

Guidelines For Managing Winter Vegetation

Introduction

Conservation tillage systems, whether no-till or stale seedbed, require herbicide programs that successfully control native winter vegetation or planted cover crops prior to planting. Elimination of competing vegetation helps to ensure crop stand establishment, rapid early season crop growth and efficient fertilizer utilization. Winter vegetation common to Louisiana ranges from easy-to-control weeds, such as annual bluegrass and common chickweed, to difficult-to-control species, such as curly dock and ryegrass. Cover crops may include wheat, rye, vetch, winter peas and tillage radish among others. Consequently, proper weed identification and herbicide selection are keys to a successful preplant burndown weed control program.

More than 20 winter weeds are commonly found in fields throughout Louisiana. However, only a few key species necessitate selection of the most effective herbicide program. Glyphosate and paraquat continue to be the “backbone” of most burndown herbicide programs. Each product exhibits specific strengths and weaknesses. Tank-mixtures with other herbicides broaden the spectrum of control and/or provide residual control until planting. Glyphosate provides slow systemic control of weeds, while paraquat results in fast contact control requiring thorough weed coverage for maximum effectiveness. Addition of ammonium sulfate to glyphosate spray solution can be beneficial when hard water (water containing mineral salts, including iron, calcium and magnesium) is used as the carrier. These conditions are more often observed in private wells and not municipal water sources.

Glyphosate provides good-to-excellent control of annual bluegrass, Carolina foxtail, little barley, buttercup species, chickweed species, dandelion, horseweed (mare’s-tail), shepherd’s-purse, bittercress and Virginia pepperweed. Control of geranium species, curly dock, henbit, cutleaf evening-primrose, smartweed species and legume cover crops has been poor to fair. Tank-mixture with other herbicides can improve control of these weeds as presented in Table 1.

Paraquat provides good to excellent control of annual bluegrass, little barley, buttercup species, geranium species, chickweed species, henbit and shepherd’s-purse. Control of ryegrass, curly dock, cutleaf evening-primrose, horseweed (mare’s-tail), smartweed species, swinecress, legume cover crops and Virginia pepperweed has been poor. Tank-mix partners increase activity of paraquat on these species (Table 1).

Liberty 280 SL is effective on numerous winter weeds found in Louisiana (Table 1). Activity of the herbicide is greater under higher temperatures. Although it is an excellent burndown herbicide, producers are limited in the amount of Liberty 280 SL that can be used per season including burndown timing. In some cases, producers are well advised to save their Liberty 280 SL for managing weeds within the growing crop.

Timing of Vegetation Removal

Timing of vegetation removal is another critical factor for successfully implementing reduced tillage programs. Conservation tillage practices provide an environment favorable to insect pest populations, primarily cutworms. Cutworm larvae feed on existing winter vegetation until it is removed or decomposed to a point no longer adequate as a food source. If present at planting, cutworm larvae may threaten stands of emerging crops. Research has shown that destroying winter vegetation at least three to four weeks prior to cotton planting is critical. Cutworms are able to feed on decaying vegetation. Therefore, a herbicide application six to eight weeks prior to planting is preferable. Labeled pyrethroid insecticides can be used in combination with a burndown herbicide or at-planting[1] when the potential for cutworm infestation is high. If any living vegetation remains on the seedbed at planting, insecticide should be used for cutworm management. Recent research has shown that even when insects are managed, weeds like cutleaf evening-primrose and swinecress will reduce crop yield when not removed well in advance of planting. In a five-year study, corn yield was 15 to 25 percent higher when weeds were removed four weeks before planting compared to two weeks.

Use of Fall- Or Spring-Applied Residual Herbicides for Managing Troublesome Weeds

Increased problems in managing weeds like henbit and Italian ryegrass in the spring have led to increased interest in fall herbicide programs. Research has shown that an application of a residual herbicide in the fall can assist spring herbicide applications for preplant burndown in overall management of numerous troublesome weeds. Applications in Louisiana are optimum beginning mid- to late October through November when temperatures have cooled and chance of rainfall for activation is greater. Numerous herbicides provide good control of grass and broadleaf winter annual weeds (Table 2).

In some cases, the soil must be tilled, moved or in some way disturbed prior to planting. Be certain to check the product labels for specific recommendations. Although these treatments will result in a relatively weed-free seedbed at planting, the soil will be exposed to weathering. Therefore, these treatments should not be used alone on highly erodible or sloping soil. LSU AgCenter research has shown that certain residual herbicides can be used in combination with cover crops applied after emergence giving both weed control and agronomic and soil stability benefits. **Be certain to consult with your local Farm Service Agency (FSA) or National Resource Conservation Service (NRCS) office to determine if you can use these treatments without conflicting with your conservation plan.**

Following the spring burndown herbicide application, weeds may regrow or new weeds may germinate when the treatment is applied six to eight weeks prior to planting. In these situations, use of residual herbicides such as Goal 2XL, Valor, Canopy EX, Envive, Enlite, Leadoff, and Valor XLT with glyphosate, paraquat, or glufosinate can be beneficial in increasing control of existing weeds or provide soil residual control. However, they

perform best as residual herbicides used earlier in the season (January and early February) or closer to planting. The use of residual herbicides earlier in the season will improve the control of troublesome winter weeds and help protect crops from yield losses associated with late burndown timings. Sequential applications of glyphosate or paraquat are also very effective and may eliminate the need for tank-mixes. Glyphosate applied alone or in tank mixture six weeks prior to planting followed by paraquat, glufosinate, or glyphosate plus Reviton at planting is an excellent weed control program.

Plant-back restrictions can influence which residual herbicide that is selected. Table 4 provides a list of the plant-back restrictions for commonly used fall- and spring-applied herbicides for major crops in Louisiana. Always refer to labels prior to application for revisions.

Glyphosate-Resistant Horseweed (Mare's-Tail) and Italian Ryegrass

Glyphosate-resistant horseweed (mare's-tail) is present in Louisiana. In Louisiana, few acres receive a burndown application composed strictly of glyphosate because of weeds that are difficult to control with glyphosate alone. Thorough scouting and tank-mixes with herbicides will control glyphosate-resistant horseweed (mare's-tail). It is recommended that 8 to 12 oz/A labeled dicamba formulations be tank-mixed with glyphosate when horseweed (mare's-tail) is present, whether glyphosate-resistance is suspected or not. Herbicides such as Sharpen, Leadoff, Canopy EX, Envive, or 2,4-D can exhibit good activity on emerged horseweed (mare's-tail) but not to the level of dicamba. Fall application of Leadoff, Canopy EX, Envive, Envoke, Valor XLT, Fierce, or Valor prior to horseweed (mare's-tail) emergence provides excellent residual control. Please consult individual product labels for rates, precautions and plant-back restrictions.

Research indicates that glyphosate and paraquat-resistant Italian ryegrass are present in Louisiana. Producers are encouraged to closely monitor Italian ryegrass populations. Mississippi State University weed scientists have developed a glyphosate-resistant Italian ryegrass management plan that has been adopted by LSU AgCenter weed scientists. Management of glyphosate-resistant Italian ryegrass depends upon the crop to be planted in the spring and can be divided into a fall, winter or spring management timing, but research has shown greater Italian ryegrass control when control measures are initiated in the fall followed by a winter or spring herbicide application. Fields should be double-disked (all crops) or treated with Command at 16 to 28 oz/A, Boundary at 2.0 pt/A, metribuzin at 3 to 5 oz/A, Dual Magnum or equivalent at 1.33 to 1.67 pt/A, Zidua at 3.25 to 5 oz/A, Anthem Flex at 3.64 to 5.46 oz/A, Anthem Max at 3.25 to 4.87 oz/A, or trifluralin at 3 pt/A in mid-October thru November. Please consult individual product labels for rates, precautions, and plant-back restrictions. Emerged glyphosate-resistant Italian ryegrass will not be controlled by these products; therefore, these products should be tank-mixed with paraquat at 0.5 to 0.75 lb a.i./A. Preliminary research has shown that Reviton at 2 oz can provide fair control of small (1-2 inches) ryegrass but not to the level of paraquat. Research has also shown that combinations of Dual Magnum or Zidua applied two weeks after emergence of a cereal rye cover crop to be very effective in managing Italian

ryegrass. Regardless of which fall control measure is utilized, fields should be scouted in January/February, and if glyphosate-resistant Italian ryegrass has emerged, Select Max at 12 to 16 oz/A (or equivalent rate of 1, 2 or 3 lb clethodim formulation) should be applied. Preplant applications of Select Max or any other clethodim formulation should be made at least 30 days before planting corn or rice. Multiple applications of Select Max or any other clethodim formulation are discouraged to prevent development of resistance to this herbicide. If no control measures are initiated in the fall or winter, or if glyphosate-resistant Italian ryegrass was not observed earlier, paraquat at 0.75 to 1.0 lb a.i./A should be applied when resistance is identified. Research has shown that the addition of atrazine (corn) at 1 qt/A, metribuzin (soybean) at 4 oz/A, or diuron (cotton) at 1.5 pt/A will increase efficacy of paraquat against glyphosate-resistant Italian ryegrass. Sequential applications should be based on careful scouting for emerged glyphosate-resistant Italian ryegrass.

Summary

Burndown herbicide decisions should be based on activity of glyphosate or paraquat on the most difficult to control weed species present. Appropriate tank mixtures should be considered based on their ability to enhance control with glyphosate or paraquat and/or to provide residual activity.

Guidelines for Choosing a Burndown Program

1. Vegetation should be destroyed at least three to four weeks prior to planting, preferably six to eight weeks.
2. Choice of herbicide program depends on the most difficult-to-control weed species present.
3. Use glyphosate if annual ryegrass, horseweed (mare's-tail), swinecress, speedwell, groundsel, Virginia pepperweed or wheat is the target vegetation. Use paraquat if a geranium species or henbit is the primary weed present.
4. If glyphosate-resistant Italian ryegrass or horseweed (mare's-tail) is suspected or confirmed, utilize alternative/complimentary residual or postemergence herbicides based upon research.
5. Carolina geranium, curly dock, cutleaf evening-primrose, clover species, henbit, smartweed, swinecress and legume cover crop control can be increased when glyphosate is tank-mixed with other herbicides.
6. Carolina foxtail, curly dock, cutleaf evening-primrose, clover species, dandelion, groundsel, henbit, horseweed (mare's-tail), smartweed, speedwell, swinecress, Virginia pepperweed and legume cover crop control can be increased when paraquat is tank-mixed with other herbicides.
7. Consider using an insecticide program that controls cutworms if any live vegetation is present at planting.

Table 1. Effectiveness of selected spring-applied herbicides and combinations for controlling winter vegetation.

Table Legend

Rating	Score
None to Slight	0-3
Fair	4-6
Good	7-8
Excellent	9-10

	Paraquat	Paraquat + Goal 2XL	Paraquat + Harmony Extra	Paraquat + Firstshot	Paraquat + Clarity	Paraquat + 2,4-D	Glyphosate	Glyphosate + Goal	Glyphosate + Harmony Extra	Glyphosate + FirstShot	Glyphosate + Clarity	Glyphosate + 2,4-D	Clarity	2,4-D	Glyphosate + Valor	Glufosinate
Annual bluegrass (2-6")	9	9	9	9	9	9	9	9	9	9	9	9	0	0	9	9
Ryegrass (6-10")	4	5	5	5	4	4	7	7	7	7	7	7	0	0	7	6
Carolina foxtail (2-6")	8	9	8	8	8	8	9	9	9	9	8	9	0	0	9	9
Little barley (2-6")	9	9	9	9	9	9	9	9	9	9	9	9	0	0	9	9
Buttercups (2-6")	9	9	9	9	9	9	9	9	9	9	9	9	-	9	9	9
Geranium spp. (2-6")	9	9	9	9	9	9	5	6	8	8	7	8	5	6	6	9
Chickweeds (2-4")	9	9	9	9	9	9	9	9	9	9	9	9	3	3	9	9
Curly dock (6-8")	4	5	7	7	7	7	6	7	9	9	8	9	8	7	8	8
Cutleaf eveningprimrose (6-8")	4	7	8	8	8	9	4	6	7	7	8	9	8	9	6	8
Cutleaf eveningprimrose (2-5")	4	7	8	8	8	9	5	8	7	7	8	9	8	9	8	9
Clovers/medics (2-6")	6	8	9	9	8	8	5	7	8	8	9	9	9	9	-	9
Dandelion (4-6")	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Groundsel (2-4")	7	9	9	9	9	9	9	9	9	9	9	9	-	9	9	9
Henbit (6-8")	8	9	9	9	8	8	6	9	9	9	8	7	6	5	9	9
Horseweed (mare's-tail) (4-10")	5	7	7	7	6	6	9	9	9	9	9	9	9	6	9	9
Smartweed spp. (2-6")	4	7	9	9	8	6	7	8	9	9	9	8	8	6	9	-
Purslane speedwell (2-4")	7	8	9	9	8	8	9	9	9	9	9	9	-	5	9	-
Shepherd's purse (6-10")	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8
Smallflower bittercress (6-10")	9	9	9	9	9	9	9	9	9	9	9	9	7	7	9	-
Swinecress (2-4")	2	3	7	7	6	6	7	8	9	9	8	8	7	6	8	9
Legume cover crops (6-8")	6	8	9	9	9	9	5	7	8	8	9	9	9	9	7	9
Virginia pepperweed (4-6")	2	7	7	7	9	9	9	9	9	9	9	9	-	3	9	-
Wheat (8-12")	7	8	7	7	6	6	9	9	9	9	8	9	0	0	9	7

Table 2. Effectiveness of selected fall-applied herbicide combinations for control of winter annual weeds 90 days after application.¹

Herbicide	Annual bluegrass	Buttercup species	Chickweed species	Cutleaf eveningprimrose	Henbit	Swinecress	Shepherd's purse
Canopy EX ²	7	9	9	7	8	8	8
Dual Magnum	8	7	7	5	7	7	7
Enlite ²	7	9	9	7	7	8	8
Envive ²	7	9	9	7	8	8	8
Fierce	8	9	9	7	9	8	8
Goal/Galigan ³	7	9	9	8	9	9	9
LeadOff	8	9	9	7	9	8	8
Valor	6	9	9	7	8	8	8
Valor XLT ²	8	9	9	7	9	8	8

¹ Glyphosate at 1 lb/A or paraquat (Gramoxone SL at 1 qt/A) was tank-mixed with each residual herbicide.

² For use only when soybeans will be planted the following spring.

³ Goal/Galigan must be tilled, moved or in some way disturbed prior to planting.

Table 3. Effectiveness of burndown herbicides used in corn four weeks after application.¹

Table Legend

Rating	Score
None to Slight	0-3
Fair	4-6
Good	7-8
Excellent	9-10

	Annual bluegrass	Italian ryegrass	Carolina foxtail	Little barley	Carolina geranium	Chickweed	Curly dock	Cutleaf eveningprimrose ²	Henbit	Horseweed	Speedwell	Shepherd's purse	Bittercress	Swinecress	Smartweed
2,4-D ³	0	0	0	0	5	3	6	9	5	5	6	8	6	5	5
glyphosate	9	6	8	9	6	9	5	5	6	8	9	9	8	7	6
glyphosate + Banvel/Clarity	9	6	8	9	8	9	8	8	8	8	9	9	9	8	7
glyphosate + Goal	9	6	8	9	7	9	6	6	8	8	9	9	9	7	7
glyphosate + Valor	9	6	8	9	5	9	5	8 ²	9	8	9	9	8	8	8
glyphosate + FirstShot	9	6	8	9	7	9	8	6	8	8	9	9	9	8	9
glyphosate + 2,4-D	9	6	8	9	8	9	7	9	7	8	9	9	9	7	7
glyphosate + Sharpen	9	6	8	9	8	9	7	8	8	9	9	9	9	9	-
glyphosate +2,4-D + Clarity	9	6	8	9	8	9	9	9	8	9	9	9	8	9	9
glyphosate + 2,4-D +Valor	9	6	8	9	8	9	8	9	9	8	9	9	9	8	9
glyphosate +2,4-D + LeadOff	9	8	8	9	8	9	8	9	9	8	9	9	9	9	8
paraquat ³	8	4	7	8	8	9	4	5	5	5	6	8	8	2	4
paraquat + Goal/Galigan	9	5	8	9	9	9	5	6	8	6	7	9	9	3	5
paraquat + FirstShot	8	5	7	9	9	9	5	7	8	6	8	9	9	6	9
paraquat + 2,4-D	8	4	7	8	8	9	6	9	7	5	7	8	9	5	5

¹ Consult the label(s) prior to use and determine:

(1) proper burndown application timing and herbicide rate; (2) if surfactant or crop oil concentrate is needed in the burndown treatment; and (3) the required time period between burndown application and crop planting.

² Small cutleaf eveningprimrose only (4- to 5-inch rosette or less).

³ Numerous formulations of 2,4-D and paraquat are available.

Table 4. Plant-back restrictions for commonly used fall and spring applied burndown herbicides.¹

Herbicide	Corn	Cotton	Grain Sorghum	Rice	Soybean
2,4-D	See label	See label	See label	See label	See label
Aim	none	none	none	none	none
Boundary	4m	12m	12m	8m	none
Canopy EX	See label	See label	See label	See label	none
dicamba	See label	See label	See label	See label	See label
Diuron	See label	See label	See label	See label	See label
Dual Magnum	none	none	none	12m	none
Enlite	9m	9m	9m	9m	none
Envive	see label	see label	12m	see label	none
Fierce	7d-1m	45d-2m	11-12m	10-12m	none
FirstShot	14d	14d	14d	0d	3/7d
Goal/Galigan	10m	7d	10m	10m	7d
Harmony GT XP	none	45d	45d	45d	none
LeadOff	none	30d (see label)	10m	10m	30d (see label)
glufosinate	none	none	180d	none	none
Valor	See label	See label	See label	See label	none
Valor XLT	10m (soil pH < 7.0); 18m (soil pH > 7.0)	10m (soil pH < 7.0); 30m (soil pH > 7.0)	10m (soil pH < 7.0); 18m (soil pH > 7.0)	9m (soil pH < 7.0); 18m (soil pH > 7.0)	none
Zidua	none	1-4m	6-12m	10-24m	0-4m

¹ Always consult label for specific requirements/precautions and differing restrictions based on rate, soil type, rainfall/irrigation and/or pH.

Table 5. General fall and spring applied programs.

Active Ingredient and Rate	Formulated Product and Rate	Weeds Controlled	Remarks and Precautions
paraquat @ 0.47-0.94 lb/A	paraquat 2 or 3 lb/gal formulations @ 1.9-3.8 pt/A or 1.25-2.5 pt/A; Add 0.25% v/v NIS	Most small annual grasses and broadleaf weeds including glyphosate-resistant ryegrass. Fair to poor activity on horseweed (mare's-tail), dock, cutleaf eveningprimrose, smartweed, swinecress, and Virginia pepperweed.	Results in rapid plant desiccation. Provides no soil residual weed control. Use higher rates (2-2.5 pt/A) for ryegrass control. Labeled tank mixtures with other herbicides increases control of broadleaf weeds mentioned.
thifensulfuron methyl + titribenuron methyl @ 0.016-0.25 lb/A	FirstShot @ 0.5-0.8 oz/A; Add 0.25% v/v NIS	Smartweed, knotweed, dock, cutleaf eveningprimrose, henbit, wild garlic/ onion and other small seeded winter broadleaf weeds.	Apply with glyphosate, or paraquat for improved control of annual grasses and select broadleaf weeds, especially at lower labeled use rates.
glyphosate2 @ 1.0 lb/A	glyphosate (4 or 5 lb/gal formulations) @ 1.0qt/A or 22 oz/A	Good activity on most emerged annual grass and broadleaf weeds. Fair activity on dock, cutleaf eveningprimrose, smartweed, swinecress, buttercup, geranium and henbit.	Provides no soil residual activity. Labeled tank mixtures with other herbicides increases control of broadleaf weeds mentioned.
glufosinate @ 0.53-0.79 lb/A	glufosinate 2.34 formulations (Liberty 280 SL, Cheetah etc.) @ 29-43 oz/A	Annual grass and broadleaf weeds. Good alternative for control of glyphosate-resistant horseweed (mare's-tail).	Provides no soil residual activity. Optimum results have been obtained when applied under warm, high humidity conditions with bright sunlight between sunrise and two hours before sunset. Do not use air induction spray tips due to potential coverage issues. Apply in a minimum of 15 GPA. Consult label for allowed tank mixtures with other herbicides listed above and below.
pyroxasulfone + flumioxazin @ 0.143-0.214 lb/A	Fierce @ 3-4.5 oz/A	Annual grass and broadleaf weeds. Good residual control of glyphosate-resistant ryegrass and horseweed (mare's-tail) with fall application.	Labeled primarily for residual fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
S-metolachlor + metribuzin @ 1.63 lb/A	Boundary @ 2 pt/A	Annual grass and broadleaf weeds. Good residual control of glyphosate-resistant ryegrass and horseweed (mare's-tail) with fall application.	Labeled primarily for residual fall and spring burndown application. Fall application is labeled from Sept. 1-Nov. 30. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
pyroxasulfone @ 0.106-0.159 lb/A	Zidua WG @ 2-3 oz/A; Zidua SC @ 3.25-5 oz/A	Annual grass and broadleaf weeds. Good residual control of glyphosate-resistant ryegrass with fall application.	Labeled for residual fall and spring burndown application. Fall application is labeled from Sept. 1-Dec. 1. Apply with glyphosate or paraquat for control of emerged grasses and broadleaves.

Active Ingredient and Rate	Formulated Product and Rate	Weeds Controlled	Remarks and Precautions
pyroxasulfone @ 0.106-0.159 lb/A + carfentrazone @ 0.008-0.011 lb/A	Anthem Flex @ 3.64-5.46 oz/A	Glyphosate-resistant Italian ryegrass and small seeded annual winter weeds.	Apply to prepared seedbeds between Sept. 1 and Dec. 1. Optimum control is generally observed when applied from late October to mid-November. Mix with paraquat to control emerged ryegrass. Incorporation to a depth of 2-3 inches will be beneficial if activating rainfall is not received soon after application. Refer to label for maximum combined fall and spring amounts.
pyroxasulfone @ 0.106-0.159 lb/A + fluthiacet-methyl @ 0.0032-0.0048 lb/A	Anthem Max @ 3.25-4.87 oz/A	Glyphosate-resistant Italian ryegrass and small seeded annual winter weeds.	Apply to prepared seedbeds between Sept. 1 and Dec. 1. Optimum control is generally observed when applied from late October to mid-November. Mix with paraquat to control emerged ryegrass. Incorporation to a depth of 2-3 inches will be beneficial if activating rainfall is not received soon after application. Refer to label for maximum combined fall and spring amounts.
clomazone @ 0.0375-0.66 lb/A	Command 3 ME @ 16-28 oz/A	Glyphosate-resistant Italian ryegrass and small seeded annual winter weeds.	Apply to prepared seedbeds between Oct. 1 and Nov. 30. Mix with paraquat to control emerged ryegrass. Incorporation to a depth of 2-3 inches will be beneficial if activating rainfall is not received soon after application. Refer to label for maximum combined fall and spring amounts and rate range according to soil type.
carfentrazone @ 0.016-0.031 lb/A	Aim @ 1.0-1.6 oz/A; Add 0.25% v/v NIS	Morningglory, hemp sesbania, pigweed and other broadleaves. May be used to control cotton plants in replant situations.	Apply prior to cotton emergence. Provides no residual soil activity or control of emerged grasses. Apply with glyphosate or paraquat for control of emerged grasses and improved control of broadleaves. Consult label for adjuvant requirements.
2,4 D @ 0.5-1.0 lb/A	2,4-D (4L formulations) @ 1-2 pt/A	Good activity on buttercup, cutleaf eveningprimrose, wild onion, dock and glyphosate-resistant horseweed (mare's-tail). Fair activity on geranium and hennbit but poor on chickweed.	Provides minimal residual soil activity or control of emerged grasses. Apply with glyphosate or paraquat for control of emerged grasses and improved control of broadleaves.
dicamba @ 0.25-0.5 lb/A	Clarity @ 8-16 oz/A; Engenia @ 6.4-12.8 oz/A; Xtendimax @ 11-22 oz/A	Good activity on glyphosate-resistant horseweed (mare's-tail), chickweed and dock. Fair activity on geranium and buttercup.	Provides minimal residual soil activity or control of emerged grasses. Apply with glyphosate or paraquat for control of emerged grasses and improved control of broadleaves.
halauxifen-methyl @ 0.004 lb/A	Elevore @ 1 oz/A	Excellent control of hennbit and good control of glyphosate-resistant horseweed (mare's-tail). Fair control of cutleaf eveningprimrose.	Provides minimal residual soil activity or control of emerged grasses. Apply with glyphosate or paraquat for control of emerged grasses and improved control of broadleaves.

Active Ingredient and Rate	Formulated Product and Rate	Weeds Controlled	Remarks and Precautions
flumioxazin @ 0.032-0.064 lb/A	Valor SX @ 1-2 oz/A	Good residual activity on glyphosate-resistant horseweed (mare's-tail) in fall and annual broadleaf weeds in fall and spring. Very good residual control of smartweed.	Labeled primarily at higher rate for residual fall and spring burndown application. Lower rate aids in speed of activity in glyphosate tank-mixes. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
oxyfluorfen @ 0.25-0.5 lb/A	Goal 2XL/Galigan 1-2 pt/A	Good residual activity on annual grass and broadleaf weeds including henbit, geranium, and smartweed.	Provides good residual control plus activity on select emerged weeds. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
chlorimuron + metribuzin @ 0.281 lb/A	Canopy @ 6 oz/A	Most small-seeded annual broadleaf weeds and wild garlic/onion. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
chlorimuron + tribenuron @ 0.37 lb/A	Canopy EX @ 2 oz/A	Most small-seeded annual broadleaf weeds and wild garlic/onion. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
flumioxazin + chlorimuron @ 0.076 lb/A	Valor XLT @ 3 oz/A	Most small-seeded annual broadleaf weeds and wild garlic/onion. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
chlorimuron + flumioxazin + thifensulfuron @ 0.09 lb/A	Envive @ 3.5 oz/A	Most small-seeded annual broadleaf weeds and wild garlic/onion. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
chlorimuron + flumioxazin + thifensulfuron @ 0.105 lb/A	Enlite @ 3.5 oz/A	Most small-seeded annual broadleaf weeds and wild garlic/onion. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.

Active Ingredient and Rate	Formulated Product and Rate	Weeds Controlled	Remarks and Precautions
rimsulfuron + thifensulfuron @ 0.5 oz/A	Leadoff @ 1.5 oz/A; Add 0.25% v/v NIS	Dock, smartweed, henbit, wild garlic/onion and most small-seeded annual broadleaf weeds. Excellent residual control of annual winter weeds including glyphosate resistant horseweed (mare's-tail) from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
thifensulfuron methyl @ 0.014-0.028 lb/A	Harmony GT XP @ 0.3-0.6 oz/A; Add 0.25% v/v NIS	Most small-seeded annual broadleaf weeds, wild garlic/onion and dock. Excellent residual control of annual winter weeds from fall application.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Higher rate required for residual control of winter weeds from fall application. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves.
S-metolachlor @ 1.25-1.6 lb/A	Dual Magnum @ 1.33-1.67 pt/A	Glyphosate-resistant Italian ryegrass and small seeded annual winter weeds.	Apply to prepared seedbeds between Sept. 1 and Dec. 1. Optimum control is generally observed when applied from late October to mid-November. Mix with paraquat to control emerged ryegrass. Incorporation to a depth of 2-3 inches will be beneficial if activating rainfall is not received soon after application.
saflufenacil @ 0.022-0.044 lb/A oz/A	Sharpen @ 1-2 oz/A; Add 1% v/v MSO + 8.5 lb/100 gallon AMS	Good activity on most annual broadleaf winter weeds.	Labeled for fall and spring burndown application. Optimum fall timing is late October to mid-November. Apply with glyphosate or paraquat for improved control of emerged grasses and broadleaves. Higher rate required for residual control of winter weeds from fall application. See label for specific adjuvant requirements with application.
clethodim @ 0.09-0.12 lb/A	Select Max @ 12-16 oz/A (or equivalent 2 lb clethodim formulation); Add 1% v/v COC	Glyphosate-resistant Italian ryegrass and annual grasses.	Optimum timing is late January into spring to small actively growing plants. No residual control. Tank Mixture with 2,4-D or dicamba can result in decreased control. Inadequate or complete control failure may indicate resistance.
tiafenacil @ 0.022-0.066 lb/A	Reviton @ 1-3 oz/A; Add 1% v/v MSO	Horseweed (mare's-tail), cutleaf eveningprimrose, henbit, white clover and numerous small seeded annual broadleaf and grasses.	Provides no residual soil activity. Consult label for adjuvant requirements. Apply with glyphosate for improved burndown and efficacy.