, Avast, Whitecap (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.

Weed	Herbicide	Amount of Formulation	Precautions and Remarks*
Emergent and Marginal Weeds	Navigate (2,4-D granular)	150-200 lb/surface acre	Weeds controlled: pennywort, spatterdock, waterchestnut, water lily, waterprimrose, watershield and others. 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. Note: some liquid formulations of 2,4-D are labeled for aquatic use. Always check the label before applying any herbicide.
	Reward (Diquat)	1 gal/surface acre, 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, others (Glyphosate 5.4 lb/gal)	See label for intended species	For control of cattail, spatterdock, American lotus, waterprimrose 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 aquatic herbicides, at 2 qts./100 gal. of spray mix.
	Habitat, others (Imazapyr)	1-6 pt/surface acre	Weeds controlled: cattail, frogbit, pennywort, spatterdock, waterchestnut, water lily, waterprimrose and others. Apply in 100 gal of water per acre with 2 qt. nonionic surfactant. Check label for species and rates.
	Renovate 3, Renovate OTF (Triclopyr amine)	2-8 qt/surface acre	Weeds controlled: frogbit, pennywort, spatterdock, water lily, waterprimrose, watershield and others. Check label for species and rates. Use of a nonionic surfactant is recommended.

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

RESTRICTIONS AND WAITING PERIODS

Herbicide	Restrictions
Copper sulfate and 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.
Navigate (2,4-D granular)	Do not apply to water used for irrigation, agricultural sprays, watering dairy animals or domestic water supplies. Always read the label before use.
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.
Aquathol K, Aquathol Super K (Endothall-dipotassium salt)	**Fishing and Swimming:** no restrictions. **Livestock Watering** restrictions are based upon concentration in water. See label. **Irrigation:** 7 days for annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf.
Clipper (Flumioxazin)	**Fishing, Swimming, Livestock Watering**: no restrictions. **Irrigation:** 5 days for food crops and ornamentals grown for production, 0 to 3 days for turf and landscape ornamentals, depending on application method and concentration in water. See label.
Sonar, Avast, Whitecap (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.
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.
Habitat (Imazapyr)	Do not apply within 0.5 mile of an active, potable water intake. **Fishing, Swimming, Livestock Watering**: no restrictions. **Irrigation:** 120 days.
Sodium carbonate peroxyhydrate (various)	No restrictions.
Renovate 3, Renovate OTF (Triclopyr amine)	See label for setback distances from an active, potable water intake. **Fishing, Swimming, Livestock Watering**: no restrictions. **Irrigation:** 120 days

EXPECTED WEED RESPONSE TO AQUATIC HERBICIDES

Weed	Copper (sulfate and complexes)	Peroxide compounds	2,4-D	Reward (diquat)	Aquathol (endothall)	Clipper (flumioxazin)	Sonar, etc. (fluridone)	Rodeo, etc. (glyphosate)	Habitat (imazapyr)	Renovate (triclopyr)
ALGAE										
Blue-green	4	4	1	1	1	--	1	1	1	1
Planktonic	4	4	1	1	1	3	1	1	1	1
Filamentous	4	4	1	5	1	4	1	1	1	1
Macroalgae	4	--	1	4	1	2	1	1	1	1
SUBMERSED										
Bladderwort	1	1	2	3	2	--	5	1	1	2
Coontail	1	1	4	5	5	4	5	1	1	4
Egeria	3	1	1	5	2	5	5	1	1	1
Eurasian watermilfoil	1	1	5	4	5	4	5	1	1	5
Hydrilla	3	1	1	4	5	4	5	1	1	1
Naiad, brittle	4	1	1	5	5	5	5	1	1	1
Naiad, Southern	4	1	1	2	2	5	4	1	1	1
Pondweed species	1	1	1	5	5	4	5	1	1	1
FLOATING										
Duckweed	2	1	2	4	1	5	5	1	1	2
Frogbit	1	1	3	5	1	4	1	2	5	4
Watermeal	1	1	1	2	1	5	4	1	1	1
EMERGENT										
American lotus	1	1	4	1	1	--	4	5	4	4
Cattail	1	1	3	3	1	2	4	5	5	3
Pennywort	1	1	4	3	1	4	4	5	5	4
Spatterdock	1	1	4	1	1	--	4	5	5	2
Water lily	1	1	4	1	1	3	4	5	5	4
Waterprimrose	1	1	5	1	1	4	3	5	5	5
Watershield	1	1	5	3	1	4	3	5	4	5

**Key to Response Ratings: 1=Not recommended; 2=Poor control; 3=Fair control; 4=Good control; 5=Excellent control; -- = Data not available. Response ratings adapted from information courtesy of Dr. Robert J. Richardson, Professor, Crop Science Department, North Carolina State University and the Southern Regional Aquaculture Center.*

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. 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 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 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 nonuniform 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 label and the weed control manual recommendations for corn, he decides to spray Gramoxone 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.

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

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

What about the surfactant?

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.

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

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

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

8 acres X 0.6 oz./A = 4.8 oz. Staple per tank

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 Hooded 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.

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 (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 20 ounces, equals the application rate in GPA. In this case the hoods are applying at 20 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 13 ounces, equals the application rate in GPA. In this case the post directing nozzles are applying at 13 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 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. Let's 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.

SUMMARY OF HERBICIDE MECHANISM OF ACTION ACCORDING TO THE WEED SCIENCE SOCIETY OF AMERICA (WSSA)

Site of Action Group	Herbicide Mode of Action
1	Acetyl CoA Carboxylase (ACCase) Inhibitors
2	Acetolactate Synthase (ALS) or Acetohydroxy Acid Synthase (AHAS) Inhibitors
3, 15, 23	Mitosis Inhibitors
4	Synthetic Auxins
5, 6, 7	Photosystem II Inhibitors
8, 16	Fatty Acid and Lipid Biosynthesis Inhibitors
9	Enolpyruvyl Shikimate-3-Phosphate (EPSP) Synthase Inhibitors
10	Glutamine Synthetase Inhibitors
11, 12, 13, 27	Carotenoid Biosynthesis Inhibitors
14	Protoporphyrinogen Oxidase (PPG Oxidase or Protox) Inhibitors
17, 25, 26	Potential Nucleic Acid Inhibitors or non-descript mode of action
18	Dihydropteroate Synthetase Inhibitors
19	Auxin Transport Inhibitors
20, 21, 28, 29	Cellulose Inhibitors
22	Photosystem I Inhibitors
24	Oxidative Phosphorylation Uncouplers

wssa.net/wp-content/uploads/WSSA-Herbicide-MOA-20160911.pdf

RAINFREE REQUIREMENT FOR POSTEMERGENCE HERBICIDES

Trade Name	Restrictions
Accent Q	Accent Q is rainfast in 4 hours.
Achieve Liquid	Achieve is not affected by rain falling 1 hour or more after application.
Acuron	No information on label.
Aim EC	To avoid significant crop response, applications should not be made within 6-8 hours of either rain or irrigation.
Anthem Flex	Rainfall or irrigation within 1 hour may wash off Anthem Flex. Do not irrigate within 4 hours. Do not irrigate fields after a delayed preemergence application until wheat spikes.
Anthem Maxx	Rainfall or irrigation within 1 hour may wash Anthem Maxx off of weeds. Do not irrigate within 4 hours of a post emergence application.
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.
Axial XL	Axial XL herbicide applied alone is not affected by rain falling 30 minutes or more after application.
Axiom DF	Excessive rainfall after application may cause crop injury to young seedlings.
Banvel	No information on label.
Basagran	Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of Basagran.
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.
Canopy	When used for burndown, Canopy is rainfast after 1 hour.
Capreno	Capreno is rainfast 1 hour after application to most weed species.
Celebrity Plus	For best performance, rainfall or irrigation should not occur for 4 hours after application.
Cheetah Max	Cheetah Max is rainfast 4 hours after application to most weed species.
Cimarron Plus	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.
Crossbow	No information on label.
Distinct	Distinct is rainfast 4 hours after application when used with the recommended adjuvants.
Durango	Heavy rainfall soon after application may wash product off of the foliage and a repeat application may be required for adequate control.
Envive	When used for burndown, Envive is rainfast after 1 hour.
Envoke	Envoke is rainfast within 3 hours of application.
ET	1 hour
Equip	Equip is rainfast in 2 hours after application to most weed species.
Extreme	Extreme should be applied a minimum of 1 hour before rainfall or overhead irrigation.
Fierce	Fierce herbicide is rainfast one hour after application.

Trade Name	Restrictions
Finesse Cereal and Fallow	Rainfall is needed to move Finesse into the soil. Postemergence weed control may be reduced if rainfall occurs within 6 hours after application.
FirstRate	FirstRate is rainfast in 2 hours.
First Shot SG	No information on label
Flexstar	Flexstar requires a 1 hour rainfree period for best results.
Flexstar GT 3.5	Heavy rainfall or irrigation shortly after application may reduce performance.
Frontrow	Frontrow is rainfast in 2 hours.
Fusilade DX	Fusilade DX herbicide is rainfast 1 hour after application.
Goal 2XL	No information on label.
Gramoxone SL	Because Gramoxone SL is rapidly absorbed by the weed foliage, rain occurring 30 minutes or more after application will have no effect on the activity of Gramoxone SL. Sufficient rainfall or sprinkler irrigation to cause washoff prior to planting may be needed to prevent damage to the crop.
Harmony Extra SG with TotalSol	Several hours of dry weather are needed to allow Harmony Extra SG to be sufficiently absorbed by weed foliage.
Harmony SG with TotalSol	Weed control may be reduced if rainfall or snowfall occurs soon after application. Several hours of dry weather are needed to allow Harmony SG to be sufficiently absorbed by weed foliage.
Hoelon	No information on label.
Hornet	Hornet is rainfast in 2 hours.
Huskie	Rainfall within 1 hour may result in reduced weed control.
Impact	Should be applied a minimum of 1 hour before rainfall/irrigation
Karmex DF	Moisture is required to activate the herbicide: Best results occur if rainfall (or sprinkle irrigation) occur within 2 weeks after application.
Keystone NXT	Needs 0.25 inches for activation
Laudis	Rainfast 1 hour after application
Leadoff	Residual weed control is dependent on rainfall or irrigation for herbicide activation.
Lexar EZ	If a significant rainfall does not occur within 7 days after application, weed control may be decreased.
Liberty 280SL	Liberty is rainfast 4 hours after application to most weed species, therefore, rainfall within 4 hours may necessitate retreatment or may result in reduced weed control.
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.
Osprey	Rainfast 4 hours after application. Rainfall within 4 hours may result in reduced weed control.
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.
PowerFlex HL	Rainfast within 4 hours after application
Prefix	No information on label.
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.
Realm Q	No information on label.
Reflex	Reflex herbicide requires a 1hour rainfree period for best results.
Resource	Resource is rainfast 1 hour after application.

Trade Name	Restrictions
Roundup Power Max Roundup WeatherMax/ Glyfos/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 70DG	No information on label.
Select	Do not apply if rain is expected within 1 hour of application, as control may be unsatisfactory.
Select Max	Do not apply if rain is expected within 1 hour of application, as control may be unsatisfactory..
Sequence	Heavy rainfall or irrigation shortly after application may require retreatment.
Solstice	Requires a minimum of 1 hour rain-free.
Sonic	Rainfall or irrigation is required to activate the herbicide.
Staple LX	Rainfall (0.5- 1 inch) following the postemergence application is required for residual control. A minimum of 4 hours is needed to allow Staple LX to be absorbed by weed foliage.
Status	Rainfast 4 hours after application
Steadfast Q	Steadfast 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.
Surveil	Surveil is rainfast two hours after application.
Ultra Blazer	Rainfall or overhead irrigation within 4 hours after application may reduce the effectiveness of Ultra Blazer.
Valor SX	Rainfast 1 hour after application.
Valor XLT	Rainfast 1 hour after application.
Verdict	Rainfast 1 hour after application
Yukon	Rainfall or irrigation occurring within 4 hours after application may also reduce effectiveness.
2,4-D	No information on label.

NOTES:

FORAGE, FEED AND GRAZING RESTRICTIONS FOR HERBICIDES

C-Corn Ct-Cotton S-Soybeans 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 or feed forage from treated areas for 60 days following application, or illegal residues may result.
Accent Q	**X**					Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.
Achieve Liquid					**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.
Acuron	**X**					Do not graze or feed forage from treated areas for 45 days following application. Do not harvest forage within 60 days after application.
Aim EC	**X**				**X**	Barley, oats and wheat (Forage after 7 days).
Anthem	**X**					Do not harvest or feed corn grain or stover until 70 days after application.
Anthem ATZ	**X**					Do not harvest field corn for forage within 60 days of the last application of Anthem ATZ herbicide. Do not harvest or feed corn grain or stover (fodder) within 70 days after the last application.
Anthem Flex		**X**			**X**	Do not harvest, feed, or graze within 7 days after application.
Anthem Maxx			**X**			Do not graze or feed treated soybean forage or hay to livestock. Do not harvest/feed field corn forage until 30 days after last application.
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.
Authority Elite			**X**			Do not use for forage within 60 days after application and do not cut hay within 120 days after application.
Authority First			**X**			Do not feed treated soybean forage or soybean hay to livestock.
Authority MTZ			**X**			Do not graze treated soybean or harvest for forage or hay.
Authority XL			**X**			Do not feed treated soybean forage or soybean hay to livestock
Axial XL					**X**	Do not graze or feed forage from wheat within 30 days of application.
Axiom DF					X	Do not allow animals to graze treated fields for a minmum of 30 days following application.
Banvel	**X**	**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.
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 60 days following application.
Boundary 6.5EC			**X**			Treated soybean plants may be grazed or fed to livestock 40 days after the last application of Boundary.
Buctril	**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/feed soybean forage or hay within 60 days following any 2,4-DB application.
Callisto	**X**					Do not harvest forage, grain, or stover within 45 days after application.
Canopy			**X**			Do not graze treated fields or harvest for forage or hay.
Caparol		**X**				Do not feed treated forage to livestock, or graze treated areas, or illegal residues may result.
Capreno	**X**					Do not apply Capreno within 45 day of grazing livestock or harvesting corn forage.
Celebrity Plus	**X**					Do not apply within 32 days of forage harvest. Do not apply within 72 days of corn grain and stover harvest.

Chemical	C	Ct	S	GS	W	Restrictions and Remarks
Cheetah Max			**X**			Do not graze treated areas or harvest for forage or hay.
Clarity	**X**	**X**	**X**			Corn may be harvested or grazed for feed once the crop has reached the ensilage stage or later in maturity. Do not feed soybean fodder or hay following Preharvest application.
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, may be 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.
Corvus	X					Do not harvest field corn forage within 45 days of application of Corvus herbicide.
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**		X			Do not graze or feed to livestock the forage. Do not harvest for 75 days for silage
Degree	**X**					Do not graze area or feed treated forage for 60 days after application.
Degree Xtra	**X**			**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.
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.
Enlist One		**X**	**X**			Do not apply within 30 days of forage harvest.
Envive			X			Do not graze treated fields or harvest for forage or hay.
Envoke		**X**				No information on label.
ET		**X**				Do not apply within 7 days of harvest.
Equip	**X**					Do Not graze within 45 days of application
Extreme			**X**			Do not graze or feed treated soybean forage, hay or straw to livestock.
Fierce	**X**					No information on label.
Finesse Cereal and Fallow					X	No grazing restrictions.
FirstRate			**X**			Do not harvest soybeans for forage or hay for 14 days after application.
First Shot SG						Do not graze livestock in treated areas.
Flexstar			**X**			Do not graze treated areas or harvest for forage or hay.
Flexstar GT 3.5			**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 NXT	**X**			**X**		Do not apply FulTime NXT within 60 days of harvest for field corn or grain sorghum forage uses or 45 days for sweet corn forage uses. Do not graze or harvest rotational cover crops for food or animal feed for 18 months following last application.
Fusilade DX		**X**	**X**			Do not graze or harvest for forage or hay.
Goal 2 XL		**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.

Chemical	C	Ct	S	GS	W	Restrictions and Remarks
Gramoxone SL	**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 60 or more days after application of Guardsman Max. Sorghum forage may be grazed or fed to livestock 45 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.
Halex GT	**X**					Do not graze or feed forage from treated area for 45 days of application.
Harmony Extra SG with TotalSol					**X**	Allow 7 days between application and grazing of treated areas. In addition, allow 7 days between application & feeding of forage from treated areas to livestock. Allow at least 30 days between application and feeding of hay from treated areas to livestock. Harvested straw may be used for bedding and/or feed.
Harmony SG with TotalSol					**X**	Allow 7 days between application and grazing of treated areas. In addition, allow 7 days between application & feeding 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 5.6L	**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**					Applicaton must occur before corn reaches 20 inches in height or V6 growth stage and an interval of at least 45 days is required between application and harvest.
Huskie				**X**	**X**	Do not graze or harvest forage within 25 days, grain and straw within 60 days after application.
Impact	X					Do not graze or feed treated forage for at least 45 days after application.
Instigate	**X**					Do not graze, feed forage, grain or fodder from treated areas to livestock with 45 days of application.
Intimidator			**X**			Do not graze or feed treated soybean forage, hay or straw to livestock.
Karmex DF		**X**				Do not allow livestock to graze treated cotton.
Keystone NXT	**X**					Do not apply Keystone NXT within 60 days of harvest of field corn for field corn forage uses.
Lariat	**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 60 days following application of this product.
Laudis	X					Do not graze livestock or harvest corn forage within 45 days of application.
Leadoff	**X**					Do not graze, feed forage, grain or fodder (stover) from treated areas to livestock with 30 days of application.
Lexar EZ	**X**					To avoid illegal residues, do not graze or feed forage from treated areas for 45 days following last application.
Liberty 280 SL	**X**		**X**			Do not apply herbicide within 60 days of harvesting corn forage and within 70 days of harvesting corn grain and corn fodder. Do not graze treated crop or cut for hay (soybean).
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**			**X**		Do not graze treated fields or feed forage from treated areas to livestock. Do not feed gin trash to livestock. Do not graze or feed plants to livestock within 3 months of application
Lumax	**X**					To avoid illegal residues, do not graze or feed forage from treated areas for 45 days following application. Do not harvest forage, grain, or stover within 60 days after application.
Marksman	**X**			**X**		Corn may be harvested or grazed for feed after it has reached the ensilage (milk) stage or later maturity. Do not graze or feed forage from treated area 21 days or more following application (sorghum).
MSMA		**X**				Do not feed foliage to livestock or graze treated areas.
Metribuzin 75DF	**X**		**X**		**X**	Soybean vines or hay treated with Metribuzin 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 Metribuzin may be harvested for silage or grain 60 days after treatment.
Osprey					**X**	Do not apply Osprey herbicide within 30 days of harvesting wheat forage, and 60 days for hay, grain, and straw.
Op-Till			**X**			Do not graze or feed treated soybean forage, hay or straw to livestock.

Chemical	C	Ct	S	GS	W	Restrictions and Remarks
Outlook	**X**	**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. Sorghum forage may be grazed or fed to livestock 60 days or more after application. Cotton gin by products may be fed to livestock.
Perpetuo			**X**			Do not graze animals or use as a feed within 28 days of herbicide application.
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.
Power Flex HL					**X**	Do not graze treated crop within 7 days of application.
Prefix		**X**	**X**			Do not graze or feed treated forage or hay from soybeans to livestock following or post app. of Prefix. Do not graze or feed forage or fodder from cotton to livestock.
Princep	**X**					Do not graze treated areas, or illegal residues may result.
Prowl/Pendimax 3.3/ Prowl H2O		**X**	**X**	**X**		Do not feed forage or graze livestock in treated cotton fields. Livestock can graze or be fed forage from treated 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		**X**			Do not graze or feed treated soybean forage, hay or straw to livestock. Do not harvest corn (silage, fodder, or grain) for at least 45 days after Pursuit application. Do not graze or feed treated corn forage, silage, fodder or grain for at least 45 days after an application of Pursuit.
Python	**X**		**X**			Do not graze or feed treated soybean forage, hay or straw to livestock.
Realm Q	**X**					Do not graze, feed forage, grain or fodder from treated areas to livestock with 45 days of application.
Reflex		X	**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.
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.
Resolve Q	**X**					Do not graze, feed forage, grain or fodder within 30 days of app.
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 70 DG			**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.
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 postemergence application.
Sharpen	**X**		**X**	**X**	**X**	Corn forage and silage can be harvested, fed, or grazed 80 or more days after application. . Soybean forage may be fed or grazed 65 or more days after application. Small grain forage and hay can be fed or grazed 30 or more days after application. Sorghum forage can be harvested, fed, or grazed 70 days or more after application.
Solstice	**X**					Do not harvest or feed forage with 45 days after application. Do not harvest or feed grain or stover within 70 days after application. Do not harvest or feed field corn forage until 30 days after last application
Sonic			**X**			Do not feed treated soybean forage or soybean hay to livestock.
Spartan Charge						Do not graze or feed forage harvested from Spartan Charge treated areas. Sod.

Chemical	C	Ct	S	GS	W	Restrictions and Remarks
Staple LX		**X**				No information on label
Status	**X**					Do not apply within 32 days of corn forage harvest.
Steadfast Q	**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.
SureStart II	**X**					No information on label.
Surveil			**X**			Do not graze treated fields or feed treated forage or hay to livestock.
Tendovo			**X**			Do not graze, feed forage from treated areas or harvest for hay fo 40 days following application.
TopNotch	**X**					No information on label.
Treflan 4 / Tri-4	**X**					Do not apply 6 weeks prior to harvesting forage.
Trivence			**X**			Do not graze treated fields or harvest for forage or hay.
Ultra Blazer			**X**			Do not use treated plants for feed or forage.
Valor SX			**X**			Except for field corn, do not graze treated fields or feed treated forage or hay to livestock.
Valor XLT			**X**			Do not graze treated fields or feed treated forage or hay to livestock.
Verdict	**X**		**X**	**X**		Corn forage and silage can be harvested, fed, or grazed 80 or more days after application. Sorghum forage/graze 70 or more days. Soybean: DO NOT graze or feed forage, hay, or straw to livestock.
Warrant	**X**			**X**		Do not graze treated area or feed treated forage to livestock for 40 days following application. Do not graze treated area or feed treated sorghum forage ato livestock for 60 days following application
Yukon	**X**			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. Sorghum PHI is 20 days for forage, 30 days for grain and fodder.
Zidua	**X**		**X**		**X**	Wheat forage and hay can be fed or grazed 7 or more days after application.
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. Do not permit meat or dairy animals to consume treated crop (Sorghum) as fodder or forage for 30 days following application.

POSTEMERGENCE HERBICIDE PREHARVEST INTERVALS (PHI) IN D (DAYS)

Chemical	Corn	Cotton	Soy	Grain Sorghum	Wheat	Remarks
Aatrex						No information on label.
Accent Q						No information on label.
Achieve Liquid					60 D	
Acuron						Corn (for grain, seed, or silage) may be treated up to 12 inches tall.
Aim EC		7D	**	***	****	** Soybeans must have 3 trifoliate or less, *** grain sorghum<6 collars, **** prior to jointing stage.
Anthem ATZ	45 D					Do not harvest sweet corn ears within 45 days of last application.
Anthem Flex		7D			7D	Do not harvest with 7 days after application.
Anthem Maxx			60D			The last application for soybeans should be made no later than 60 days before harvest.
Assure II		80 D	80 D			Do not apply to soybeans after pod set.
Atrazine						No information on label.
Authority Elite						No information on label.
Authority First			65 D			Allow 65 days between application and harvest of soybeans.
Axial XL					60D	Do not harvest grain for 60 days after application.
Axiom DF						No information on label.
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.
Beacon	60 D					Do not harvest grain 60 days after application.
Boundary 6.5 EC						
Buctril		75 D*				
Butyrac 200			60 D			
Callisto	45 D					
Caparol						No information on label.
Capreno	45 D					
Canopy						No information on label.
Celebrity Plus	72 D					
Cheetah Max			70D			Do not apply within 70 days of harvest.
Clarity			7D			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 trifoliate 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).
Command 3ME		65D				
Cotoran		60 D				
Cotton Pro						No information on label.

Chemical	Corn	Cotton	Soy	Grain Sorghum	Wheat	Remarks
Corvus						
Crossbow						Do not harvest hay for 14 days.
Degree Xtra	60D					Preharvest Interval for forage.
Direx						No information on label.
Distinct	72D					
Dual II Magnum			90D	75D		
Durango		7D	7D		7D	Applications must be made at least 7 days prior to planting corn.
Enlist One						Do not apply within 30 days of forage harvest.
Envive						No info on label
Envoke		60 D				
Equip	70D					
Extreme			85 D			Extreme applications should be made before soybean bloom.
Fierce						
Finesse Cereal and Fallow						No info on label
FirstRate			65 D			Prior to 50% flowering of soybeans.
First Shot SG						
Flexstar			45D			Apply Flexstar before soybeans bloom. Do not apply within 45 days of harvest.
Flexstar GT 3.5			45D			
Frontrow			70 D			
FulTime NXT	60D					Do not apply FulTime NXT within 60 days of harvest for field corn or grain sorghum forage uses.
Fusilade DX		90 D				Make the last Fusilade DX 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			
Goal 2 XL		90 D				Do not apply within 90 days of harvest.
Gramoxone SL	7 D	3 D	15 D	48D		Allow 7 days between application and harvest of corn. Allow 3 day between application and harvest of cotton. Allow 15 days between application and harvest of soybeans.
Guardsman Max				80D		No information on label about field corn.
Halex GT	45D					
Harmony Extra SG with TotalSol					45 D	
Harmony SG with TotalSol						No information on label.
Hornet	85 D					If field corn is grown for forage or ensilage, application must occur before corn.
Huskie				60D	60D	
Impact	45D					Do not apply within 45 days of harvest.
Instigate	None					Do not harvest grain within 60 days after application.
Intimidator			90D			Do not harvest within 90 days of the last application of Intimidator.

Chemical	Corn	Cotton	Soy	Grain Sorghum	Wheat	Remarks
Karmex DF						No information on label.
Keystone NXT	60D					
Laudis						No information on label.
Lexar EZ	60 D					Allow 60 days between application and harvest of corn.
Liberty 280 SL	70 D	70 D	70 D			
Lightning	45 D					
Linex 4L	57 D	76 D		75 D		Do not apply within 76 days of harvest of cotton.
Lumax	60 D					Allow 60 days between application and harvest of corn.
Marksman	60 D					Corn may be harvested or grazed for feed once the crop has reached the ensilage (milk stage) or later maturity.
Metribuzin 75DF	60D	70D				
MSMA						Apply only when cotton is 3 inches high to first bloom. Do not apply after first bloom.
Poast /Poast Plus	60D	40 D	75 D			
Optill			85 D			
Osprey					30D	Do not apply within 30 days of harvesting wheat forage, and 60 days for hay, grain, and straw.
Outlook		0D		80D		There is no preharvest interval between a postemergence application of Outlook and the harvest of cotton.
Permit						No information on label.
Poast	60D	40 D	75 D			
Power Flex HL					60D	Do not apply within 60 days of harvest. Do not cut the treated crop for hay within 28 days of application.
Prefix	90D	80D				Do not apply within 90 days of harvest
Prowl/Pendimax 3.3	60D	60D	60D	60D		Allow 60 days between application and harvest of corn, cotton, grain sorghum, and soybeans.
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	45D		85 D			Pursuit applications should be made before soybean bloom.
Python WDG	85D		85D			Do not apply within 45 days of field corn forage harvest.
Raptor			85 D			Raptor application must be made before soybean bloom.
Realm Q	70D					
Reflex		70D	45D			Apply Reflex before soybeans bloom.
Resolve Q						Do not apply to field corn grown for seed.
Resource			60D			Do not apply Resource to field corn before the 2-leaf or 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 70 DG			90D			
Select		60 D	60 D			
Select Max		60 D	60 D			Allow 60 days between application and harvest of soybeans. Allow 60 days between application and harvest of cotton.
Sequence		100 D	90D			Do not harvest cotton within 100 days of postemergence application of Sequence.
Sonic			65 D			Allow 65 days between application and harvest of soybeans.

Chemical	Corn	Cotton	Soy	Grain Sorghum	Wheat	Remarks
Staple LX		60 D				Allow 60 days between application and harvest of cotton.
Status	72D					Allow 32 days after the application to harvest corn grain.
Steadfast Q						No information on label.
Storm			50 D			
Suprend		60 D				
SureStart II	85D					
Surveil						No information on label.
Trivence						No information on label.
Ultra Blazer			50 D			
Valor		60D				
Valor XLT						No information on label.
Verdict						No information on label.
Yukon				30D		Do not apply to sorghum grown for seed production.
Warrant						No information on label.
Zidua	37D		None			Do not harvest sweet corn for human consumption less than 37 days after application of Zidua.
2,4-D	7D			30D	14D	

~ D-Day ~ * - 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 ($)	Product Rate Per Acre	Approx. Cost ($) Per Acre
AAtrex 90 DF 4L	121.00/25# bag 53.00/2.5 gal.	1.11-2.22 lbs. 1-2 qts.	5.37-10.74 5.3-10.60
Accent Q	430.0/18 oz.	0.67 oz.	16
Aim EC	235/qt.	0.5 oz.	3.67
Anthem ATZ	309/2.5 gal.	2.25 - 2.75 pts	34.76-42.49
Assure II	284.00/2.5 gal.	5-10 oz.	4.43-8.86
Atrazine Nine-O DF Atrazine 4L	118/25# bag 49/2.5 gal.	1.11-2.22 lbs. 1-2 qts.	5.24-10.48 4.9-9.8
Authority First	1060/10 lb	6.45 – 8 oz	42.73-53
Authority MTZ	570/12 lb	8 - 12 oz	23.75-35.62
Authority XL	800/10 lb	5 – 9.6 oz	25-48
Axial Bold	485/2.34 gal.	16.4 oz.	26.55
Axiom	960/25 lbs.	6-8 oz.	14.4-19.2
Banvel	196.00/2.5 gal.	0.25-4 pts.	2.45-39.2
Basagran	196/2.5 gal.	1.5-2 pts.	14.7-19.6
Bicep II Magnum	143/2.5 gal.	1.3-2.6 qts.	18.59-37.18
Boundary	251/2.5 gal.	1-3 pts.	12.55-37.65
Butyrac 200	44/gal.	2 oz.-6 pts.	0.68-33
Cadet	360/qt	0.6-0.9 oz	6.75-10.13
Callisto	396/gal.	3 oz.	9.28
Caparol	125/2.5 gal.	1 pt.	6.25
Cimarron Plus	175/10 oz.	0.25-0.5 oz.	4.38-8.75
Clarity 4EC	235/2.5 gal.	0.5-1 pt.	5.87-11.75
Classic	200/10 oz.	0.5-0.75 oz.	10-15
Cobra	630/2.5 gal.	12.5 oz.	24.60
Command 3ME	475/2.5 gal.	2-2.67 pts.	47.50-63.41
Cotoran 4L	125/2.5 gal.	2-4 pts.	12.50-25
Crossbow	162.50/2.5 gal.	1-4 qts.	16.25-65
Degree Xtra	151/2.5 gal.	2.9-3.7 qts.	43.79-55.87
Devrinol 2E	165/2.5 gal.	2-4 qts.	33-66
Devrinol 50DF	74/4# bag	2-4 lbs.	37-74
Direx 4L	58/2.5 gal.	1 pt.	2.90
Distinct DF	368/7.5 lb.	4-6 oz.	12.26-18.40
Dual Magnum	218/2.5 gal.	1-2 pt.	10.90-21.80
Dual II Magnum	270/2.5 gal.	0.66-1.67 pts.	8.91-22.55
Engenia	212.50/2.5 gal	12.8 oz.	8.50
Enlist Duo	66.50/2.5 gal	3.5-4.75 pts.	11.63-15.80
Enlist One	105/2.5 gal	1.5-2 pts.	7.88-10.50

Trade Name	Container Price ($)	Product Rate Per Acre	Approx. Cost ($) Per Acre
Envive	371/88 oz.	3 oz.	12.64
Envoke	380/3 oz.	.1-.15 oz.	12.66-19
Eptam	165/2.5 gal.	3.5 pts.	28.88
Fierce	925/6 lbs	3-4.5 oz	28.90-43.36
Finesse Cereal and Fallow	368/20 oz	0.5 oz	9.26
FirstRate	611/.75 lb	0.3 oz.	15.28
Firstshot SG	199/20 oz	0.5-0.8 oz	4.97-7.96
Flexstar GT 3.5	153/2.5 gal.	66-71 oz.	31.56-33.95
Flexstar	226/2.5 gal.	1-1.5 pts.	11.30-16.95
Fusilade DX	179/gal.	6-12 oz.	8.39-16.78
Goal 2XL*	150/2.5 gal.	1-2 pts.	7.50-15
Gramoxone 3SL	106/2.5 gal.	40-48 oz.	13.25-15.90
Grazon P+D	98/2.5 gal.	2-3 pts.	9.80-14.70
Harmony Extra Total Sol	673.44/48 oz.	0.5-0.6 oz.	7.02-8.42
Halex GT	199/2.5 gal	3.6-4 pts.	35.82-39.80
Harness Xtra 5.6	181/2.5 gal.	1.4-3 qts.	29.34-54.30
Karmex* XP	34.70/5 lb	0.25-0.5 lb.	1.74-3.47
Leadoff	400/60 oz	1 oz	6.66
Liberty 280 SL	206/2.5 gal.	32-40 oz	20.60-25.75
Metribuzin 75DF	225/10 lb	3 oz.-1 lb.	4.22-22.50
Milestone	120/qt.	3-7 oz.	11.25-26.25
MSMA	95/2.5 gal.	0.33 gal.	12.54
Osprey	437/95 oz.	4.76 oz.	21.89
Outlook	458/2.5 gal.	12-21 oz.	17.17-30.05
Permit	530/20 oz.	0.67-1.33 oz.	17.75-35.25
Poast	320/2.5 gal.	1-2.5 pts.	16-40
PowerFlex HL	1300/10 lbs.	2 oz/A	16.25
Prefix	189/2.5 gal	1 qt.	18.90
Princep 90DF 4L	70.50/10# bag 86/2.5 gal.	1.1-1.7 lbs. 2-3 pts.	7.75-11.99 8.60-12.90
Prowl H2O	146/2.5 gal.	2-3 pt.	14.60-21.90
Pursuit	500/gal.	4 oz.	15.63
Python WDG	825/2.5 lb	0.8-1 oz.	16.50-20.63
Raptor	645/gal.	4-5 oz.	20.16-25.20
Realm Q	398/80 oz	4 oz	19.90
Reflex	190/2.64 gal.	1-1.5 pts.	8.99-13.49
Remedy Ultra	90/gal.	1-4 qts.	22.50-90
Resource	283/gal.	4 oz.	8.84
Reward 2L	116/gal	0.5-2 gal.	58-232
Rodeo	116/2.5 gal.	2 qts.	23.20
Roundup PowerMax 3	145/2.5 gal.	22 oz.-44 oz.	9.96-19.93
Scepter 70DG	800/8.75 lbs.	2.1-2.8 oz.	12-16

Trade Name	Container Price ($)	Product Rate Per Acre	Approx. Cost ($) Per Acre
Select Max	310/2.5 gal	6-16 oz.	5.81-15.50
Sequence	180/2.5 gal	2.5 pt.	22.50
Sharpen	993/gal	1 oz.	7.75
Sodium Chlorate 6 lb. gal. (harvest aid)	25/2.5 gal.	0.75-1 gal.	7.36-9.8
Sonar	950/qt	not applicable	not applicable
Spartan 4F	63/qt.	8.0-10.1 oz.	15.72-19.68
Spartan Charge	94/qt	3.75 – 5.75 oz	11-16.90
Staple LX	568/0.5 gal.	1.2 oz.	10.98
Steadfast Q	866/60 oz.	0.75 oz.	10.83
Storm	284/2.5 gal.	1.5 pts.	21.30
Tavium	150-2.5 gal.	56.5 oz.	26.48
Trifluralin 4EC	98/2.5 gal	1.5 pts.-2 pts.	7.35-9.80
Ultra Blazer	136/2.5 gal.	0.5-1.5 pt.	3.40-10.20
Valor	300/5 #	2.0-2.5 oz.	7.50-9.38
Verdict	684/2.5 gal	5 oz.	10.68
Warrant	123/2.5 gal	3 pt.	18.45
Weedmaster	84/2.5 gal.	1-4 pts.	4.20-16.80
Xtendimax	127.50/2.5 gal	22 oz	8.76
Zidua SC	2,246/2.5 gal	2 -3 oz	14-21
2,4-D amine	65/2.5 gal.	0.5-2 pt.	1.63-6.50
2,4-D ester (4 lb./gal. formulation)	96/2.5 gal.	0.33-2 qt.	1.58-9.60

**Normally applied in combination with MSMA.*

CROP ROTATIONAL GUIDELINES FOR HERBICIDES

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

Chemical	C	Ct	S	GS	T	W	Remarks
Accent Q	None	10 M	15 D	10 M	10 M	4 M	Grain sorghum 10 months with a pH<7.5 or 18 M pH >7.5. Tobacco 10 months with a pH< 6.5 or 18 months with a pH>6.5.
Achieve Liquid	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.
Acuron	None	10M	10M	10M	18M	4M	
Aim EC	None	None	None	None	None	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.
Anthem	0M	4M	0M	10M	18M	6M	
Anthem ATZ	0M	18M	18M	18M	18M	18M	Read label for rotational crops.
Anthem Flex	0M	4M	4M	18M	18M	0-6M	Depended on rate used 1.82 oz = 0 month, 3.64 oz =1M, 5.46 oz =4M, 7.28 oz = 6M
Anthem Maxx	0M	4M	0M	11-18M	18M	4-6M	Check use rate if rotating to wheat or tobacco.
Atrazine (AAtrex, Bicep II Magnum, Marksman)		8M					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.
Authority Elite	10M	18M	None	10M	10M	4.5M	
Authority First	10M	18M	None	12M	30M	4M	Corn – Observe an 18 month rotational interval if 6.45 – 8 oz of Authority First DF herbicide is applied to soils of 1.5% OM or less, and pH is above 7.
Authority MTZ	10,4M	12M	None	18,12M	12M	4M	Field corn may be planted after 4 months where Authority MTZ DF herbicide was applied at 14 oz/A or less. Sorghum may be planted after 12 months where Authority MTZ was applied at 20 oz/A or less.
Authority XL	10M	12M	None	10M	10M	4M	
Axial XL	30D	30D	30D	30D	90D		
Axiom DF	None	8 M	None	12 M	12 M		
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.
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.

Chemical	C	Ct	S	GS	T	W	Remarks
Boundary 6.5 EC	8 M	12 M	None	12 M	12 M	4.5 M	If planting is necessary in fields, field may be planted with soybeans or potatoes.
Brake	10 M	0 M	2 M	10 M	18 M	8 M	
Buctril							Do not plant rotational crops within 30 days following treatment.
Butyrac 200							No information on label.
Callisto	None	10M	10M	1 year	Spring	120 D	Small grains may be planted 120 days after application.
Canopy	10 M	10 M	None	10 M	10 M	4 M	Rotational intervals based on a soil pH of 7.0 or less. See label for high pH soils.
Caparol 4L		None					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.
Capreno	None	10M	10M	10M	18M	4M	10M- 15" rain, 18M- 30" rain.
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.
Cheetah Max	10M	0M	0M	18M	18M	4M	
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	10 M	10 M	None	12 M	10 M	4 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	9M	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.
Corvus	None	None	9M	17M	17M	4M	
Cotoran 4L	8 M	None	9 M	9 M	12 M	3 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.
Degree Xtra							Do not rotate to crops other than soybeans, corn, milo (grain sorghum), wheat or tobacco.
Devrinol 2-EC	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 4L	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	120D	120D	120D	120D	120D	120D	Except with 1 in. rainfall or irrigation after last application (4 oz/A) then replant can occur in 30 days.
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.
Enlist One	9M		30D				Do not replant fields treated with this product in the same growing season with crops other than those labeled for 2,4-D use.
Envive	10M	10M	None	10M	10M	4M	
Envoke	7 M	7 M	7 M	7 M	7 M	3 M	

Chemical	C	Ct	S	GS	T	W	Remarks
Fierce	7D	4M	None	18M	18M	4M	30 days for corn if conventional till. **See Label**.
Finesse	18M	18M	18M	4M	18M	None	
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.
First Shot SG	14D	14D	7D	14D	45D	None	
Flexstar	10M	None	None	18M	18M	4M	
Flexstar GT 3.5	10 M	None	None	18 M	18 M	4 M	
FulTime NXT	None					4M	Read label for rotation crop restrictions.
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.
Goal 2XL	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.
Halex GT	None	10M	10M	None	10M	120D	
Harmony Extra SG with TotalSol	14 D	14D	7 D	14 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.
Harmony SG with TotalSol	None	7D	None	None	45D	None	
Harness	None	#	F Y	F Y	F Y	4Ml	Do not rotate to crops other than soybeans, corn, milo(sorghum), wheat, or tobacco.
Harness Xtra	None	#	F Y	F Y	#	F Y	
Huskie	4M		4M	7D		7D	Sunflowers maybe planted after 9 months.
Impact	None	9M	9M	9M	18M	3M	
Instigate	None	10 M	10M	10M	18M	4M	
Keystone NXT	None	12M	12M	12M	12M		Read label on rotational crop restrictions
Laudis	None	10M	8M	10M	12M	4M	Corn may be planted right after application
Leadoff	None	30D	30D	10M	10M	3M	
Liberty 280 SL	None	None	None	180 D	180D	70 D	Do not plant rotational crops in a field treated with Liberty herbicide within 180 days after the last application of this product with the exception of wheat, barley, buckwheat, millet, oats, rye, 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.
Linex	12M	12M	12M	12M	12M	12M	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.
Metribuzin 75DF	4 M		None	12 M	12 M	4 M	If initial seeding fails to produce a stand, crop registered for the rate of metribuzin 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.
MSMA							No information on label.
Outlook	None	Spring	None	None	Spring	4 M	There are no rotational crop restrictions in the spring following the previous years' application of Outlook. If the original application was broadcast, do not make a second application of Outlook.
Permit	1M	4M	9 M	2M	None	2 M	
Poast	30D	30D	30D	30D	30D	30D	Do not plant any other crop to be harvested for 120 days following application unless Poast is registered for use in that crop.

Chemical	C	Ct	S	GS	T	W	Remarks
Prefix	10M	1M	None	18M	18M	4.5M	To avoid injury do not plant any crops within 18 months.
Princep 4L					#		Do not plant any crop except corn until the year following, or injury may occur.
Prowl/Pendimax 3.3/Prowl H2O	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	
Realm Q	None	10M	10M	10M	18M	4M	If Realm Q is applied postemergence following a mesotrione-containing preemergence herbicide, only corn (all types) or grain sorghum may be replanted the year following application, or severe crop injury may occur.
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	None	10 M	18 M	4 M	
Resicore	0	12 M	10.5 M	10.5 M	18 M	4 M	
Resolve Q	None	1M	10M	30D	1.5M	9M	
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 70 DG	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 2EC							Do not graze treated fields or feed forage or hay to livestock.
Sequence	None	None	None	Spring	Spring	4.5 M	
Sharpen	None	3M	1-2M	None	5M	None	This is based on using a 2 oz/A rate of Sharpen. **See Label**.
Solstice	None	10M	10M	4M	10M	4M	
Spartan	10 M	18 M	None	10 M	None	4 M	
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.
Status	None	None	None	None	None	None	
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.
Storm	100 D	100D	None	100D	100D	100D	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	

Chemical	C	Ct	S	GS	T	W	Remarks
SureStart II	None	26M	Spring	12M	18M	4M	
Surveil	9M	9M	None	9M	30M	3M	
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.
Trivence	10M	18M	0M	18M	18M	4M	
Ultra Blazer	100D	100D	100D	100D	100D	100D	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	1M	2M	None	30D	2M	2M	Field Corn 14 D if 2 oz or less used. Cotton 21D if 1.5 -2 oz used.
Valor XLT	10M	10M	None	10M	12M	4M	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.
Verdict	None		1			4	Soybean: 1 month after 5 oz/A rate
Warrant	None	None	None	None		4M	If crop treated with this product is lost, following crops may be replanted immediately, but could result in crop injury.
Zidua	None	12M	None	12M	12M	6M	Rate can affect rotational months. Read label.
Zidua Pro	None	18M	None	18M	18M	4M	
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.
Quelex	3 M	3 M	3 M	3 M	15 M	0 M	

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 90 DF	Atrazine	4 lbs ai/gal 90% ai	100-497 100-585	Syngenta
Accent Q	Nicosulfuron	54.5% ai	352-773	DuPont
Achieve Liquid	Tralkoxydim	3.33 lbs ai/gal	100-1130	Syngenta
Acuron	Atrazine+bicyclopyrone+mesotrione+s-metolachlor	1.0+0.06+0.24+2.14 lb ai	100-1466	Syngenta
Aim EC	Carfentrazone	2 lb ai/gal	279-3241	FMC
Anthem	pytoxasulfone+fluthiacet-methyl	2.15 lb ai/gal	279-3450	FMC
Anthem ATZ	Atrazine +pyroxasulfone+Fluthiacet-methyl	4.006 lb + 0.485 lb + 0.014 lb ai	279-3449	FMC
Anthem Flex	Pyroxasulfone + Carfentrazone	3.733 lb ai + 0.267 lb ai	279-3464	FMC
Anthem Maxx	Pyroxasulfone + Fulthiacet-methyl	4.174 lb ai + 0.126 lb ai	279-3468	FMC
Arrow EC	Clethodim	2 lbs ai/gal	66222-60	Makhteshim-Agan
Assure II EC	Quizalofop-P	0.88 lbs ai/gal	352-541	DuPont
Atrazine FL	Atrazine	4 lbs ai/gal	Various	Various
Authority Elite	Sulfentrazone + s-metolachlor	7.0 lb ai/gal	279-3442	FMC
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
Authority XL	Sulfentrazone + Chlorimuron	62.22% + 7.78%	279-3413	FMC
Axial XL	Pinoxaden	0.42 lb ai/gal	100-1256	Syngenta
Axiom DF	Flufenacet+Metribuzin	54.4+13.6% ai	3125-488	Bayer
Balan DF	Benefin	60% ai	34704-746	UAP
Balance Flexx	Isoxaflutole	2.0 lb ai/gal	264-1067	Bayer
Banvel SL	Dicamba	4 lbs ai/gal	66330-276	Arysta
Basagran SL	Bentazon	4 lbs ai/gal	7969-45-66330	Arysta
Beacon DG	Primisulfuron	75% ai	100-705	Syngenta
Bicep II Magnum	S-Metolachlor+Atrazine+Benoxacor	2.4+3.1 lbs ai/gal	100-817	Syngenta
Blazer SL	Acifluorfen	2 lbs ai/gal	23315	United Phosphorus
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	Fluthiacet	0.91 lb ai/gal	279-3338	FMC
Callisto	Mesotrione	4 lbs ai/gal	100-1131	Syngenta
Canopy	Metribuzin + Chlorimuron	75% ai	352-444	DuPont
Canopy Ex	Tribenuron+Chlorimuron	6.8+22.7% ai	352-635	DuPont
Caparol 4L	Prometryn	4 lbs ai/gal	100-620	Syngenta
Capreno	Thiencarbazone +Tembotrione	0.57 lb + 2.88 lb ai	264-1063	Bayer

Trade Name with Formulation	Common Name	Formulation	EPA Registration Number	Manufacturer
Celebrity Plus	Dicamba+Diflufenzopyr+Nicosulfuron	42.4+17.0+10.6% ai	7969-175	BASF
Cheetah Max	Fomesafen + glufosinate	1.0 lb + 2.0 lb ai	71368-111	Nufarm
Cimarron Plus	Metsulfuron + Chlorsulfuron	48 + 15% ai	352-670	DuPont
Cimarron Extra	Metsulfuron + Chlorsulfuron	30.0 + 37.5% ai	352-669	DuPont
Clarity SL	Dicamba	4 lbs ae/gal	7969-137	BASF
Classic DG	Chlorimuron	25% ai	352-436	DuPont
Cobra EC	Lactofen	2 lbs ai/gal	59639-34	Valent
Command 3ME	Clomazone	3 lbs ai/gal	279-3158	FMC
Corvus	Thiencarbazone + Isoxaflutule	0.75 lb + 1.88 lbs ai	264-1066	Bayer
Cotoran 4L Cotoran 80DF	Fluometuron	4 lbs ai/gal 80% ai	1812-439 1812-323	DuPont
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 Devirnol 50DF	Napropamide	2 lbs ai/gal 50% ai	100-1024-70506 100-1035-70506	United Phosphorus
Diquat SL, Reward	Diquat	2 lbs cation/gal	10182-353	Syngenta
Direx 4L Direx 80DF	Diuron	4 lbs ai/gal 80% ai	1812-257 1812-362	
Distinct	Diflufenzopyr+Dicamba	20+50 % ai	7969-150	BASF
Domain DF	Flufenacet+Metribuzin	24+36 % ai	3125-527	Bayer
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 AgroSciences
Engenia	Dicamba	5 lbs ae/gal	7969-345	BASF
Enlist DUO	Glyphosate + 2,4-D	1.7 + 1.6 lbs ae/gal	62719-649	DOW
Enlist One	2,4-D	3.8 lb ai/gal	62719-695	DOW
Elevore	Halauxifen-methyl	0.572 lbs ae/gal	62719-718	Dow
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 EC	EPTC	7 lbs ai/gal	10163-283	Gowan
Escort XP	Metsulfuron	60% ai	352-439	DuPont
ET	Pyraflufen ethyl	0.208/gal	71711-7	Nichino America Inc.
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	DuPont
Extreme SL	Imazethapyr+Glyphosate	0.17 lbs ae/gal+2 lbs ai/gal	241-405	BASF
FeXapan	Dicamba	2.9 lbs ae/gal	352-913	DuPont
Fierce	Flumioxazin + Pyroxasulfone	33.5% + 42.5%	63588-93-59639	Valent
Finale SL	Glufosinate	1 lb ai/gal	432-1229	Bayer

Trade Name with Formulation	Common Name	Formulation	EPA Registration Number	Manufacturer
Finesse DF	Chlorsulfuron+Metsulfuron	62.5+12.5% ai	352-827	DuPont
FirstRate DF	Cloransulam	84% ai	62719-275	Dow AgroSciences
First Shot SG	Thifensulfuron + Tribenuron	25% + 25% ai	352-755	DuPont
Flexstar GT 3.5	Fomesafen + Glyphosate	0.56 lb + 2.26 lb ai/gal	100-1385	Syngenta
Flexstar SL	Fomesafen+Adjuvants	1.88 lbs ai/gal	10182-418	Syngenta
ForeFront	Aminopyralid + 2,4-D	6.58 +51.06% ai	62719-524	Dow AgroSciences
FulTime NXT	Acetochlor+atrazine	2.7 + 1.34 lbs ai	62719-668	Dow AgroSciences
Fusilade DX EC	Fluazifop-P	2 lbs ai/gal	100-1070	Syngenta
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	DuPont
Glyfos	Glyphosate	4 lbs ai/gal	4787-31	Cheminova
Glyfos X-TRA	Glyphosate	4 lbs ai/gal	4787-23	Cheminova
Glyphomax Plus	Glyphosate	4 lbs ai/gal	62719-322	Dow AgroSciences
Goal 2XL EC	Oxyfluorfen	2.0 lbs ai/gal	62719-424	Dow AgroSciences
Gramoxone SL	Paraquat	3.0 lbs ai/gal	100-1217	Syngenta
Grazon P+D SL	Picloram+2,4-D	0.54+2 lbs ai/gal	62719-182	Dow AgroSciences
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 lbs ai/gal	100-1282	Syngenta
Harmony Extra SG with TotalSol	Tribenuron+Thifensulfuron	16.67+33.33% ai	352-714	DuPont
Harmony SG with TotalSol	Thifensulfuron-methyl	50% ai	352-633	DuPont
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
Huskie	Pyrasulfotole + bromoxynil	0.31 lb + 1.75 lb ai	264-1023	Bayer
Impact	Topramezone	2.8 lb ai/gal	5481-524	Amvac
Instigate	Rimsulfuron + Mesotrione	4.17% + 41.67%	352-873	DuPont
Intimidator	S-metolachlor+metribuzin-fomesafen	3.39 + 0.75 +0.67 lb ai	34704-1065	Loveland
Karmex DF	Diuron	80% ai	1812-362	DuPont
Kerb 50-W WP	Pronamide	51% ai	62719-397	Dow AgroSciences
Keystone NXT	Acetochlor + atrazine	3.1 lb + 2.5 lbs	62719-671	Dow AgroSciences
Laudis	Tembotrione	3.5 lb ai/gal	264-860	Bayer
Leadoff	Rimsulfuron + Thifensulfuron	16.7% + 16.7%	353-853	DuPont
Lexar EZ	S-metolachlor+mesotrione+ atrazine	1.74 + 0.224 + 1.74 lbs ai/gal	100-1201	Syngenta
Liberty 280 SL	Glufosinate	2.34 lbs ai/gal	264-829	Bayer
Lightning	Imazethapyr+Imazapyr	52.5+17.5% ai	241-377	BASF
Linex DF Linex 4L	Linuron	50% ai 4 lbs ai/gal	1812-320 1812-245	DuPont
Lorox DF	Linuron	50% ai	1812-320	DuPont
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	Aminopyralid	40.6% ai	62719-519	Dow AgroSciences

Trade Name with Formulation	Common Name	Formulation	EPA Registration Number	Manufacturer
Metribuzin 75DF	Metribuzin	75% ai	66222-106	Makhteshim Agan
MSMA SC	MSMA	Various	Various	Various
Optill	Saflufanacil + imazethepr	0.178 lbs + 0.502 ai	7969-280	BASF
Osprey	Mesosulfuron	4.5% ai	264-802	Bayer
Outlook	Dimethenamid-P	6 lbs ai/gal	7969-156	BASF
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
PowerFlex HL	Pyroxsulam	13.13% ai	62719-643	Dow AgroSciences
Prefix	S-metolachlor + Fomesafen	46.5 + 10.2% ai	100-1268	Syngenta
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
Quelex	Halauxifen-methyl	0.572 lbs ae/gal	62719-661	Dow
Rage D-Tech	Carfentrazone + 2,4-D	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
Realm Q	Rimsulfuron + Mesotrione	7.5% + 31.25%	352-837	DuPont
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	DuPont
Resolve Q	Rimsulfuron + Thifensulfuron	18.4 + 4.0% ai	352-777	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 Power Max	Glyphosate	5.5 lb ai/gal	524-549	Monsanto
Roundup Weather Max	Glyphosate+surfactants	5.5 lbs ai/gal	524-537	Monsanto
Scepter DG	Imazaquin	70% ae	241-30	BASF
Select 2EC	Clethodim	2 lbs ai/gal	59639-3	Valent
Select Max EC	Clethodim	0.97 lbs. ai/gal	59639-132	Valent
Sequence EW	Glyphosate + S-metolachlor	2.25 + 3.0 lbs ai/gal	100-1185	Syngenta
Sharpen	Saflufenacil	2.85 lbs ai	7969-278	BASF
Sonic	Sulfentrazone + Cloransulam-methyl	0.7 lbs ai/gal	279-3246-62719	Dow AgroSciences
Spartan 4F	Sulfentrazone	4 lbs ai/gal	279-3220	FMC
Staple LX	Pyrithiobac sodium	3.2 lbs ai/gal	352-613	DuPont

Trade Name with Formulation	Common Name	Formulation	EPA Registration Number	Manufacturer
Status	Sodium salt of diflufenzopyr + Sodium salt of dicamba	17.1 + 44.0% ai	7969-242	BASF
Steadfast Q	Nicosulfuron+Rimsulfuron	25.2+12..5% ai	352-774	DuPont
Stinger EC	Clopyralid	3 lbs ae/gal	62719-73	Dow AgroSciences
Storm	Bentazon + Acifluorfen	2.67 lb ai + 1.33 lb ai/gal	70506-59	United Phosphorus
Suprend 80 WG	Prometryn+trifloxysulfuron-sodium	79.3 + 0.7 % ai	100-1163	Syngenta
SureStart II	Acetochlor+flumetsulam+clopyralid	3.75+0.12_0.38 lb ai	62719-679	Dow AgroSciences
Surveil	Cloransulam-methyl + flumioxazin	48% ai	62719-689	Dow AgroSciences
Synchrony XP	Chlorimuron+Thifensulfuron	21.5+6.9%	352-648	DuPont
Tavium	Dicamba + S-metolachlor	1.12 + 2.26 lb ae/gal		
Trifluralin 4 EC	Trifluralin	4 lbs ai/gal	5905-519	Helena
Trivence	Chlorimuron ethyl + flumioxazin+ metribuzin	61.3% ai	352-887	DuPont
Ultra Blazer	Acifluorfen	2 lbs ai/gal	70506-60	United Phosphorus
Valor	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
Verdict	Saflufenacil + Dimethenamid-P	5.57 lb ai/gal	7969-279	BASF
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
Warrant	Acetochlor	3.0 lb ai/gal	524-591	Monsanto
XtendiMax	Dicamba	2.9 lbs ae/gal	524-617	Monsanto
Zidua SC	Pyroxasulfone	4.17 lb ai/gal	7969-374	BASF
Zidua Pro	Pyroxasulfone+Saflufenacil+Imazthaypr	2.28+1.33+0.48 lb ai/gal	7969-365	BASF
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

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