

Burndown Herbicide Programs for Corn and Soybeans

In almost all no-till corn and soybean fields, it is essential to apply herbicides with foliar activity before crop emergence to control existing weeds. Depending upon the herbicide approach used in the field for that year, herbicides used to control weeds at planting may include glyphosate or Gramoxone Max, or it may be possible to rely solely on PRE herbicides with foliar activity (atrazine, Canopy XL, Sencor, etc) in combination with 2,4-D. The latter approach will be most suitable when weeds in the field are fairly small, usually several weeks before planting.

Glyphosate (Roundup WeatherMax, Touchdown, Glyphomax, etc)

Fields with quackgrass, Canada thistle, and other cool-season perennial weeds will almost always require the use of glyphosate around the time of planting. This treatment can reduce the population of perennial weeds that reach an appropriate size by the time of application, such as quackgrass. For other perennials such as Canada thistle, the level of long-term control with glyphosate will be variable, since they may be small at the time of application. Application of glyphosate to small perennials often controls existing foliage, but regrowth occurs later in the growing crop. Cool-season perennials, legumes, and cool-season grasses are more effectively controlled with glyphosate the previous fall if crop rotation allows. Glyphosate is also effective on most annual broadleaf and grass weeds, although the addition of 2,4-D ester greatly improves control of marestalk (horseweed), atriplex, giant ragweed, mustard species and some other key no-till weeds. Activity of glyphosate on established dandelion and some winter annuals can be extremely slow when applied in the spring under cool conditions, and use of fall application or alternative herbicides should be considered in fields where chickweed, purple deadnettle, and dandelion have been problematic (see later section on fall applications). Glyphosate is most effective when applied alone or with 2,4-D, in spray volumes of 10 gpa or less, and when ammonium sulfate is included in the spray mix. Ammonium sulfate helps maintain glyphosate effectiveness in hard water, or when tank-mixed with residual herbicides. Glyphosate activity can be reduced when tank-mixed with certain residual herbicides (Sencor, for example), and when applied using 28% nitrogen solution or a similar material as the spray carrier. For this reason, glyphosate labels often specify that these types of mixtures should be used only for control of small annual weeds.

2,4-D ester (Weedone, Salvo, etc)

In many no-till fields, vegetation up until early May consists primarily of broadleaf weeds, and 2,4-D ester is an economical and effective tool for control of these weeds. While 2,4-D alone can provide adequate control of many broadleaf weeds, there are restrictions on rate and timing of applica-

tion to minimize the risk of crop injury. In addition, 2,4-D is weak on chickweed, purple deadnettle, henbit, and a few other weeds, especially at lower rates.

2,4-D ester is most often used in combination with other herbicides to ensure that complete control of emerged weeds is achieved. Weeds not well-controlled by other herbicides that 2,4-D helps out on include marestalk, prickly lettuce, mustards, giant ragweed, Pennsylvania smartweed, and dandelion. When applied too close to soybean or corn planting, 2,4-D can potentially reduce crop stands and cause injury to new seedlings. With regard to soybeans, restrictions are as follows for most products: rates up to 0.5 lb ai/A must be applied at least 7 days before planting; rates between 0.5 and 1 lb ai/A must be applied at least 30 days before planting. Two exceptions to this are Weedone 650 and E-99, which can be applied at a rate of 1 lb ai/A up to 15 days before planting. With regard to corn, some labels suggest that 2,4-D be applied at least 7 to 14 days before planting or 3 to 5 days after planting. Other labels allow application anytime after planting. The risk of corn injury seems to be primarily when 2,4-D is applied around the time of corn planting, and application is followed by enough rain to move 2,4-D into the soil where seeds are germinating. There is also risk of injury when seed furrows fail to close completely and rain washes herbicide into the seed furrow where direct contact with seed is possible. Injury may be more severe when 2,4-D is applied with chloroacetamide herbicides, especially to corn in the spike stage.

Paraquat (Gramoxone Max)

Use of Gramoxone in no-till systems has declined greatly over the past decade due to reductions in the price of glyphosate and the greater versatility of glyphosate across a range of weed life cycles (perennial, biennial, etc) and sizes. Gramoxone is most effective on small annual weeds, and when combined with photosynthetic inhibitor-type residual herbicides (atrazine, Sencor). Mixing 2,4-D ester with Gramoxone also results in more complete control of broadleaf weeds. Gramoxone is probably most useful when rapid desiccation of weeds is essential, in order to allow tillage or planting. For example, a combination of Gramoxone plus atrazine or Sencor will result in more rapid death and desiccation of chickweed or purple deadnettle, compared to glyphosate, when applied in the spring under cool conditions. Gramoxone should not be used for control of perennial or biennial weeds, legumes, or cool-season grasses. Gramoxone is most effective when applied with crop oil concentrate in relatively high spray volumes (at least 15 gpa), and spray volume should be increased as weed density increases.

Residual herbicides with foliar activity (atrazine, Sencor, Canopy XL, etc)

A number of residual herbicides also have foliar activity, and will control or help control small annual weeds. Herbicides in this category include atrazine, Callisto, Balance Pro, Sencor, Canopy XL, Python, FirstRate, and Hornet. These herbicides have activity primarily on small weeds, and the

spectrum of control varies by herbicide. All have activity on broadleaf weeds, but some have little or no activity on emerged grasses. The most effective strategy when using one of these herbicides, in order to minimize the need for glyphosate or Gramoxone, is to apply several weeks prior to planting with 2,4-D ester. If emerged grasses are present, consult the product label to make sure it will provide adequate grass control, and supplement the spray mix with glyphosate or Gramoxone as needed. Mixtures of residual herbicides with 2,4-D and/or Gramoxone should generally be applied with crop oil concentrate. Mixtures with glyphosate should include only ammonium sulfate and possibly nonionic surfactant, depending upon the glyphosate product used.

Fall herbicide applications

Some winter annual and perennial weeds have been difficult to manage in no-till systems with spring herbicide treatments. For example, control of well-established dandelions in the spring with 2,4-D and/or glyphosate has been inconsistent and extremely slow at times. Common chickweed and purple deadnettle can prevent the soil from drying and interfere with crop planting if not controlled by late winter or early spring. Application of herbicides in the fall can be an effective strategy for managing some perennials and winter annual weeds. The timing of application and herbicide choice varies with the weeds present and the goal of the fall treatment. OSU weed scientists have conducted several years of research on management of winter annual weeds with fall and spring herbicide applications. More information is available in the "Problem Weeds" section of this guide (see dandelion and winter annuals), and in past C.O.R.N. newsletter articles (archive available at <http://corn.osu.edu>).

Table 3. Weed Response to “Burndown” Herbicides

This table gives a general comparative rating of “burndown” herbicides used in no-till corn and/or soybean production. Under unfavorable conditions, some herbicides may not perform as well as indicated below. Under very favorable conditions, control may be better than indicated. Soil type, rate of herbicide, weed stage of growth and environmental conditions all interact to influence herbicide performance.

Weed control rating:

9 = 90% to 100%

8 = 80% to 90%

7 = 70% to 80%

6 = 60% to 70% control, NR = not recommended, and - = insufficient information.

Weed control rating of 5 or less is rarely significant. These treatments are rated for control of existing vegetation only. Treatments containing glyphosate should be applied with ammonium sulfate (and surfactant if required by the glyphosate product label). Most other treatments should be applied with a crop oil concentrate or methylated seed oil (plus fertilizer solution if recommended by the label). Atrazine, Balance, CanopyXL, Hornet, Python, Guantlet, simazine, Valor, and Sencor should be applied before weeds are 2 to 3 inches tall unless mixed with 2,4-D, glyphosate, or Gramoxone. Ratings for 2,4-D are based on a rate of 0.5 lb ai/A unless otherwise indicated - increasing the 2,4-D rate to 1.0 lb ai/A will improve control of legumes, dandelion and some other weeds.

	Giant Foxtail	Lambsquarters	Common Ragweed	Giant Ragweed	Annual Smartweeds	Common chickweed	Mustards, Shepherd's-purse	Winter Wheat, Rye Cover	Orchardgrass/Fescue Sod	Canada Thistle	Red Clover	Alfalfa	Hairy Vetch	Marestail	Prickly Lettuce	Deadnettle, henbit	Dandelion
Fall application																	
2,4-D (0.5 lb/1.0 lb)	-	-	-	-	-	3/5	9	NR	NR	5/6	6/8	5/7	6/8	8/9	8/9	4/8+	6/7
2,4-D + dicamba (WeedMaster/Brash)	-	-	-	-	-	7	9	NR	NR	7	9	8	9	9	9	8	7
Basis + 2,4-D	-	-	-	-	-	9	9	NR	NR	6	6	5	6	9	9	8+	8
Canopy XL + 2,4-D	-	-	-	-	-	6	9	NR	NR	5	6	5	6	9	9	9	8
Canopy XI + Express + 2,4-D	-	-	-	-	-	9	9	NR	NR	5	6	5	6	9	9	9	9
Express + 2,4-D (1 quart)	-	-	-	-	-	9	9	NR	NR	6	6	5	6	9	9	8	7
Glyphosate	-	-	-	-	-	9	9	9	9	9	8	8	8	9	8	8	8+
Glyphosate + 2,4-D	-	-	-	-	-	9	9	9	8	8	9	9	9	9	9	9	9
Sencor + 2,4-D	-	-	-	-	-	7+	9	NR	NR	4	2	3	6	9	9	9	7
Simazine + 2,4-D	-	-	-	-	-	9	9	NR	5	5	6	5	6	9	9	8+	8
Valor + glyphosate + 2,4-D	-	-	-	-	-	9	9	9	8	8	9	8	8	9	9	9	8
Spring application																	
Atrazine	7	9	9	8	9	8	8	5	NR	4	NR	NR	7	8	9	9	4
Atrazine + 2,4-D	7	9	9	9	9	8+	9	5	NR	5	8	7	8	9	9	9	6
Atrazine + Gramoxone Max	9	9	9	9	9	9	9	8	6	4	7	4	8	9	9	9	4
Atrazine + Hornet	7	9	9	9	9	8	8	5	NR	8	6	6	7	8	9	9	4
Balance/Epic + atrazine	8	9	9	8	9	9	9	5	4	4	6	5	7	9	9	9	6
2,4-D (0.5 lb/1.0 lb)	NR	9	9	9	7/8	3	8/9	NR	NR	4	7/8	7/8	8/9	7/8+	8/9	3/7	7/8
2,4-D + dicamba	NR	9	9	9	9	6	9	NR	NR	6	9	8	9	9	9	4	8
Dicamba	NR	9	9	9	9	6	7	NR	NR	5	9	8	8	7	9	3	7
Canopy XL + glyphosate	9	9	9	9	9	6	8	9	4	6	7	6	6	9	8+	8	8+
Canopy XL + 2,4-D	5	9	9	9	9	5	9	NR	NR	4	8	7	8	8	9	8	8
Canopy XL + Gramoxone	9	9	9	9	9	6	8	7	3	4	7	3	7	6	9	9	8
FieldMaster/Expert	9	9	9	9	8	8	8	8	4	5	6	5	7	8	8	8	7
FieldMaster/Expert + 2,4-D	9	9	9	9	9	8	9	8	4	6	7	7	8	9	9	9	8
FirstRate/Amplify + 2,4-D	0	9	9	9	9	3	8	NR	NR	4	NR	NR	NR	8	8	3	7
Glyphosate	9	9	9	8	7	6	8	9	4	6	7	6	6	8	8	5	7
Glyphosate + 2,4-D	9	9	9	9	8	7	9	9	4	6	8	8	8	9	9	6	8+
Gramoxone Max	9	8	8	8	6	6	7	7	3	3	7	3	7	5	6	4	5
Lumax/Lexar	6	9	9	9	9	9	8	5	NR	6	NR	NR	7	8	9	9	8
Lumax/Lexar + 2,4-D	6	9	9	9	9	9	9	5	NR	6	7	7	8	9	9	9	8+
Python + 2,4-D	NR	9	9	9	7	5	8	NR	NR	4	NR	NR	NR	8	8	5	6
Sencor + 2,4-D	3	9	9	9	9	8	8	NR	NR	4	2	3	NR	8+	8	8	6
Sencor + Gramoxone	9	9	9	8	8	9	7	7	3	3	7	3	7	7	7	7	6
Sencor + Gramoxone + 2,4-D	9	9	9	9	9	9	9	7	NR	5	7	7	8	8+	9	9	6
Valor + 2,4-D + glyphosate	9	9	9	9	8	7	9	9	4	6	8	8	8	9	9	8	8+

Table 4. Application Intervals for Early Preplant Herbicides

This table gives the time interval, in days, that herbicides and herbicide combinations can be applied before planting corn or soybeans. Herbicide rates may increase when applied early preplant; consult labels for detailed information on application rates. Soil-applied herbicides not included in this table are not labeled for early application, and should be applied close to the time of planting or as directed by the label. Fall applications are usually targeted for control of emerged winter annuals and limited residual control in to the next growing season.

Corn	Single Application in Spring	Labeled for Fall Application
AAtrex, atrazine	up to 30 days	No
Axiom	up to 45 days	Yes
Balance Pro, Epic	up to 21 or 30 days ²	No
Define	up to 30 days	Yes
Degree, Degree Xtra	up to 30 days	No
Dual II Magnum/Cinch, Bicep/Cinch ATZ, Expert	up to 30 days	No
Guardman Max, Outlook	up to 30 days ¹	No
Harness/Confidence, Volley	up to 30 days	No
Harness Xtra/Confidence Xtra, Volley ATZ	up to 30 days	No
Hornet	up to 30 days	No
Keystone	up to 30 days	No
Lariat, Bullet	up to 30 days	No
Lumax, Lexar	up to 14 days	No
MicroTech	up to 30 days	No
Optill	up to 30 days	No
Princep/simazine	up to 14 days	Yes
Python	up to 30 days	Yes
Sencor	up to 14 days	Yes
Stalwart C, Stalwart Xtra	up to 30 days	No
Surpass	up to 30 days	No
Topnotch/FulTime	up to 40 days	No

Soybeans	Single Application	Labeled for Fall Application
Axiom	up to 45 days	Yes
Boundary	up to 30 days	No
Canopy XL	anytime up to previous fall	Yes
Command/Commit 3ME	up to 30 days	No
Domain	up to 30 days	No
Dual II Magnum/Cinch	up to 30 days	No
FirstRate/Amplify	up to 28 days	No
Outlook	up to 30 days ¹	No
Gangster	up to 14 days	No
Micro-Tech	up to 30 days	No
Prowl, Pentagon, Pendimax	up to 15 days	No
Pursuit	up to 45 days	Yes
Python	up to 30 days	Yes
Scepter	up to 45 days	Yes
Sencor	up to 15 days	Yes
Valor	up to 30 days	Yes

¹ Early application not recommended in areas where average annual rainfall exceeds 40 inches.

² Balance can be applied 30 days before planting if followed with planned postemergence treatments - otherwise it can be applied 21 days before planting.

Burndown Herbicides in No-Tillage Corn and Soybeans

Herbicide	Formulation	Product Rate Range
2,4-D Amine	Various	0.5 - 1 lb ai/A
2,4-D Ester	Various	0.5 - 1 lb ai/A

Tank-mix with: Most preplant and preemergence corn and soybean herbicides.

- Apply in fall or spring for control of emerged annual broadleaf weeds, including ragweeds, lambsquarters, mustard species, marestail, prickly lettuce, and dandelion. Provides control or suppression of perennial broadleaf weeds and legume sods (alfalfa, clover).
- Mode of action: growth regulator.
- 2,4-D ester or amine can be applied preplant or preemergence to corn, but labels vary with regard to specific recommendations on timing of application. The Weedar and Weedone labels recommend application either 7 to 14 days before planting or 3 to 5 days after planting before the corn has emerged. Labels of other 2,4-D products allow application any time after planting.
- Applications of 2,4-D around the time of planting can injure corn. This is more likely to occur in coarse-textured soils with low organic matter content, and when above-average rainfall and prolonged soil moisture occur within a week after planting. When applied preemergence, 2,4-D amine is more likely to injure corn than 2,4-D ester. Weedar and Weedone labels do not allow preplant or preemergence use of 2,4-D on light, sandy soils. Injury may be more severe when 2,4-D is applied with chloracetamide herbicides.
- Many 2,4-D products are labeled for use in the spring prior to no-till soybean planting. OSU recommends the use of 2,4-D low-volatile ester (LVE) or similar products only for this application. 2,4-D amine products are more water soluble and may leach into the seed zone. For 2,4-D LVE, rates up to 0.5 lb active ingredient per acre must be applied at least 7 days before soybean planting. Application rates of more than 0.5 lb up to 1.0 lb active ingredient per acre generally must be applied at least 30 days before planting. Two exceptions to this are E-99 and Weedone 650, which can be applied at a rate of 1.0 lb ai/A up to 15 days before planting. Do not apply more than 1 lb ai per acre. Only one spring application is allowed per year.
- 2,4-D is more effective than glyphosate for control of legume sods, marestail, dandelion, and prickly lettuce. For best control of alfalfa prior to corn planting, apply in combination with 1/2 pint of dicamba. If legume sods are cut prior to application of 2,4-D or 2,4-D plus dicamba, allow sufficient regrowth (4 to 6 inches) before herbicide application, or poor control may result.
- When applied at rate of 1 lb ai/A in the fall, 2,4-D will control dandelion, mustards, marestail, purple deadnettle, and many other broadleaf weeds. Add glyphosate for effective control of common chickweed, wild carrot, poison hemlock, cressleaf groundsel, and dense populations of dandelion.

Herbicide	Formulation	Product Rate Range
Dicamba	4L	1/2 - 1 pt

Tank-mix with: Most preplant and preemergence corn herbicides.

- Dicamba is sold under a number of trade names, including Banvel, Clarity, Sterling, and Oracle. Dicamba is a translocated herbicides that can be applied before, during, or after no-till corn planting for control of emerged broadleaf weeds.
- Mode of action: growth regulator.
- Use 1/2 pint on coarse-textured soils, and 1 pint on medium- or fine-textured soils containing at least 2 percent organic matter.
- Dicamba is more effective than glyphosate for control of legume sods, especially when applied in combination with 2,4-D. When planting into a legume sod, apply dicamba after regrowth of 4 to 6 inches has occurred.
- The addition of crop oil, surfactant, or fluid fertilizer may improve control of emerged weeds. Do not apply with crop oil when corn is more than 5 inches tall.
- Corn should be planted at least 1 1/2 inches deep with good-seed furrow closure. May injure corn if recommended rates are exceeded, application is not uniform, or corn is planted too shallow.
- The 1 pint rate provides limited residual control of small-seeded, annual broadleaf weeds.
- Some dicamba products are labeled for application in the spring prior to soybean planting. The Clarity label allows soybeans to be planted 14 days after application of 8 oz/A, and 28 days after application of 16 oz/A, as long as one inch of rainfall has occurred between application and planting.

Burndown Herbicides in No-Tillage Corn and Soybeans

Herbicide	Formulation	Product Rate Range
Dicamba + atrazine	3.2L	2 - 3 1/2 pt

Tank-mix with: Most preplant and preemergence corn herbicides.

- Dicamba plus atrazine is sold under a number of trade names, including Marksman, Sterling Plus, Banvel-K+atrazine, and Stratos. These products control most emerged annual broadleaf weeds, and suppress or control perennial broadleaf weeds, and provide some residual control of broadleaf weeds.
- Mode of action: photosynthesis inhibitor (atrazine), growth regulator (dicamba).
- Can be applied before, during, or after planting to emerged, actively growing weeds. Apply 2 pints on coarse soils with at least 2 percent organic matter, and 3 1/2 pints on medium- or fine-textured soils with at least 2 percent organic matter.
- The addition of crop oil, surfactant, or fluid fertilizer may improve control of emerged weeds. Do not apply with crop oil after corn is 5 inches tall.
- When planting into a legume sod, apply after regrowth of 4 to 6 inches has occurred.
- Corn should be planted at least 1 1/2 inches deep with good seed-furrow closure. May injure corn if recommended rates are exceeded, application is not uniform, or corn is planted too shallow.

Herbicide	Formulation
Expert	4.88L

Tank-mix with: Dual II Magnum, atrazine, simazine, glyphosate, Prowl, dicamba, 2,4-D, Python, Hornet,

- Expert is a premix of glyphosate, s-metolachlor (Dual II Magnum), and atrazine for burndown and residual control of grass and broadleaf weeds in no-till and conservation tillage corn. See glyphosate and Bicep II Magnum descriptions for more information on these herbicides.

Expert Use Rates (qt/A)		
Soil Texture	Less Than 3% OM	3% OM or More
Coarse – sand, loamy sand, and sandy loam	2.5 to 3.75	3 to 3.75
Medium – loam, silt loam, and silt	3 to 3.75	3 to 3.75
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	3 to 3.75	3 to 3.75

- Mode of action: EPSP synthase inhibitor (glyphosate), photosynthesis inhibitor (atrazine), shoot meristem inhibitor (s-metolachlor).
- Use rates provide the equivalent of 1.25 to 2 pints/A of Touchdown IQ and 1.75 to 2.6 quarts/A of Bicep II Magnum.
- Apply before, during, or after planting but before crop emergence.
- Can be applied postemergence to Roundup Ready corn. Use water as the spray carrier for postemergence applications.
- Can be applied in water or nitrogen fertilizer solutions (28% or 32% UAN only). Control of emerged weeds, especially perennial and large annual weeds, may be reduced if fertilizer is used as the carrier.
- The addition of ammonium sulfate (17 lbs/100 gallons) can improve control of emerged annual weeds under cool or dry conditions.

Burndown Herbicides in No-Tillage Corn and Soybeans

Herbicide	Formulation
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Field Master 4L

Tank-mix with: Simazine, Harness, atrazine, Roundup WeatherMax, Balance.

Field Master Use Rates (qt/A)	
Soil Textural Group	qt/A
Coarse	3.5 to 5
Medium	4 to 5
Fine	4 to 5

- Field Master is a premix of glyphosate, acetochlor (Harness), and atrazine for burndown and residual control of grass and broadleaf weeds in no-till and conservation tillage corn. See glyphosate and Harness Xtra descriptions for more information on these herbicides.
- Mode of action: EPSP synthase inhibitor (glyphosate), photosynthesis inhibitor (atrazine), shoot meristem inhibitor (acetochlor).
- Use rates provide the equivalent of 16 to 22 oz/A of Roundup Weathermax and 2 to 3 quarts/A of Harness Xtra 5.6.
- Apply before, during, or after planting but before crop emergence. Can be applied postemergence to Roundup Ready corn.
- Can be mixed with Balance for improved control of velvetleaf, annual grasses, triazine-resistant lambsquarters, and burcucumber. See the Balance description for guidelines to avoid crop injury.
- Can be applied in water or nitrogen fertilizer solutions (28% or 32% UAN only). Do not use fertilizer solution as the spray carrier for control of annual weeds more than 6 inches tall or perennial weeds.
- The addition of ammonium sulfate (17 lbs/100 gallons) can improve control of annual weeds under cool or dry conditions.

Herbicide	Formulation	Product Rate Range
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Glyphosate Various 0.38 - 1.5 lbs acid/A

Tank-mix with: Most preplant and preemergence corn and soybean herbicides.

- Do not apply broadcast after the crop has emerged, unless the crop has tolerance to glyphosate and is labeled as Roundup Ready.
- Glyphosate is a nonselective, translocated herbicide that controls emerged annual and perennial grass and broadleaf weeds, volunteer cereals, and grass cover crops. Table 20 contains a list of some currently available glyphosate products. Application rates, adjuvant recommendations, and other guidelines for use vary among glyphosate products, and users should consult labels and local product use guides for more specific information. The following comments are meant as general guidelines for the use of glyphosate.
- Mode of action: EPSP synthase inhibitor.
- Most annual weeds can be controlled with the lower labeled rates when less than about 6 inches tall. Rates should be increased accordingly as weeds become taller. Pennsylvania smartweed, atriplex, giant ragweed, crabgrass, fall panicum, barnyardgrass, marestail, dandelion, and a number of winter annual weeds can be difficult to control, and should be as small as possible at the time of application. A mixture of glyphosate plus 2,4-D ester (0.5 lbs ai/A) will improve control of prickly lettuce, dandelion, marestail, giant and common ragweed, Pennsylvania smartweed, velvetleaf, mustard species, and other broadleaf weeds.
- Glyphosate resistance has developed in marestail populations in Ohio and Indiana. To reduce the risk of resistance, apply a mixture of glyphosate plus 2,4-D ester at least 7 days before soybean planting, and consider including preemergence herbicides that have residual activity on marestail (e.g. Valor, Sencor, CanopyXL). Avoid use of herbicide programs consisting solely of multiple glyphosate applications (in Roundup Ready crops) where marestail is present. See "marestail" in the "Problem Weeds" section of this guide for additional management information.
- For control of rye or overwintered wheat, apply in a spray volume of 10 gpa or less and use the appropriate rate for small grain size. Wheat should be treated before reaching a height of 18 inches.
- Roundup, Glyphomax, and some other glyphosate products can be applied immediately prior to alfalfa harvest in spring or fall, and the treated alfalfa and weeds harvested and fed to livestock. This application is useful where corn will be planted immediately after alfalfa harvest, since it provides more effective alfalfa and perennial grass control, compared to application after harvest. Allow a minimum of 36 hours between application and harvest. Alfalfa should be harvested 3 to 7 days after application to avoid loss of quality and maximize perennial control. The preemergence herbicide program for corn should include atrazine at a rate of 1 1/4 to 1 1/2 quarts (or the equivalent amount in a premix). Postemergence application of Banvel or Banvel + 2,4-D may be required for complete control of alfalfa in the corn.

Burndown Herbicides in No-Tillage Corn and Soybeans

- Glyphosate activity will be maximized when applied in water in a spray volume of 10 gpa or less. When tank-mixing with residual herbicides, apply in 10 or more gallons of water or nitrogen fertilizer solution per acre.
- Glyphosate activity on perennial and large annual weeds may be reduced when mixing with residual herbicides or applying in nitrogen fertilizer solution. Residual herbicides most likely to reduce activity include Bullet and MicroTech, and herbicides with contact activity on emerged weeds (Valor, Sencor, Domain, Boundary, atrazine, etc). Consult labels for rates and precautions when tank-mixing with residual herbicides.
- Recommendations for the use of ammonium sulfate (17 lbs/100 gallons of water) with glyphosate vary among products. Addition of ammonium sulfate may improve control, and is recommended under the following conditions: when tank-mixing with residual corn or soybean herbicides, when air temperature is 55 degrees or less, or when hard or high pH water is used as the carrier.

Herbicide	Formulation	Product Rate Range
Gramoxone Max	3L	1.3 - 2.7 pt

Tank-mix with: Most preplant and preemergence corn and soybean herbicides.

- Do not apply broadcast after the crop has emerged.
- Gramoxone Max (paraquat) is a nonselective contact herbicide that controls emerged annual grass and broadleaf weeds. Gramoxone usually provides acceptable control of a rye cover, but is less effective than glyphosate for control of forage grasses such as orchardgrass and tall fescue. Gramoxone is not effective for control of perennial broadleaf weeds, legume sods, perennial grass sods, or volunteer wheat although some suppression of these may occur.
- Mode of action: cell membrane disruptor.
- May not control marestail and prickly lettuce. May not control smartweed, giant ragweed, and fall panicum that are more than 4 to 6 inches tall. Control of these and many other weeds will be improved when Gramoxone is tank-mixed with photosynthetic inhibitor herbicides (atrazine, Sencor, and Lorox). The addition of 2,4-D will also improve control of many broadleaf weeds.
- Application rates vary with weed size. Apply 1.3 to 1.7 pints for 1- to 3-inch weeds, 1.7 to 2 pints for 3- to 6-inch weeds, and 2.2 to 2.7 pints for weeds more than 6 inches tall. Rates can be reduced when applied with photosynthetic inhibitor herbicides.
- Apply with crop oil concentrate (1 gallon/100 gallons spray) or nonionic surfactant (1 quart/100 gallons). Crop oil concentrate is the preferred spray adjuvant, especially when tank-mixing with other herbicides.
- When using flat fan nozzles spaced at 20 inches or less, apply in a spray volume of at least 10 gpa with a pressure of at least 30 psi. Increase spray volume to at least 15 to 20 gpa if weeds are more than 3 inches tall. For large spray equipment with flood type nozzles, use a spray volume of at least 20 gpa with a pressure of at least 30 psi.
- Allow 30 minutes between application and rainfall.
- Do not apply with suspension or high-phosphate liquid fertilizers.

Herbicide	Formulation	Product Rate Range
Harmony Extra	75DF	0.5 - 0.6 oz
Express	75DF	1/6 - 1/3 oz
Basis	75DF	1/3 - 1 oz

- Harmony Extra and Express can be applied in the fall and/or spring up to 45 days before planting corn or soybeans for control of wild garlic and other broadleaf weeds.
- Harmony Extra is a premix of thifensulfuron (Harmony GT) plus tribenuron-methyl (Express) that controls wild garlic and annual broadleaf weeds, including lambsquarters, mustard species, Pennsylvania smartweed, field pennycress, and shepherd's purse. Express controls purple deadnettle, chickweed, and field pennycress, and provides partial control of shepherd's-purse and other mustard species.
- Basis is a premix of rimsulfuron plus thifensulfuron (Harmony GT) that can be applied in the fall (0.33 to 0.5 oz/A) before planting corn for control of winter annual weeds up to 3 inches tall, including chickweed, deadnettle, henbit, and mustards. Spring applications (0.3 to 1 oz/A) before corn planting can provide burndown of small annual grass (up to 2 inch) and broadleaf (up to 3 inch) weeds, and several weeks of residual control of foxtails, lambsquarters, and pigweeds. Apply with

Burndown Herbicides in No-Tillage Corn and Soybeans

crop oil concentrate (1%, v/v) and ammonium nitrogen fertilizer. Can be tank-mixed with other herbicides approved for these uses. Do not apply in the fall or spring before soybean planting.

- Mode of action: ALS inhibitor.
- To control wild garlic, apply 0.5 to 0.6 ounce or Harmony Extra when garlic plants are less than 12 inches tall with 2 to 4 inches of new growth. Control will be better if applied during warm weather (60 F or more) to actively growing garlic plants. Thorough spray coverage of garlic plants is essential.
- Apply with crop oil concentrate (1% v/v) or nonionic surfactant (0.25% v/v). Use flat fan or low-volume flood nozzles for best results.

Herbicide	Formulation	Product Rate Range
Ready Master ATZ	4L	1.5 - 2 qt/A

Tank-mix with: Atrazine, Harness, Micro-Tech, Partner.

- Ready Master ATZ is a premix of atrazine plus glyphosate that provides burndown of emerged weeds and residual control of broadleaf weeds. The 2-quart rate provides the equivalent of 1 lb/A of atrazine and 22 oz/A of Roundup WeatherMax.
- Mode of action: photosynthesis inhibitor (atrazine), EPSP synthase inhibitor (glyphosate).
- Apply up to 14 days before corn planting, and before emergence of conventional (non-Roundup Ready) corn hybrids. Can be applied after emergence of Roundup Ready corn.
- The addition of ammonium sulfate (17 lbs/100 gallons) is recommended when tank-mixing with residual corn herbicides, when air temperatures are less than 55 degrees, and when hard or high pH water is used as the carrier.

Herbicide	Formulation	Product Rate Range
Weedmaster/Brash	3.87L	0.5 - 6 pts

- Weedmaster/Brash is a premix of 2,4-D amine plus dicamba for control of emerged weeds in the fall after corn or soybean harvest, or in the summer or fall after wheat harvest.
- Mode of action: growth regulator.
- Controls mustards, marestail, cressleaf groundsel, dandelion and some other winter annual weeds, but is weak on purple dead-nettle and common chickweed.
- Apply when annual weeds are less than 6 inches tall, when biennials are in the rosette stage, and when perennials are at least 6 inches tall or in the bud to bloom stage.
- Any crop can be planted 120 days after application of rates up to 6 pints per acre.
- Can be applied prior to wheat planting, but allow an additional 10 days between application and planting for each pint applied (e.g. for a 2 pint rate allow 20 days).
- The standard adjuvant recommendation is 2 to 4 pints of nonionic surfactant per 100 gallons of spray solution.