

Corn Herbicide Management Strategies

Preemergence herbicide programs have long been the mainstay of weed management in corn, due in large part to the low cost of atrazine and its broad spectrum of control. A total preemergence approach can still be effective in fields with low to moderate populations of most annual weeds. The commonly used premix of atrazine plus an acetamide herbicide (Bicep II Magnum, Degree Xtra, FulTime, etc) can be supplemented as necessary with Balance, Python, Hornet, or simazine to improve control of weeds such as fall panicum, triazine-resistant lambsquarters, and velvetleaf. However, all of these tank-mix partners except simazine can occasionally injure corn, especially when corn is planted too shallow, on coarse-textured soils, and when cold, wet conditions occur after planting. In fields with moderate to high weed populations, a preemergence plus postemergence approach will provide more consistent control with less risk of corn injury. A number of options are available for this type of program at a reasonable cost. A preemergence plus postemergence approach is especially effective in fields with giant ragweed, burcucumber, moderate to high annual populations of annual grass, velvetleaf, and triazine-resistant lambsquarters, and perennial weeds. A number of effective total postemergence herbicide programs are also available. However, research indicates that total postemergence programs lacking residual activity should be used only in fields with low weed populations. A total postemergence herbicide program should be applied before most weeds in a field exceed 4 to 6 inches in height, and reinfestation with later-emerging weeds is likely if a herbicide with residual activity is not included. Using a postemergence program that has substantial residual activity allows more flexibility in the window of application. Herbicides can be applied when weeds are anywhere from 2 to 5 inches tall, since the residual component will control weeds that emerge after application.

Preemergence Corn Herbicide Programs

Total preemergence (PRE) herbicide programs fit fields with:

- low to moderate annual grass populations
- low giant ragweed populations
- any population of most annual broadleaf weeds

Total preemergence programs do not fit fields with:

- high grass populations
- moderate to high giant ragweed, cocklebur, velvetleaf, and annual morningglory populations
- perennial weeds
- burcucumber

Advantages of PRE programs:

- one-pass, can apply while planting
- with adequate rain, provides control through the first 6 weeks, and later-emerging weeds have much reduced impact on corn yield
- effective on many annual grass and broadleaf weeds

Disadvantages of PRE programs:

- dependence upon adequate rain within narrow period of time
- not effective enough on tough broadleaf or perennial weeds or in high grass populations
- corn needs to be competitive earlier in season compared to PRE plus POST programs

Approaches:

Atrazine premix products (Bicep, Harness Xtra, etc) or similar mixes are effective broad-spectrum treatments for fields suited to total preemergence.

- can add simazine or Balance to improve grass control (or use a mixture of Epic + atrazine)
- can add reduced rate of Balance to boost consistency under low rainfall conditions
- can add Balance, Callisto, Python, or Hornet to improve triazine-resistant lambsquarters, giant ragweed, and velvetleaf control
- atrazine rates of 1.5 to 2 lb/A can improve control of velvetleaf and giant ragweed. Some premix products have less than 1.5 lbs/A

In low to moderate grass populations with adequate rain, preemergence grass herbicides are comparable in their effectiveness, especially when mixed with atrazine. However, differences show occasionally in OSU research:

For longevity of grass control:

s-metolachlor/metolachlor > Degree Xtra > FulTime = Keystone = Guardsman Max = Axiom+atrazine = Define+atrazine > Harness Xtra > Balance

Amount of rain needed for activity:

Balance < Harness Xtra = FulTime = Keystone < Guardsman Max = Degree Xtra < Define+atrazine = Axiom+atrazine = metolachlor/s-metolachlor

Preemergence plus Postemergence Corn Herbicide Programs

Preemergence (PRE) plus Postemergence (POST) herbicide programs fit any field, but are especially well-suited for fields with:

- moderate to high annual grass populations
- moderate to high giant ragweed, cocklebur, velvetleaf, and annual morningglory populations
- perennial weeds
- burcucumber

Advantages of PRE plus POST programs:

- very consistent, as long as some rain on PRE
- creates wider window for POST application, compared to total POST programs
- good on many tough weeds

Disdvantages of PRE plus POST programs:

- dependence upon rain for PRE activity (although have planned POST backup)
- two-pass
- cost

Approaches:

In fields with low to moderate grass populations, can take an approach of preemergence grass herbicide followed by postemergence broadleaf herbicide (without much grass activity). Examples:

- Outlook followed by dicamba+atrazine
- TopNotch followed by Hornet + Clarity

To provide postemergence control of a few grass escapes, can take an approach of a preemergence grass herbicide followed by a postemergence broadleaf herbicide that also has activity on small grasses. Examples:

- Dual II Magnum followed by NorthStar or Celebrity Plus
- Outlook followed by Distinct + atrazine
- Harness followed by Marksman

In fields with moderate to high grass and/or problem broadleaf populations, can take an approach of preemergence grass or grass+broadleaf herbicide (full or reduced rate) followed by broad-spectrum postemergence herbicide with grass and broadleaf activity. Examples:

- Cinch ATZ followed by Steadfast ATZ
- atrazine and/or simazine followed by Lightning + Distinct (Clearfield corn)
- atrazine + simazine followed by Liberty (Liberty Link corn)

- Harness Xtra followed by glyphosate (RR corn)
- Bicep followed by Spirit + Accent
- Balance + atrazine followed by Equip

Total Postemergence Corn Herbicide Programs (without residual)

Total postemergence (POST) herbicide programs that do not provide residual control should be used primarily in fields with:

- low annual grass populations
- low to moderate annual broadleaf populations

Avoid use in fields with:

- moderate to high annual grass populations
- high broadleaf populations
- burcucumber
- perennial broadleaf weeds (might emerge too late for control)

Advantages of total POST without residual:

- one-pass, can plant first and apply later
- not dependent upon rainfall for activity (although soil moisture status affects weed response to herbicides)

Disadvantages of total POST without residual:

- narrow window of application should be applied before weeds exceed 4 inches in height to avoid yield loss
- lack of control of weeds that emerge after application
- application too early for best perennial weed control

Approaches:

In fields with low weed pressure, can make a single postemergence application of herbicides without residual. Examples:

- Accent + Clarity
- Option + Distinct
- Celebrity Plus
- Glyphosate (RR corn)
- Liberty (Liberty Link corn)

Total Postemergence Corn Herbicide Programs (with residual)

Total postemergence (POST) herbicide programs that provide substantial residual control can be used in fields with:

- most annual weed populations

Avoid use in fields with:

- perennial broadleaf weeds (might emerge too late for control)
- high giant ragweed and annual grass populations

Advantages of total POST with residual:

- one-pass, can plant first and apply later
- not dependent upon rainfall for postemergence activity (although soil moisture status affects weed response to herbicides)
- consistent control of many annual weed populations

Disadvantages of total POST with residual:

- should be applied before weeds exceed 4 inches in height to avoid yield loss
- application too early for best perennial weed control
- need rain within 2 weeks of application for residual activity

Approaches:

Can make a single postemergence application before weeds exceed 4 inches in height with mix of postemergence herbicides with grass and broadleaf activity and residual herbicides with primarily broadleaf activity (if grass population not high). Examples:

- Liberty ATZ (Liberty Link corn)
- ReadyMaster ATZ (RR corn)
- Accent + Marksman
- Option + Marksman or atrazine

In fields with moderate to high grass pressure, may need residual component with more activity on grasses than those listed above. Examples:

- Glyphosate + Degree Xtra (RR corn)
- Lightning + atrazine (Clearfield corn)
- Liberty + atrazine/chloroacetamide premix (Liberty Link corn)

The following examples have limited soil residual, but residual may not be broad-spectrum or long enough in fields with moderate to high weed populations:

- Steadfast ATZ
- Basis Gold + Clarity

Table 5. Weed Response to Herbicides in Corn

This table compares the relative effectiveness of herbicides on individual weeds. Ratings are based on labeled application rate and weed size or growth stage. Performance may be better or worse than indicated in the table, due to weather or soil conditions or other variables.

Weed control rating:
 9 = 90% to 100% control
 8 = 80% to 90% control
 7 = 70% to 80% control
 6 = 60% to 70% control
 - = insufficient data

Crop tolerance rating:
 0 = Excellent
 1 = Good
 2 = Fair
 3 = Poor

Weed control rating of 5 or less is rarely significant. Crop injury of 1 or less is rarely significant.

Mode of Action	Grasses										Broadleaf Weeds																
	Crop Tolerance	Barnyardgrass	Crabgrass	Fall Panicum	Giant Foxtail	Yellow Foxtail	Shattercane	Seeding Johnsongrass	Rhizome Johnsongrass	Quackgrass	Yellow Nutsedge	Annual Morningglory	Black Nightshade	Burcucumber	Cocklebur	Common Ragweed	ALS-resistant common ragweed	Giant Ragweed	ALS-resistant giant ragweed	Jimsonweed	Lambsquarters	Triazine-Resistant Lambsquarters	Pigweed (redroot)	Smartweed	Velvetleaf	Waterhemp	
Preplant or Preemergence																											
Acetochlor ¹	S	1	9	9	8	9	9	5	4	0	0	8+	0	8+	0	0	7	7	2	2	4	7+	7+	8+	5	3	8
Acetochlor+atrazine ¹	S/P	1	9	9	8	9	9	5	4	0	6	8+	8	9	6	8	9	9	8	8	9	9	7+	9	9	8	9
Alachlor ¹	S	1	8	8+	8	8+	8+	5	4	0	0	8	0	8+	0	0	5	5	2	2	4	6	6	8	4	0	8
Alachlor + atrazine ¹	S/P	1	9	8+	8	8+	8+	5	4	0	6	8	8	9	6	8	9	9	8	8	9	9	6	9	9	8	9
Atrazine	P	0	8	5	3	7	7	2	0	0	8	7	8	9	6	8	9	9	8	8	9	9	0	9	9	8	9
Axiom	S/P	1	8	8+	8	8+	8+	5	4	0	0	6	3	8	0	2	7	7	2	2	6	8	5	9	7	7	8
Balance Pro	M	2	8	7	8	8	6	6	6	0	0	3	5	9	7	3	9	9	6	6	9	9	9	9	8	9	8
Callisto	M	1	3	6	3	3	3	0	0	0	0	6	9	7	5	7	7	6	6	-	9	9	9	9	9	9	9
Define	S	1	8	8+	8+	8+	8+	5	4	0	0	6	0	8	0	0	5	5	2	2	4	6	6	8	4	2	8
Epic	S/M	2	8	9	9	9	9	6	6	0	0	6	5	9	7	3	9	9	6	6	8+	9	9	8	9	8	9
Guardsman Max	S/P	1	9	8+	8	8+	8+	5	4	0	5	8	8	9	5	8	9	9	7	7	9	9	6	9	9	7+	9
Hornet	A/G	2	0	0	0	0	0	0	0	0	0	6	8+	3	8	8+	8+	7+	7+	8	9	9	9	9	8+	9	5
Lumax/Lexar	M/S/P	1	9	9	8	9	9	5	4	0	6	8	8	9	7	8	9	9	8	8	9	9	9	9	9	9	9
Metolachlor ²	S	1	8	9	8+	9	9	5	4	0	0	8+	0	8	0	0	5	5	2	2	4	6	6	8	4	2	8
s-Metolachlor ²	S	1	8	9	8+	9	9	5	4	0	0	8+	0	8	0	0	5	5	2	2	4	6	6	8	4	2	8
Metolachlor + atrazine ²	S/P	1	9	9	8	9	9	5	4	0	6	8	8	9	6	8	9	9	8	8	9	9	6	9	9	8	9
s-Metolachlor + atrazine ²	S/P	1	9	9	8	9	9	5	4	0	6	8	8	9	6	8	9	9	8	8	9	9	6	9	9	8	9
Outlook	S	1	8	8+	8	8+	8+	5	4	0	0	8	0	8+	0	0	5	5	2	2	4	6	6	8	4	2	8
Python	A	2	0	0	0	0	0	0	0	0	0	5	8	3	7	7	0	5	0	7	9	9	9	9	8	8+	5
Simazine	P	0	8	7	7	8	8	4	2	0	6	2	7	9	6	7	9	9	7	7	8	9	0	9	8+	7	5
Preemergence																											
Lorox/Linex	P	2	5	5	5	5	5	0	0	0	0	0	2	7	0	6	8	8	5	5	6	9	9	9	9	6	8
Prowl/Pendimax	R	2	8	8	8	8	8	6	6	2	0	0	0	0	0	2	2	0	0	2	8	8	9	3	4	8	

1Acetochlor, alachlor, and premixes of these with atrazine are available from a number of manufacturers - see corn herbicide descriptions for more information. Grass weed control ratings presented here for acetochlor are for Degree products, which can provide a longer period of grass control compared to other acetochlor products. Broadleaf weed control ratings assume an atrazine rate of 1.5 lbs ai/A - the atrazine rate in some premix products may be lower.

2Metolachlor and s-metolachlor, and premixes of these with atrazine, are available from a number of manufacturers - see corn herbicide descriptions for more information. Metolachlor products have undergone limited testing at their labeled rates in OSU and Purdue University research.

Table 5. Weed Response to Herbicides in Corn (continued)

	Mode of Action	Grasses										Broadleaf Weeds																
		Crop Tolerance	Barnyardgrass	Crabgrass	Fall Panicum	Giant Foxtail	Yellow Foxtail	Shattercane	Seedling Johnsongrass	Rhizome Johnsongrass	Quackgrass	Yellow Nutsedge	Annual Morningglory	Black Nightshade	Burcucumber	Cocklebur	Common Ragweed	ALS-resistant common ragweed	Giant Ragweed	ALS-resistant giant ragweed	Jimsonweed	Lambsquarters	Triazine-Resistant Lambsquarters	Pigweed (redroot)	Smartweed	Velvetleaf	Waterhemp	Canada Thistle
Postemergence																												
2,4-D	G	2	0	0	0	0	0	0	0	0	0	9	7	3	9	9	9	9	9	7	9	9	9	9	6	8	8	6
Accent	A	1	8+	4	8+	9	9	9	9	9	9	6	8	0	8	5	0	0	0	0	8	5	5	9	8	5	7	6
Aim	D	2	0	0	0	0	0	0	0	0	0	8	8	3	3	6	6	3	3	3	7	7	8+	5	9	7	2	
Atrazine	P	1	7	5	5	8	8	2	0	0	7	7	9	9	8	9	9	9	8	8	9	9	0	9	9	8	9	6
Basagran	P	0	3	0	0	0	0	0	0	0	8	4	3	2	9	7	7	6	6	9	6	6	4	9	8+	4	7	
Basis	A	2	7	6	7	7	7	7	4	-	-	6	0	-	7	6	0	0	0	4	8	8	9	8	9	5	5	
Basis Gold	A/P	2	8+	4	8	9	8	9	9	6	7	6	8+	7	8	7	9	8	7	7	8	9	5	9	9	7	8	7
Beacon	A	2	2	4	8	7	7	9	9	7	8+	6	6	8	9	9	9	0	9	0	9	5	5	9	8	8	5	6
Bromoxynil	P	1	0	0	0	0	0	0	0	0	0	8	9	7	9	9	9	8	8	9	9	9	7	8	8	6	6	
Bromoxynil+Atrazine	P/P	1	2	2	0	2	2	0	0	0	2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	7+	
Callisto	M	1	0	7*	0	0	0	0	0	0	5	7	9	-	7	8	8	9	9	-	9	9	8	9	9	9	5	
Celebrity Plus	A/G	2	8+	4	8+	9	9	9	9	9	7	9	8	8+	9	9	9	9	9	9	9	9	9	9	8	8	9	
Dicamba	G	2	0	0	0	0	0	0	0	0	0	9	8	7	9	9	9	9	9	9	9	9	9	8	7+	8	7	
Dicamba+atrazine	P/G	2	2	2	0	2	2	0	0	0	2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7+	
Distinct	G	2	6	6	6	6	6	0	0	0	0	9	8	7	9	9	9	9	9	9	9	9	9	8+	8	8	9	
Equip	A	2	8+	7	7+	9	7	9	8+	8	3	8	9	8	9	9	0	8	0	8+	8	8	9	7	9	5	6	
Exceed	A	1	0	0	7	5	5	9	5	5	5	7+	8	9	9	9	0	9	0	9	8	8	9	9	9	5	6	
Glyphosate ³	E	0	8	8	8	9	9	9	9	9	7	6	8	8	9	8+	8+	8+	8+	9	8+	8+	9	8	8	9	9	
Hornet	A/G	1	0	0	0	0	0	0	0	0	0	7	7	6	9	9	9	9	9	7	7+	7+	7+	9	8+	5	8+	
Laddok	P/P	1	2	2	0	2	2	0	0	0	8+	8	8	6	9	9	9	9	9	9	9	5	9	9	9	8	7+	
Liberty ²	L	0	7	8	8	9	7	8	8	7	6	5	8	9	8	9	9	9	9	9	8	8	8	9	8	8	6	
Liberty ATZ ²	P/L	0	7	7	7	9	7	7	7	7	6	9	9	8	9	9	9	9	9	9	9	8	8	9	9	9	7+	
Lightning ¹	A/A	1	7	7	7	8	8	8+	8+	7	3	5	7+	9	6	9	7	0	8	0	8+	8+	8+	9	9	9	5	6
NorthStar	A/G	2	2	4	7	6	6	9	9	6	7	5	8	9	9	9	9	7	9	6	9	9	9	9	9	8+	8	7
Option	A	1	8+	7	8	9	7	9	9	8+	8+	3	5	9	8	7	7	0	5	0	8	7	7	8	6	8	5	5
Permit	A	1	0	0	0	0	0	0	0	0	0	9	6	4	5	9	8	0	8	0	8	5	5	9	7	8	5	6
Priority	A/D	2	0	0	0	0	0	0	0	0	0	9	8	8	5	9	8	6	8	3	8	7	7	9	8	9	6	6
Resource	D	2	0	0	0	0	0	0	0	0	0	4	4	4	7	7	7	4	4	7	7	7	9	4	9	7	3	
Shotgun	P/G	2	5	3	3	6	6	0	0	4	5	9	9	7	9	9	9	9	9	9	9	9	9	9	9	8+	9	3
Spirit	A	2	2	2	7	6	6	9	9	6	7	5	7	8	9	9	9	0	9	0	9	6	6	9	8+	8+	5	6
Starane	G	1	0	0	0	0	0	0	0	0	0	9	7	7	8	9	9	0	0	7	0	0	0	7	8	0	0	
Steadfast	A	2	8	4	8	9	9	9	9	8	8	5	6	0	7	6	4	0	3	0	6	4	4	9	7	5	5	6
Steadfast ATZ	A/P	2	8	7	8	9	9	9	9	8	8	7	8+	7	8	9	9	8	8	7	9	9	4	9	9	8	6	
Stinger	G	0	0	0	0	0	0	0	0	0	0	0	8	2	9	9	9	9	9	9	8	0	0	0	5	0	0	9
WideMatch	G	1	0	0	0	0	0	0	0	0	0	9	7	7	9	9	9	9	9	8	0	0	0	7	8	0	8	
Yukon	A/G	2	0	0	0	0	0	0	0	0	9	8	7	7	9	9	7	9	7	9	8	8	8	9	9	9	8	7

¹Apply to Clearfield (imidazolinone-resistant or tolerant) corn only.

²Apply to Liberty Link (glufosinate-resistant) corn only.

³Apply to Roundup Ready (glyphosate-tolerant) corn only.

*Large crabgrass only

Mode of action: A= ALS inhibitor; C= ACCase inhibitor; D= cell membrane disruptor; G= growth regulator; P= photosynthesis inhibitor; S= shoot meristem inhibitor; R= root meristem inhibitor; L= glutamine synthetase inhibitor; E= EPSP synthase inhibitor; M= pigment inhibitor

Corn: Soil-Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation	Product Rate Range
AAtrex/atrazine	4L 90DF	2 - 4 pt 1.1 - 2.2 lb

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

- Mode of action: photosynthesis inhibitor.
- Atrazine is generally applied at a rate of 1.4 to 2 pounds active ingredient per acre to control broadleaf weeds.
- Low rates may result in reduced control of velvetleaf, cocklebur, giant ragweed, and morningglory. Rates approaching 2 pounds active ingredient may be necessary for velvetleaf control. Atrazine will not control fall panicum, regardless of rate.
- Maximum soil-applied rate on soils not highly erodible is 2 pounds of active ingredient per acre. Maximum rate on highly erodible soils is 2 pounds active ingredient on fields with at least 30% crop residue, and 1.6 pounds active ingredient on fields with less than 30% crop residue. Soil applications may be followed with a postemergence application of atrazine, but total of all treatments cannot exceed 2.5 pounds active ingredient per acre per year.
- Preplant application of atrazine with crop oil concentrate and/or nitrogen fertilizer solution can control small, emerged annual weeds.
- Plant only corn or sorghum the year (including fall) of atrazine application.
- Where oats, forage legumes, or forage grasses will be planted the following spring, do not apply more than 0.8 pounds active ingredient per acre.

Herbicide	Formulation
Acetochlor	various

Tank-mix with: most preemergence corn broad-leaf herbicides - see labels.

- Acetochlor (plus safener) is sold under various trade names, including Harness, TopNotch, Surpass, Degree, Confidence, and Volley.
- Acetochlor controls annual grasses, pig-weed, and black nightshade, and control or suppresses yellow nutsedge, lambsquarters, and common ragweed. Control of lambsquarters and common ragweed will generally be less effective compared to most broadleaf herbicides, but more effective than other acetamide herbicides.
- Mode of action: shoot meristem inhibitor.
- Can be applied to field corn, popcorn, and production seed corn, but should generally not be used on corn seed stock. See labels for precautions.
- Degree and TopNotch are encapsulated products that can provide a longer period of annual grass control compared to other acetochlor products.
- Acetochlor products can be applied after planting but prior to weed emergence, and before corn height exceeds 11 inches. All acetochlor products except Degree must be applied using water as the spray carrier after the corn has emerged.

Degree 3.8L Use Rates (pts/A)		
Soil Textural Group	Less than 3% OM	3% or more OM*
Coarse	2.25 to 3.25	3.25
Medium	3.25 to 4.25	3.25 to 4.25
Fine	3.25 to 4.25	4.25 to 5.0

*On soils with 6 to 10% organic matter use 4.25 to 6.25. If soils have more than 10% organic matter, use 6.25.

Harness/Confidence 7EC Broadcast Rate (pt/A) ^a		
Soil texture	Organic Matter Content	
	Less than 3% OM	3% or more OM ^b
Coarse	1.25 to 1.75 pt	1.75 pt
Medium	1.75 to 2.25 pt	1.75 to 2.25 pt
Fine	1.75 to 2.25 pt	2.25 to 2.75 pt

a. Use higher rate in recommended range in areas of high weed infestations.

b. On soils with 6 to 10% OM use 2.5 to 3.4 pt/A. On soils with more than 10% OM use 3.4 pt/A.

Surpass/Volley 6.4EC Use Rates (pt/A) in Conventional Tillage Systems When Applied within 14 Days Before Planting ^a		
Soil Textural Group	Less than 3% OM	3% OM or Greater
Coarse	1.5 to 2.25	1.5 to 2.5
Medium	1.5 to 2.5	1.5 to 2.5
Fine	1.5 to 2.75	2 to 3

a. Use higher end of rate range if OM content is at higher end of rate range or under anticipated heavy weed infestations.

Corn: Soil-Applied Herbicides — Preplant or Preemergence

- Degree or Degree plus atrazine can be applied to emerged corn in water or nitrogen fertilizer solution, but corn should not exceed 6 inches in height if fertilizer solution is used as the carrier. Do not apply in fertilizer solution when air temperatures exceed 85 degrees. Mixtures with products other than atrazine should be applied only in water if the corn has emerged. Leaf burn may occur when acetochlor is applied to emerged corn.

Surpass/Volley 6.4EC Use Rates (pt/A) in Reduced or No-till System or Conventional Systems When Applied More than 14 Days Before Planting

Soil Textural Group	Soil Organic Matter Content	
	Less than 3% OM	3% OM or Greater
Coarse	2	2
Medium	2 to 2.5	2.5
Fine	3	3

TopNotch 3.2L Use Rates (qt/A)

Soil Textural Group	Time from Application to Planting			
	Less than 10 Days	10 to 30 Days	30 to 40 Days	After planting &/or Emergence
Coarse	2	2 to 2.5 ^a	2.5 ^a	2
Medium	2 to 2.5	2.5	2.5 to 3	2 to 2.5
Fine	2.5 to 3	2.5 to 3	3 to 3.75	2.5 to 3

a. On coarse textured soils with less than 3% OM the maximum use rate is 2.25 qt/A.

Herbicide

Formulation

Acetochlor + atrazine

Various

Tank-mix with: Most other preemergence broadleaf corn herbicides - see labels.

Degree Xtra 4L Use Rates (qts/A)

Soil Textural Group	Rate
Coarse	2.9
Medium*	2.9 to 3.7
Fine*	3.2 to 3.7

*In areas of heavy weed pressure rates can be increased to 4.3 qts/A

- Acetochlor plus atrazine (plus safener) is sold under various trade names, including Harness Xtra, Degree Xtra, FulTime, Keystone, Confidence Xtra, and Volley ATZ. These premix products control annual broadleaf and grass weeds in corn. The ratio of atrazine to acetochlor varies with product, and some products require the addition of atrazine or another broadleaf herbicide for effective control of some broadleaf weeds.

FulTime 4L Use Rates (qt/A) in Conventional Tillage Systems When Applied within 14 Days Before Planting

Soil Textural Group	Less than 3% OM	3% OM or Greater
Coarse	2.5 to 2.7	2.7 to 3
Medium	2.7 to 3.3	3 to 3.3
Fine	3 to 3.5	3 to 5

- Degree Xtra and FulTime are encapsulated formulations that can provide a longer period of annual grass control compared to other acetochlor products.

- Mode of action: photosynthesis inhibitor (atrazine), shoot meristem inhibitor (acetochlor).

- Can be applied to field corn, popcorn, and production seed corn, but should generally not be used on corn seed stock. See labels for precautions.

- Can be applied after planting and before corn height exceeds 11 inches and before weeds reach the 2-leaf stage. When tank-mixing with postemergence herbicides to control larger weeds, follow the most restrictive label with regard to maximum corn size.

FulTime 4L Use Rates (qt/A) in Reduced or No-till System or Conventional Systems When Applied More than 14 Days Before Planting

Soil Textural Group	Time from Application to Planting		
	Greater than 10 Days Before Planting	Less than 10 Days Before or After Planting	After Planting and/or Emergence
Coarse	Do not apply more than 14 days before planting	2.5 to 3	2.5 to 3
Medium	2.7 to 4	2.7 to 3.3	2.7 to 3.3
Fine	3.3 to 5	3 to 5	3 to 4

Corn: Soil-Applied Herbicides — Preplant or Preemergence

- All acetochlor products except Degree Xtra should be applied using water as the spray carrier after the corn has emerged.
- Degree Xtra can be applied in water or nitrogen fertilizer solution, but corn should not exceed 6 inches in height if fertilizer solution is used as the carrier. Do not apply in fertilizer solution when air temperatures exceed 85 degrees. Mixtures with products other than atrazine should be applied only in water if the corn has emerged. Leaf burn may occur when applied to emerged corn.
- Can be mixed with Balance to improve control of velvetleaf, annual grasses, triazine-resistant lambs-quarters, and burcucumber. See Balance description for precautions to avoid crop injury.

Harness Xtra/Confidence Xtra 5.6L Broadcast Rate (qt/A) ^a		
Soil texture	Less than 3% OM	3% or more OM
Coarse	1.4	1.7
Medium	1.7 to 2.4	2.3 to 2.6
Fine	2.3 to 2.6	2.3 to 3.0

a. In areas of heavy infestations use up to 2.3 qt/A on coarse-textured soils and 2.3 to 3.0 qt/A on medium- and fine-textured soils, but do not exceed 2.5 qt/A on highly erodible soils with less than 30% plant residue.

Keystone/Volley ATZ 5.25L Use Rates in Conventional Tillage (qt/A)		
Soil Texture	Less Than 3% OM	3% OM or More
Coarse	2.2 to 2.4	2.4 to 2.6
Medium	2.4 to 2.8	2.6 to 2.8
Fine	2.6 to 3.0	2.6 to 3.4

Herbicide	Formulation	
Alachlor	Various	
Tank-mix with:	Atrazine, simazine, Hornet, dicamba, Marksman, pendimethalin, Lorox, Senacor, Balance Pro.	
■	Alachlor controls annual grasses and pigweed, and controls or suppresses yellow nutsedge and black nightshade. Product trade names include Lasso and Micro-Tech among others.	
■	Mode of action: shoot meristem inhibitor.	
■	Micro-Tech can be applied after corn emergence until the corn is 5 inches tall, but should be applied before weeds have passed the 2-leaf stage in a mixture with atrazine. Can be applied to emerged corn in water or nitrogen fertilizer solution. Do not apply in fertilizer solution when air temperature exceeds 85 degrees. Other alachlor products and combinations should be applied in water after the corn has emerged. Leaf burn may occur when applied to emerged corn.	
■	Incorporation to 2 inches will improve yellow nutsedge control and reduce dependence upon rainfall.	

Lasso Use Rates (qt/A) ^a		
Soil Textural Group	Less Than 3% OM	Greater Than 3% OM
Coarse	2 to 2.25	2 to 2.25
Medium	2 to 2.75	2 to 2.75
Fine	2 to 2.75	2.5 to 3.25

a. Use higher rate in the recommended range in areas of heavy weed infestations. Use a minimum of 2.5 qt/A on coarse-textured soils and 3 to 4 qt/A on medium or fine textured soils to control black or hairy nightshade. On coarse soils with 10% or more organic matter use 4 qt/A. On muck or peat soils use 4 qt/A.

Corn: Soil-Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation
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Alachlor + atrazine

various

- Alachlor + atrazine is available from various manufacturers, and includes products such as Lariat and Bullet. Bullet is a microencapsulated formulation, which may provide more effective control than Lariat and other non-encapsulated products in no-till situations.
- Mode of action: photosynthesis inhibitor (atrazine), shoot meristem inhibitor (alachlor).
- Lariat can be applied in water, and Bullet can be applied in water or 28% liquid nitrogen fertilizer, after planting until weeds reach the 2-leaf stage and when corn is no more than 5 inches tall. Application of Bullet in 28% should not be made if temperature exceeds 85 F. Leaf burn may occur when applied to emerged corn.

Bullet Broadcast Rate (qt/A) ^a		
Soil texture	Less than 3% OM	3% or more OM
Coarse	2.5	3
Medium	3	3.75
Fine	3.75	3.75 to 4.5

Lariat Use Rates (qt/A) ^a		
Soil Textural Group	Less Than 3% OM	Greater Than 3% OM
Coarse	2.5	3
Medium	3	3.75
Fine	3.75	3.75 to 4.5

^aIn areas of heavy infestations use 4 to 5 qt/A, but do not exceed 4.25 qt/A on highly erodible soils with less than 30% plant residue.

Herbicide	Formulation
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Axiom

68DF

Tank-mix with: Atrazine, dicamba, Hornet, pendimethalin, dicamba+atrazine, Sencor, Balance Pro, Python, Define.

- Axiom is a premix of flufenacet (Define) plus metribuzin (Sencor) for control of annual grasses, lambsquarters, and pigweed. Axiom controls or suppresses waterhemp, black nightshade, and yellow nutsedge. Axiom is more effective than other grass herbicides (Dual, Harness etc) for early-season suppression of common ragweed and smartweed.
- Mode of action: shoot meristem inhibitor (flufenacet), photosynthesis inhibitor (metribuzin).
- Do not apply after corn has emerged.
- Incorporation to a depth of 2 inches will improve yellow nutsedge control and reduce dependence upon rainfall.

Axiom (68% DF) Use Rates (oz/A) in Conventional Tillage Applications Made Within Two Weeks Prior to Planting ^a					
Soil Textural Group ^b	Soil Organic Matter Content				
	< 0.5%	0.5 to 1%	1 to 1.5%	1.5 to 3%	> 3%
Coarse	8 oz	8 to 10 oz	10 to 12 oz	13 oz	15 oz
Medium	10 to 15 oz		15 to 18 oz		17 to 20 oz
Fine	20 to 22 oz				20 to 23 oz

a. Use next higher rate under heavy surface residue, heavy weed pressures, or when soil OM is at the upper end of range. If soil pH is >7.4, use the lower rate of the rate range shown. Not recommended for peat or muck soils.

b. For more information refer to the "Rate Selection/Soil Texture" section of the label.

Axiom (68% DF) Use Rates (oz/A) in Conservation, Minimum, and No-till Systems; or Conventional Tillage System Applications Made Greater Than Two Weeks Prior to Planting ^a					
Soil Textural Group ^b	Soil Organic Matter Content				
	< 0.5%	0.5 to 1%	1 to 1.5%	1.5 to 3%	> 3%
Coarse	9 oz	9 to 11 oz	11 to 13 oz	14 oz	16 oz
Medium	11 to 18 oz		18 to 20 oz		19 to 22 oz
Fine	20 to 23 oz				

a. Use next higher rate under heavy surface residue, heavy weed pressures, or when soil OM is at the upper end of range. If soil pH is >7.4, use the lower rate of the rate range shown. Not recommended for peat or muck soils.

b. For more information refer to the "Rate Selection/Soil Texture" section of the label.

Corn: Soil-Applied Herbicides —Preplant or Preemergence

Herbicide	Formulation
Balance Pro	4L

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

■ Balance Pro (isoxaflutole) can be applied preplant or preemergence for control of annual broadleaf weeds, including velvetleaf, pigweed, waterhemp, burcucumber, black nightshade, smartweed, lambsquarters (including triazine-resistant), and common ragweed. Balance is not effective for control of cocklebur, giant ragweed, and morningglory, but may help control these weeds in a tank-mix with atrazine.

■ Mode of action: pigment inhibitor.

■ Provides limited early-season control of annual grasses, allowing a reduction in the rate of companion grass herbicides (Dual, Harness, Surpass, etc).

■ Can be applied up to 30 days prior to planting of LibertyLink, Roundup Ready, or Clearfield hybrids where a postemergence treatment is planned.

■ A mix of Balance Pro plus atrazine (1 lb ai/A) will control small, emerged annual weeds (2 inches or less), including field pennycress, shepherd's-purse, chickweed, henbit, and marestail. Apply with crop oil concentrate or nitrogen fertilizer solution as the carrier to maximize burndown activity. Tank-mix with 2,4-D, Gramoxone, or glyphosate for improved burndown activity on larger weeds.

■ Isoxaflutole has occasionally injured corn, but severe injury has been fairly rare. Conditions that increase the risk of injury include high rainfall, cold temperatures, coarse-textured soils, and shallow planting. To reduce the risk of injury, do not exceed recommended rate for soil type, plant corn at least 1 1/2 inches deep, and make sure seed is completely covered with soil and the seed furrow is firmed.

■ Seed corn inbreds vary in their tolerance; consult seed company before using Balance Pro on seed corn inbreds.

Balance Pro Use Rates (fl oz/A) ^a						
	Soil Texture					
	Coarse Soils ^b		Medium Soils ^b		Fine Soils	
	<1.5% OM ^d	>1.5% OM	<1.5% OM	>1.5% OM	<1.5% OM	>1.5% OM
EPP or PPI; applied 8 to 21 days before planting	Not recommended	1.5 to 3.0	2.25 to 3.75	3.0 to 3.75	3.75 to 4.5	3.75 to 4.5
EPP, PPI, or PRE; applied 0-7 days before planting	Not recommended	1.5 to 1.88	1.88 to 2.76	2.25 to 3.0	2.25 to 3.0	2.25 to 3.0

a. Potential tank mix partners include, but not limited to: Dual, Dual II, Dual II Magnum, Frontier, Harness, Lasso, Surpass, and Topnotch.

b. When applied preemergence to medium soils with pH greater than 7.5, reduce the rate by 0.25 fl oz/A.

c. Balance Pro may be applied up to 30 days before planting when used in a planned sequential application program.

d. Not recommended for coarse soils with less than 1.5% OM or pH greater than 7.5.

Herbicide	Formulation	Product Rate Range
Callisto	4L	6 - 7.7 oz

Tank-mix with: Atrazine, most acetamide grass herbicides and acetamide/atrazine premix products.

■ Callisto (mesotrione) can be applied preplant or preemergence for control of many annual broadleaf weeds, including lambsquarters (including triazine-resistant), Pennsylvania smartweed, pigweeds, waterhemp, velvetleaf, and black nightshade. Callisto has limited activity on giant ragweed, cocklebur, and morningglory, but may help control these weeds in a tank-mix with atrazine.

■ Mode of action: pigment inhibitor.

■ Callisto does not control grass weeds, and should be applied in combination with Harness, Dual, TopNotch, or another acetamide grass herbicide, or an acetamide/atrazine premix (Bicep II, Magnum, Degree Xtra, etc.).

■ Can be applied preplant, preemergence, or postemergence to field corn, seed corn, and yellow popcorn. Do not apply to sweet corn or white popcorn.

■ Postemergence rate should not exceed 3 oz/A. To avoid crop injury, do not apply postemergence with emulsifiable concentrate herbicides or methylated seed oils. To avoid injury to yellow popcorn, apply with crop oil concentrate (do not add fertilizer solution) after crop emergence.

Corn: Soil-Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation
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Define

4SC

Tank-mix with: Atrazine, simazine, Hornet, Lorox, dicamba, pendimethalin, Sencor, dicamba+atrazine, Balance Pro.

- Define (flufenacet) can be applied preplant or preemergence for control of annual grass weeds, and partial control of black nightshade, pigweed, and waterhemp.
- Mode of action: shoot meristem inhibitor.
- Can be applied postemergence up to the V5 corn stage.

Define Use Rates (oz/A) for Conventional Tillage Systems when Applied within 2 Weeks of Planting^a		
Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	15	17 oz
Medium	17 to 19	19 to 22 oz
Fine	22 to 24	22 to 25 oz
a. Use higher rate within recommended rate range for heavy weed pressures, heavy surface plant residues, and/or when soil OM is at upper end of range.		

Define Use Rates (oz/A) for Conservation, Minimum, and No-till Systems; or Conventional Tillage Systems When Applied Greater than 2 Weeks before Planting^a		
Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	16	18 oz
Medium	19 to 22	22 to 24 oz
Fine	24 to 25	24 to 25 oz
a. Use higher rate within recommended rate range for heavy weed pressures, heavy surface plant residues, and/or when soil OM is at upper end of range.		

Corn: Soil Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation
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Epic 58DF

Tank-mix with: Atrazine, Hornet, Axiom, Define, dicamba+atrazine, dicamba.

■ Epic is a premix of flufenacet (Define) plus isoxaflutole (Balance) that controls annual grasses and many annual broadleaf weeds. Epic is weak on giant ragweed, cocklebur, and annual morningglories, and should be tank-mixed with atrazine to improve control of these weeds. See Balance and Define descriptions for more information.

- Mode of action: shoot meristem inhibitor (flufenacet), pigment inhibitor (isoxaflutole).
- Apply to field corn or corn grown for silage only.
- Do not apply after corn has emerged or severe injury may occur.
- Epic can injure corn under adverse environmental conditions and on coarse-textured soils. To avoid injury, do not exceed recommended rate for closed.

Epic Use Rates (oz/A) for Coarse Textured Soils				
Conventional tillage, Conservation tillage, and No-till Systems^a				
Soil Organic Matter (% by Weight)				
Application Timing	<1.5%	1.5 to 2	2 to 3%	>3%
Preemergence (PRE)				
Preplant (surface or incorporated) 0 to 7 days before planting	DO NOT USE	6 to 8 oz	8 to 9 oz	8 to 10 oz
Preplant (surface or incorporated) 8 to 21 days before planting		7 to 9 oz	9 to 10 oz	9 to 11 oz

a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.

Epic Use Rates (oz/A) for Medium Textured Soils			
Conventional tillage, Conservation tillage, and No-till Systems^a			
Soil Organic Matter (% by Weight)			
Application Timing	<1.5%	1.5 to 2	>2%
Preemergence (PRE)			
Preplant (surface or incorporated) 0 to 7 days before planting	DO NOT USE	7 to 10 oz	9 to 13 oz
Preplant (surface or incorporated) 8 to 21 days before planting		9 to 11 oz	11 to 15 oz

a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.

Epic Use Rates (oz/A)^a for Fine Textured Soils		
Conventional tillage, Conservation tillage, and No-till Systems		
Soil Organic Matter (% by Weight)		
Application Timing	<1.5%	>1.5
Preemergence (PRE)		
Preplant (surface or incorporated) 0 to 7 days before planting	10 to 11 oz	11 to 15 oz
Preplant (surface or incorporated) 8 to 21 days before planting	11 to 13 oz	12 to 17 oz

a. Use the higher rate of Epic within the applicable rate range under any of the following conditions: high soil OM, heavy surface plant residues, heavy weed pressure, or when applying no-till or EPP. Use the lower rate of Epic within the applicable rate range under any of the following conditions: low soil OM, increased tillage and/or incorporation of surface plant residues, or preplant applications made near the minimum interval prior to planting.

Corn: Soil Applied Herbicides — Preplant or Preemergence

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Guardisman Max 5L

Tank-mix with: Dicamba, dicamba+atrazine, Outlook, Atrazine, pendimethalin, simazine, Accent, Sencor.

- Guardsman Max is a premix of dimethenamid-P (Outlook) plus atrazine for control of annual grass and broadleaf weeds in corn.
- Mode of action: photosynthesis inhibitor (atrazine), shoot meristem inhibitor (dimethenamid).
- Can be applied early postemergence to corn that is up to 12 inches tall. Weeds should be less than 1 1/2 inches tall, unless other products are tank-mixed with Guardsman Max to control larger emerged weeds.
- Can be applied to emerged corn with surfactant or low rates of liquid nitrogen fertilizer. Do not use liquid fertilizer as the spray carrier after the crop has emerged. Crop oil concentrate may be included in postemergence applications only when Guardsman Max is applied alone or in combination with atrazine.

Guardisman Max Use Rates (pt/A) as Determined by Soil CEC^{ab}

Soil CEC	pt/A
< 5	2.4 to 2.8
5 to 9	2.8 to 3.2
10 to 14	3.2 to 3.6
15 to 20	3.6 to 4.4
> 20	3.8 to 4.6

- a. Reduced rates may be used when a POST herbicide application or cultivation is planned. For reduced rates, use 2-2.5, 2.5-3, and 3-3.5 pt/A on coarse, medium, and fine soil, respectively.
- b. For EPP applications use 4.75-5 pt/A. Do not exceed 4.75 pt/A on highly erodible soils with less than 30% plant residue cover prior to crop emergence.

Guardisman Max Use Rates (pt/A) as Determined by Soil Texture and Soil Organic Matter^{ab}

Soil texture	Organic Matter Content	
	Less than 3%	3% or more ^c
Coarse	2.4 to 2.8	2.8 to 3.4
Medium	2.8 to 3.4	3.4 to 4.2
Fine	3.4 to 4.0	4.0 to 4.6

- a. Reduced rates may be used when a POST herbicide application or cultivation is planned. If reduced rates are used, use 2-2.5, 2.5-3, and 3-3.5 pt/A on coarse, medium, and fine soil, respectively.
- b. For EPP applications use 4.75-5 pt/A. Do not exceed 4.75 pt/A on HEL with <30% plant residue cover prior to crop emergence.
- c. On soils with 8-20% organic matter, use 4.75-5 pt/A. Not recommended for soils with more than 20% OM.

Herbicide Formulation

Hornet 78.5WDG

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

- Hornet is a premix of flumetsulam (Python) plus clopyralid (Stinger). In addition to the broadleaf weeds controlled by Python, Hornet controls cocklebur and common ragweed. Expect partial control of giant ragweed.
- Mode of action: ALS inhibitor (flumetsulam), growth regulator (clopyralid).
- Hornet can be tank-mixed at a rate of 3 to 4 oz/A with atrazine premix products (Bicep, Harness Xtra, etc) to improve control of triazine-resistant lambsquarters and other broadleaf weeds.
- Apply preplant, preemergence, or at the spike stage. When using the rates shown here, apply before the corn is 2 inches tall. Preplant application with crop oil concentrate can control emerged Canada thistle and small annual broadleaf weeds, including mustards, shepherd's-purse, ragweeds, and Pennsylvania smartweed.
- Do not apply to sweet corn or popcorn. Inbred lines should be tested for crop tolerance before treating large acreages.
- Hornet can injure corn, especially when growing conditions are unfavorable soon after application. This injury appears as stunting, temporary yellowing, and reduction in root growth. To avoid injury, plant at least 1 1/2 inches deep and do not use Hornet in soils with an average of less than 1 1/2 percent organic matter.
- Soil-applied organophosphate insecticides may increase the risk of crop injury, especially when applied in-furrow. To avoid injury, apply insecticides in a band or T-band. Do not use Hornet if Thimet has been or will be applied to the corn.
- Corn treated with Hornet that is stressed or damaged by herbicide or other factors should not be treated with Accent, Permit, Exceed, Basis, Beacon, or other ALS-inhibiting herbicides.
- Do not apply where soil pH is greater than 7.8. Do not apply to soils with a combination of pH less than 5.9 and organic matter content greater than 5%.

Hornet WDG Use Rates (oz./A)^a

Soil Textural Group	Less Than 3% OM	Greater Than 3% OM
Coarse	4	4 to 5
Medium or Fine	4 to 5	5 to 6

- a. Use higher rate in range on soils with >3% OM and/or when applications are made 14 to 30 days before planting.

Corn: Soil Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation	Product Rate Range
Lumax	4L	2.5 - 3 qts
Lexar	3.7L	3 - 3.5 qts

Tank-mix with: Atrazine, simazine.

- Lumax and Lexar are premixes of atrazine plus s-metolachlor (Dual II Magnum) plus mesotrione (Callisto) for control of grass and broadleaf weeds in corn. See descriptions for these products for more information.
- Mode of action: photosynthesis inhibitor (atrazine); shoot meristem inhibitor (s-metolachlor); pigment inhibitor (mesotrione).
- Controls most annual broadleaf weeds, but expect partial control of giant ragweed, cocklebur, and annual morningglory.
- Lumax can be applied preplant (up to 14 days before planting), preemergence, or postemergence before field and seed corn exceeds 5 inches in height. Broadleaf weeds should be less than 3 inches tall at the time of postemergence application. Control of emerged grasses (up to 1.5 inches tall) will require additional atrazine.
- Lexar can be applied preplant, preemergence, or postemergence before field and seed corn exceeds 12 inches in height. Broadleaf weeds should be less than 5 inches tall at the time of postemergence application. Control of emerged grasses (up to 1.5 inches tall) will require additional atrazine.
- Nonionic surfactant can be used when Lumax is applied to emerged corn. Use of crop oil concentrate may result in temporary crop injury. Do not apply with methylated seed oil or nitrogen based adjuvants (AMS, UAN, etc) or use fertilizer solution as the carrier after corn has emerged.
- Do not apply postemergence to corn treated with an organophosphate insecticide at planting. Do not apply in a tank-mix with an organophosphate or carbamate insecticide or within 7 days before or after an application of these types of insecticides.

Herbicide	Formulation
S-metolachlor	7.64E
Metolachlor	7.8E

Soil Textural Group	Less than 3% OM	3% or more OM
Coarse	1.0 to 1.33	1.33
Medium	1.33 to 1.67	1.33 to 1.67
Fine	1.33 to 1.67	1.67 to 2.0

Tank-mix with: Atrazine, simazine, Hornet, Lorox, dicamba, pendimethalin, Sencor, dicamba+atrazine, Balance Pro.

- S-metolachlor (Dual II Magnum, Cinch) and metolachlor (Stalwart C, Parallel) control annual grasses and pigweed, and control or suppress waterhemp, black nightshade, and yellow nutsedge.

Soil Texture	Less Than 3% OM	3% OM or More
Coarse	0.85 to 1	1
Medium	1 to 1.33	1.33
Fine	1.33	1.33 to 1.67

- Stalwart and Parallel have undergone limited testing in OSU and Purdue

University field research. Dual II Magnum includes primarily the S isomer of metolachlor, which allows the use of lower rates of active ingredient compared to a mix of S and R isomers. The mix of S and R metolachlor isomers in Stalwart and Parallel is similar to Dual/Dual II, which should result in similar use rates. Stalwart and Parallel use rates are similar to Dual II Magnum, however, and are lower than use rates of Dual/Dual II. All of the products listed contain a safener to reduce the risk of corn injury. Dual II Magnum contains benoxacor as the safener and Stalwart contains dichlormid as the safener.

- Mode of action: shoot meristem inhibitor.
- Can be applied preplant or preemergence before the crop and weeds emerge. Can be applied broadcast with atrazine up to 5-inch corn or as a directed spray up to 12-inch corn, and before grass and broadleaf weeds exceed the 2-leaf stage. Do not apply using fertilizer solution as the spray carrier after the corn has emerged.
- May be applied up to 30 days before planting as a single application.
- Incorporation to a depth of 2 inches will improve yellow nutsedge control and reduce dependence upon rainfall.

Corn: Soil Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation
S-metolachlor + atrazine	5.5L
Metolachlor + atrazine	5.5L

■ S-metolachlor plus atrazine (Bicep II Magnum, Cinch ATZ) and metolachlor plus atrazine (Stalwart Xtra) control annual grass and broadleaf weeds in corn.

■ Stalwart Xtra has undergone limited testing in OSU and Purdue University field research. Bicep II Magnum includes primarily the S isomer of metolachlor, which allows the use of lower rates of active ingredient compared to a mix of S and R isomers. The mix of S and R metolachlor isomers in Stalwart Xtra is similar to Bicep/Bicep II, which should result in similar use rates. Stalwart Xtra use rates are similar to Bicep II Magnum, however, and are lower than use rates of Bicep/Bicep II. All of the products listed contain a safener to reduce the risk of corn injury. Bicep II Magnum contains benoxacor as the safener and Stalwart Xtra contains dichlormid as the safener.

■ Mode of action: photosynthesis inhibitor (atrazine), shoot meristem inhibitor (s-metolachlor/metolachlor).

■ Can be applied preplant, preemergence, and after corn emergence until corn plants are 5 inches tall and before weeds exceed the 2-leaf stage. Do not apply using fertilizer solution as the spray carrier after the crop emerges.

■ Bicep/Cinch ATZ can be applied postemergence in rescue situations (large weeds) to corn that is 4 to 12 inches tall in combination with Exceed, Exceed plus Accent, or Spirit.

Bicep II Magnum/Cinch ATZ Use Rates (qt/A)		
Soil Texture	Less Than 3% OM	3% OM or More
Coarse – sand, loamy sand, and sandy loam	1.3	1.6
Medium – loam, silt loam, and silt	1.6	2.1
Fine – sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay	2.1	2.1 ^a
		2.1 to 2.6 ^{bc}
Muck or Peat soils (more than 20% OM)	Do Not Use	

a. Do not exceed this rate on highly erodible land (HEL) with less than 30% plant residue cover.

b. Use these rates for all other applications.

c. For cocklebur, yellow nutsedge, and velvetleaf control on fine-textured soils above 3% OM, apply 3.0 qt/A Bicep II.

Stalwart Xtra Use Rates (qt/A)		
Soil Texture	Less Than 3% OM	3% OM or More
Coarse	1.3	1.6
Medium	1.6	2.1
Fine	2.1	2.1 to 2.6

Herbicide	Formulation
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Outlook 6EC

Tank-mix with: Atrazine, pendimethalin, simazine, dicamba, dicamba+atrazine, Hornet, Sencor, Balance Pro.

Outlook Use Rates (fl oz/A)		
Soil Texture	Organic Matter Content	
	Less than 3%	3% or more
Coarse	10 to 14	14 to 18
Medium	14 to 16	16 to 20
Fine	16 to 18	18 to 21

■ Outlook (dimethenamid-P) controls annual grasses and pigweed, and controls or suppresses yellow nutsedge and black nightshade.

■ Mode of action: shoot meristem inhibitor.

■ Can be applied after crop emergence, but must be applied before weed emergence, or in a tank mixture with herbicides that control emerged weeds. Do not apply to corn that is more than 12 inches tall.

■ May be applied after corn has emerged with surfactant or low rates of liquid nitrogen fertilizer. Do not use liquid fertilizer as the spray carrier after the crop has emerged. Crop oil concentrate should not be added after the crop has emerged unless specified for a particular tank mixture.

Corn: Soil Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation
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Princep/simazine	4L 90DF
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Tank-mix with: Atrazine, acetochlor, Dual II Magnum, Lasso, Bullet, Surpass, Outlook, Guardsman Max, MicroTech, Sencor.

Princep 4L Use Rates (pt/A)	
Soil Texture	pt/A
Sand, silt, and loam that is low in organic matter	4
Soil containing moderate amounts of clay and organic matter	4.8
Loam high in OM & clay (i.e. dark prairie soils of Corn Belt)	6
Peat, muck, and high-organic clay	8

- Simazine is often applied at reduced rates in combination with atrazine or atrazine premix products to improve or extend grass control.
- Mode of action: photosynthesis inhibitor.
- Simazine is more effective than atrazine for control of fall panicum and crabgrass, but is less effective for control of cocklebur, quackgrass, yellow nutsedge, velvetleaf, and giant ragweed.
- Can be applied at a rate of 1 lb active ingredient/A in the fall prior to corn planting for control of winter annual weeds such as chickweed, mustards, and deadnettle. Apply with 2,4-D for best results. If weeds are more than an inch or two tall, apply with Gramoxone or glyphosate.

Herbicide	Formulation
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Python	80WDG
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Tank-mix with: Most other preplant/preemergence corn herbicides.

Python Use Rates (oz/A)	
Soil Textural Group	Ounces per acre
Coarse	0.80 to 1.0 oz.
Medium or Fine	0.89 to 1.33 oz.

a. See Python label for use rates for specific weed species and specific soil organic matter content.

- Python (flumetsulam) controls annual broadleaf weeds, including triazine-resistant lambsquarters and velvetleaf. Control of common ragweed and cocklebur is variable, and control of giant ragweed and annual morningglory is usually poor.
- Mode of action: ALS inhibitor.
- Reduced rates of Python can be tank-mixed with atrazine premix products (Bicep, Harness Xtra, etc) to improve control of triazine-resistant lambsquarters.
- Do not apply to soils with a combination of pH less than 5.9 and organic matter content greater than 5%. Do not apply where soil pH is greater than 7.8.
- Python can injure corn, especially when growing conditions are unfavorable soon after application. This injury appears as stunting, temporary yellowing, and reduction in root growth. To avoid injury, plant at least 1 1/2 inches deep and do not use Python in soils with an average of less than 1 1/2 percent organic matter.
- Soil-applied organophosphate insecticides may increase the risk of crop injury, especially when applied in-furrow. To avoid injury, apply insecticides in a band or T-band. Do not use Python if Thimet has been or will be applied to the corn.
- Corn treated with Python that is stressed or damaged by herbicide or other factors should not be treated with Accent, Permit, Exceed, Basis, Beacon, or other ALS-inhibiting herbicides.
- Do not apply to sweet corn or popcorn. Inbred lines should be tested for crop tolerance before treating large acreages.

Corn: Soil Applied Herbicides — Preplant or Preemergence

Herbicide	Formulation	Product Rate Range
Sencor	75DF	2 - 5 1/3 oz
	4L	3 - 8 oz

Tank-mix with: Most other corn herbicides.

- Sencor (metribuzin) is labeled for application with other corn herbicides to improve residual control of broadleaf weeds, including lambsquarters, pigweed, common ragweed, Pennsylvania smartweed, and velvetleaf. In tank-mixes with 2,4-D, Gramoxone, and/or atrazine, Sencor can also improve burndown of emerged weeds in no-till.
- Mode of action: photosynthesis inhibitor.
- Apply before or after planting, but before corn emergence. Application rates increase when applied more than 10 days before planting.
- Observe the following precautions to avoid corn injury: Do not apply where soil pH is 7.0 or greater or on coarse-textured soils with less than 1 1/2% organic matter; do not apply more than 4 ounces/A of Sencor DF on soils with less than 2% organic matter; plant corn seed at least 1 1/2 inches deep.
- Sencor can be used on field corn and in hybrid seed corn production fields. Both inbred lines should have known tolerance to Sencor before using in seed production.

Corn: Soil-Applied Herbicides —Preemergence Only

Herbicide	Formulation	Product Rate Range
Lorox	50DF	2/3 - 3 lb
Linex	4L	2/3 - 3 pts

Tank-mix with: Atrazine, Lasso, Bullet, Dual II Magnum, MicroTech, Surpass, Sencor.

- Lorox/Linex (linuron) controls broadleaf weeds. Linuron is generally applied at a rate of 3/4 to 1 lb/A in combination with other corn herbicides for control of triazine-resistant pigweed and lambsquarters.
- Mode of action: photosynthesis inhibitor.
- Do not use on soils with more than 3 percent organic matter.
- Apply after corn planting, but before emergence.
- To avoid injury, corn should be planted at least 1 3/4 inches deep and adequately covered with soil.
- Do not spray over the top of emerged corn.

Herbicide	Formulation
Prowl/Pendimax	3.3EC
Prowl H2O	3.8CS

Tank-mix with: Atrazine, dicamba, Lariat, Bullet, Dual II Magnum, Lasso, dicamba+atrazine, Bicep, MicroTech, acetochlor, Outlook, Guardsman Max, Sencor.

Prowl/Pendimax Use Rates (pt/A)			
Soil Texture	Soil Organic Matter Content ^a		
	Less than 1.5%	1.5% to 3%	More than 3%
Coarse	1.8 to 2.4	2.4 to 3.6	3.6
Medium	2.4 to 3.6	3.6	3.6 to 4.8
Fine	2.4 to 3.6	3.6 to 4.8	3.6 to 4.8

a. Use the high rate for each soil classification when using Prowl 3.3 EC alone.

Prowl H2O Use Rates (pt/A)			
Soil Texture	Soil Organic Matter Content ^a		
	Less than 1.5%	1.5% to 3%	More than 3%
Coarse	2.0	3.0	3.0
Medium	3.0	3.0	4.0
Fine	3.0	4.0	4.0

- Prowl/Pendimax (pendimethalin) controls annual grasses, pigweed, and lambsquarters (including triazine-resistant biotypes), and helps control smartweed, velvetleaf, and seedling johnsongrass. Pendimethalin is often combined with atrazine for control of grass and broadleaf weeds where triazine-resistant pigweed and lambsquarters are a problem.
- Mode of action: root meristem inhibitor.
- Can be applied early postemergence on field corn, popcorn, and sweet corn up to the spike stage. See label for details.
- Apply only after planting. Do not incorporate or severe corn injury may result.
- To reduce the risk of corn injury, plant at least 1 1/2 inches deep and ensure good seed to soil contact. Combining pendimethalin with dicamba may increase the potential for crop injury, especially when corn is under stress from cool, wet conditions.

Corn: Postemergence Herbicides — Contact

Herbicide	Formulation	Product Rate Range
AimEW	1.9L	0.5 oz

Tank-mix with: Most other corn herbicides - see label.

- Aim (carfentrazone-ethyl) is a contact herbicide that controls black nightshade, velvetleaf, redroot pigweed, and small annual morningglories and lambsquarters. Aim is often tank-mixed with other broadleaf herbicides to improve control of velvetleaf.
- Mode of action: cell membrane disruptor.
- Apply when weeds are 1 to 4 inches tall for best results. Velvetleaf can be controlled up to 36 inches tall. Apply before corn exceeds the 8-collar stage.
- Apply with nonionic surfactant (0.25% v/v). UAN (2 to 4 gallons/100 gallons) or ammonium sulfate (2 to 4 lbs/A) can be added if recommended for use with other herbicides in a mix with Aim. In general, Aim should not be tank-mixed with crop oil concentrate or EC formulations of other herbicides or excessive crop injury may occur. The label does allow use of crop oil concentrate under dry conditions and in specific tank mixtures. Application with Buctril may cause unacceptable crop injury.
- Aim can be applied with drop nozzles to seed corn production fields. Avoid directing herbicide into the whorl.
- Aim can be applied to sweet corn, but the user assumes all responsibility for herbicide tolerance. Consult seed supplier about sweet corn tolerance to Aim prior to use.
- Apply in a spray volume of 10 to 20 gpa with a pressure of 20 to 40 psi. Flat fan nozzles are recommended for adequate spray coverage.
- Add Aim to the spray tank before adding other products.
- Aim usually causes leaf speckling and necrosis. The severity of injury varies with environmental conditions, adjuvants, and tank-mix partner. To reduce injury, 1) do not apply within 6 to 8 hours of rain, 2) make sure spray nozzles are positioned at least 18 inches above the crop, and 3) avoid direction of excessive amounts of herbicide into corn whorls.

Herbicide	Formulation	Product Rate Range
AAtrex/atrazine	4L 90DF	1 1/2 - 2 qt 1.67 - 2.22 lb

Tank-mix with: Dicamba, bromoxynil, 2,4-D, Basagran, Accent, Beacon, Sencor, Steadfast.

- Mode of action: photosynthesis inhibitor.
- Maximum rate for postemergence application to fields without soil-applied atrazine in the same year is 2 pounds active ingredient/A. When applied postemergence to fields with soil-applied atrazine the same year, total amount of atrazine applied may not exceed 2.5 pounds active ingredient.
- Annual broadleaf weeds are more susceptible than annual grasses.
- For grass control, apply when grasses are no more than 1 1/2 inches tall. Rates of 2 pound active ingredient/A are generally required for grass control. Atrazine will not control fall panicum.
- For control of broadleaf weeds, rates of 1.2 pounds active ingredient may be sufficient. Apply until broadleaf weeds are 4 inches tall.
- Apply atrazine with 1 quart per acre crop oil concentrate for best results. Mix atrazine with water first, and add oil last.
- Postemergence applications must be made before the crop reaches 12 inches in height.

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

Tank-mix with: Atrazine, Sencor.

- Basagran (bentazon) is a contact herbicide that controls many annual broadleaf weeds, including cocklebur, velvetleaf, and Pennsylvania smartweed. Basagran controls or suppresses Canada thistle and yellow nutsedge.
- For best results, apply with crop oil concentrate when weeds are in the 2- to 6-leaf stage.
- Apply in combination with atrazine for control of pigweed, lambsquarters, and ragweeds.

Corn: Postemergence Herbicides — Contact

Herbicide	Formulation	Product Rate Range
Bromoxynil	2S	1 - 1 1/2 pt

Tank-mix with: Atrazine, 2,4-D, Accent, Beacon, dicamba, Stinger, Sencor, Permit, Exceed, Hornet, Callisto.

- Bromoxynil is sold under the trade names Buctril, Moxy, and Broclean. Bromoxynil is a contact herbicide that controls many annual broadleaf weeds, including black nightshade, cocklebur, ragweeds, lambsquarters, and smartweed, but is weak on pigweed and large velvetleaf.
- Mode of action: photosynthesis inhibitor.
- Apply at a rate of 1 pint per acre from corn emergence until tassel emergence. The 1 1/2-pint rate may be applied after corn reaches the 4-leaf stage and before tassel emergence. Maximum corn size at the time of application varies with the tank-mix partner.
- Do not apply to seed corn inbreds or popcorn prior to the 3-leaf stage.
- Do not use surfactant or crop oil when applying bromoxynil alone or with most other herbicides. Nonionic surfactant and fertilizer solution are allowed in some tank mixtures.
- Apply in a minimum volume of 10 gpa at a minimum pressure of 30 psi using flat fan nozzles.
- May cause corn leaf burn, but effects are usually temporary.

Herbicide	Formulation	Product Rate Range
Buctril/atrazine Moxy/atrazine	3L	1 1/2 - 3 pt

Tank-mix with: Accent, dicamba, 2,4-D, Stinger, Beacon, Callisto.

- These products are 1:2 premixes of bromoxynil plus atrazine for control of most broadleaf weeds.
- Mode of action: photosynthesis inhibitor.
- Can be applied at a rate of 1 1/2 to 2 pints per acre after corn emergence and before corn is 12 inches tall. The 3-pint rate may be applied after corn reaches the 4-leaf stage and before corn is 12 inches tall.
- Do not use surfactant, crop oil, liquid fertilizers, or other additives when applying Buctril/atrazine or Moxy/atrazine alone or with most other herbicides. Nonionic surfactant and fertilizer solution are allowed in some tank mixtures.
- Apply in a volume of at least 10 gallons per acre at a minimum pressure of 30 psi using flat fan nozzles.

Herbicide	Formulation	Product Rate Range
Laddok S-12	5L	1 1/3 - 2 1/3 pt

Tank-mix with: 2,4-D LVE, atrazine, Stinger, dicamba, Sencor.

- Laddok/Headline is a 1:1 premix of bentazon (Basagran) plus atrazine for control of most broadleaf weeds, and suppression or control of yellow nutsedge, Canada thistle, and some perennial vines.
- Mode of action: photosynthesis inhibitor.
- Application rate varies with weed species and size. Apply with UAN (urea ammonium nitrate) solution, ammonium sulfate, nonphytotoxic oil concentrate, or Dash. The label allows combinations of spray additives, which vary with the weed species present. UAN or ammonium sulfate should be added when velvetleaf is the target weed, and may also improve control of cocklebur and Pennsylvania smartweed. Crop oil concentrate should also be added when common lambsquarters or common ragweed is present. Crop oil concentrate or Dash should be used when Canada thistle, yellow nutsedge, or field bindweed is present.
- Apply in a spray volume of at least 10 gpa with a minimum pressure of 40 psi. Increasing the spray volume (up to 50 gpa) will improve control when the crop and weed foliage is dense.
- To suppress Canada thistle, apply 2 1/3 pints when thistle plants are 8 to 10 inches tall until the bud stage.
- A single application of 2 1/3 pints of Laddok can suppress yellow nutsedge that is 1 to 4 inches tall.
- Provides better control of velvetleaf, annual morningglory, lambsquarters, and pigweed than Basagran alone, but is no more effective on triazine-resistant lambsquarters.

Corn: Postemergence Herbicides — Contact

Herbicide	Formulation	Product Rate Range
Resource	0.86EC	4 to 6 oz (broadcast) 4 to 8 oz (directed)

Tank-mix with: Accent, dicamba, atrazine, 2,4-D, Exceed, dicamba+atrazine.

- Resource (flumiclorac) is a contact herbicide that controls velvetleaf (up to 10 inches tall) and pigweeds. Control of lambs-quarters is variable, and some other broadleaf weeds will be suppressed.
- Mode of action: cell membrane disruptor.
- Apply when corn is in the 2- to 10-leaf stage and broadleaf weeds are in the 2- to 3-leaf stage for best results. Use a directed spray if corn size prevents adequate spray coverage of weeds.
- Crop oil concentrate should be included when Resource is applied alone. Use 1 pint/A for broadcast application and 1 quart/A for directed application. Nitrogen fertilizer solution or ammonium sulfate can also be added to improve control of large velvetleaf. Adjuvant recommendations vary with the tank-mix partner. See the label for more information.
- Apply in a spray volume of at least 10 gpa with a spray pressure of 30 to 60 psi.
- Allow 1 hour between application and rainfall.

Herbicide	Formulation	Product Rate Range
Sencor	75DF	1.6 - 3 oz

Tank-mix with: Basagran, 2,4-D, dicamba, bromxynil, Buctril/atrazine, Laddok, atrazine, dicamba+atrazine, Resource, Hornet.

- Mode of action: photosynthesis inhibitor.
- Applying Sencor in combination with one of the postemergence herbicides listed above allows a reduction in the rate of the tank-mix partner and improves control of some annual and perennial broadleaf weeds.
- The 2 ounce rate can be applied broadcast to corn in combination with Basagran (up to 1 pint/A), 2,4-D (up to 1/2 pint/A), dicamba (up to 1 pint/A), dicamba+atrazine (up to 2 pints/A), Laddok (up to 1 2/3 pints/A) or atrazine (up to 1 1/2 lbs/A). When applying broadcast with Buctril, use a Sencor rate of 1.6 to 2 ounces/A. Sencor rates greater than 2 ounces/A must be applied post-directed only in combination with Buctril or up to 3/4 pint of 2,4-D.
- Maximum corn size at the time of application depends upon the tank-mix partner. See label for more information.
- Do not apply with crop oil concentrate. Nitrogen fertilizer solution or ammonium sulfate can be used in tank-mixes with Basagran. Use of nonionic surfactant is allowed with atrazine and dicamba. Do not use any spray additives when mixing with Buctril.
- Do not use on popcorn, sweet corn, or corn inbreds grown for seed.
- This treatment can result in temporary yellowing or leaf burn, especially when corn is under stress. Do not apply when corn and weeds are not actively growing or when corn is under stress.

Corn: Postemergence Herbicides — Systemic

Herbicide	Formulation	Product Rate Range
Accent SP	75DF	2/3 oz (1 packet per 4 acres)

Tank-mix with: Bromoxynil, dicamba, dicamba+atrazine, atrazine, Buctril+atrazine, Beacon, Resource, Exceed, Callisto.

- Accent (nicosulfuron) is a translocated sulfonylurea herbicide that controls annual and perennial grasses and some annual broadleaf weeds, including foxtails, fall panicum, johnsongrass, quackgrass, shattercane, Pennsylvania smartweed, pigweed, and annual morningglory. Accent does not control crabgrass. Application of Accent with a dicamba product will suppress or control many perennial broadleaf weeds..
- Mode of action: ALS inhibitor.
- Accent is labeled for use on field corn, popcorn, seed corn, and some sweet corn hybrids grown for processing. Growers should contact seed suppliers for recommendations and information on crop tolerance and use of soil-applied organophosphate insecticides prior to Accent use on popcorn or seed corn. Do not apply to any white popcorn inbred or hybrid unless approved by the seed supplier. Accent can be used on High Lysine, Waxy, White or other Food Grade hybrids. A list of approved sweet corn hybrids is available from DuPont.
- Accent can be applied broadcast or as a directed spray to field corn that is up to 20 inches tall or up to 6 collars (whichever occurs first). Apply as a directed spray when corn is 20 to 36 inches tall. Do not apply to corn that is at or past the 10-collar stage or more than 36 inches tall.
- Accent can be applied broadcast to popcorn or seed corn that is less than 20 inches tall or up to 6 collars (whichever occurs first). Do not apply to popcorn or seed corn that is more than 20 inches tall.
- OSU research has shown it can be difficult to achieve adequate season-long weed control with a single postemergence application of herbicides with limited residual activity (such as Accent). Applying a reduced rate of a preplant or preemergence herbicide prior to postemergence herbicide application will result in more consistent control of longer duration.
- For best results, apply Accent with crop oil concentrate (1 gallon/100 gallons spray) plus nitrogen fertilizer solution (28% - 2 to 4 quarts/A) or ammonium sulfate (2 to 4 lbs/A). Substituting a methylated seed oil (Meth Oil, Priority MSO, Sun-It II, for example) for crop oil concentrate can improve control under drought-stressed conditions. Nonionic surfactant (1 to 2 qts/100 gallons spray) can also be used instead of crop oil if required in a tank-mix with another herbicide.
- Apply in a spray volume of at least 10 gpa with a pressure of 20 to 40 psi. Increase volume to at least 15 gpa in heavy weed pressure. Avoid spraying excessive amounts of herbicide directly into the corn whorl.
- Apply when grasses are at the following heights: foxtails and fall panicum — 2 to 4 inches; quackgrass — 4 to 10 inches; shattercane and seedling johnsongrass — 4 to 12 inches; rhizome johnsongrass — 8 to 18 inches.
- Control of yellow and green foxtail may be reduced in some tank-mixes with broadleaf herbicides. Consult the label for spray additive recommendations when tank-mixing with broadleaf herbicides, and follow the most restrictive label with regard to maximum corn size at the time of application.
- Control may be reduced if applied during conditions of drought stress, abnormally hot or cold weather, when daytime temperatures do not exceed 50 degrees, or following periods of large day/night temperature fluctuations.
- Where Accent is applied to corn previously treated with soil applications of organophosphate insecticides, temporary crop injury may occur. Do not tank-mix Accent with foliar-applied organophosphate insecticides or with Basagran, Laddok, or 2,4-D. Do not apply these materials within 7 days before through 3 days after applying Accent.

Herbicide	Formulation	Product Rate Range
Basis	75DF	1/3 oz (1 packet per 4 acres)

Tank-mix with: Atrazine, dicamba, dicamba+atrazine, pendimethalin.

- Basis is a premix of rimsulfuron plus thifensulfuron (Harmony GT), translocated sulfonylurea herbicides. Basis controls small annual grasses and a few broadleaf weeds, and provides a few weeks of residual control of foxtails, lambsquarters, and pigweeds.
- Mode of action: ALS inhibitor.
- Apply when field corn is in the spike to 2-collar (approx. 6 inches) stage and before grass weed height exceeds 2 inches. Grasses controlled include foxtails, barnyardgrass, and fall panicum. A cultivation is generally required following Basis application for effective grass control. In OSU research, Basis has provided only fair control of grasses without cultivation.
- Controls smartweeds, lambsquarters, pigweed, and velvetleaf that are 1 to 3 inches tall. Basis should be tank mixed with another postemergence herbicide if other broadleaf weeds are present.

Corn: Postemergence Herbicides — Systemic

- Apply in a minimum spray volume of 15 gpa with a pressure of 20 to 40 psi. Include nonionic surfactant (1 to 2 quarts/100 gallons) plus nitrogen fertilizer solution (28% - 2 to 4 quarts/100 gallons) or ammonium sulfate (2 to 4 lb/100 gallons). Crop oil concentrate (1 to 2 gallons/100 gallons) can be substituted for surfactant under drought conditions.
- Basis may cause temporary crop injury, including stunting and bleaching of new growth. Risk of injury increases if corn is treated after the 2-collar stage.
- Do not apply to seed corn, popcorn, or sweet corn.

Herbicide	Formulation	Product Rate Range
Basis Gold	89.5DF	14 oz (1 packet per 4 acres)

Tank-mix with: Accent, dicamba, Hornet, Distinct, Callisto.

- Basis Gold is a premix of nicosulfuron (Accent), rimsulfuron, and atrazine for control of broadleaf and grass weeds in corn. See descriptions for the component herbicides for more information.
- Mode of action: ALS inhibitor (nicosulfuron, rimsulfuron), photosynthetic inhibitor (atrazine).
- Controls giant and green foxtail, fall panicum, and barnyardgrass up to 3 inches tall, yellow foxtail up to 2 inches tall, shattercane up to 6 inches tall, and quackgrass up to 4 inches tall. Does not control crabgrass. Control of larger annual or perennial grass weeds with Basis Gold is less effective than the labeled rate of Accent.
- Controls most annual broadleaf weeds up to 3 or 4 inches tall, including ragweeds, cocklebur, velvetleaf, lambsquarters (except triazine-resistant), pigweeds, waterhemp, Pennsylvania smartweed, and annual morningglories. Tank-mixing with a dicamba product generally improves control of broadleaf weeds, and is necessary for large annual broadleaf weeds or perennial broadleaf weeds.
- Can be applied to field corn up to 12 inches tall, or before 6 collars are present, whichever occurs first. Do not apply to seed corn, popcorn, or sweet corn.
- Apply with crop oil concentrate (1 gallon/100 gallons spray) plus liquid nitrogen fertilizer (1 to 2 quarts/A) or ammonium sulfate (2 lbs/A). Substituting a methylated seed oil (Meth Oil, Priority MSO, Sun-It II, for example) for crop oil concentrate may improve control under drought-stressed conditions. Mixtures with some herbicides (Clarity) can be applied using nonionic surfactant instead of crop oil concentrate, but a reduction in grass control may occur.
- OSU research has shown it can be difficult to achieve adequate season-long weed control with a single postemergence application of herbicides with limited residual activity (such as Basis Gold). Applying a reduced rate of a preplant or preemergence herbicide prior to postemergence herbicide application will result in more consistent control of longer duration.
- Apply in a spray volume of at least 15 gpa with a spray pressure of 20 to 40 psi. Increase spray volume and pressure as weed density and size increase. Flat fan or Turbo Floodjet nozzles are recommended.
- To avoid a reduction in grass control or crop injury, do not tank-mix with 2,4-D, Basagran, Laddok, or organophosphate insecticides.
- Where Basis Gold is applied to corn previously treated with soil applications of organophosphate insecticides, temporary crop injury may occur. Application of Basis Gold to corn treated with Thimet may cause severe crop injury.

Herbicide	Formulation	Product Rate Range
Beacon	75DF	3/8 - 3/4 oz

Tank-mix with: Bromoxynil, 2,4-D, dicamba, Accent, Atrazine, Marksman, Buctril+atrazine, Resource.

- Beacon (primisulfuron) is a translocated sulfonyleurea herbicide that controls or suppresses annual and perennial grasses and controls annual broadleaf weeds. Beacon provides only partial control of foxtail species and may be less effective than Accent for rhizome johnsongrass and quackgrass control, but is generally more effective than Accent for broadleaf weed control. Does not control ALS-resistant weeds.
- Mode of action: ALS inhibitor.
- Mixtures of Beacon plus dicamba or 2,4-D will suppress a number of perennial broadleaf weeds.
- Beacon is labeled for use on field corn, popcorn, and seed corn. Popcorn and inbred lines grown for seed may be severely injured by Beacon and should be thoroughly tested for potential sensitivity to Beacon before treating large acreage. Do not use Beacon on sweet corn.
- Apply broadcast or as a directed spray when field corn is between 4 and 20 inches tall, and as a directed spray after corn is 20 inches tall and before tassel emergence. All applications to inbred lines and popcorn should be made post-directed or semi-directed (nozzles positioned to avoid placing spray in whorl) after corn is 10 inches tall but before tassel emergence.

Corn: Postemergence Herbicides — Systemic

- Apply with nonionic surfactant (0.25% v/v) or crop oil concentrate (1 to 4 pints per acre); crop oil concentrate is generally the preferred additive. Liquid nitrogen fertilizer (2 to 4 quarts/A) or ammonium sulfate (2 to 4 lbs/A) may be added, but should not substitute for surfactant or oil concentrate. Crop oil concentrate plus nitrogen fertilizer can be use when tank-mixing with atrazine, Accent, or 2 oz/A or less of dicamba. Most other tank-mixes should be applied with nonionic surfactant. See label for detailed information on tank-mixing.
- Apply when grasses are at the following heights: shattercane and seedling johnsongrass — 4 to 12 inches; rhizome johnsongrass — 8 to 16 inches; quackgrass — 4 to 8 inches; fall panicum — less than 2 inches. Beacon will control common and giant ragweed that are 2 to 9 inches tall. Most other broadleaf weeds should be 1 to 4 inches tall when Beacon is applied.
- Do not make a foliar postemergence or a soil application of any organophosphate insecticide within 10 days before or 7 days after Beacon application.

Herbicide	Formulation	Product Rate Range
Callisto	4L	3 oz

Tank-mix with: Atrazine, Liberty, Liberty ATZ, Basagran, Accent, Accent Gold, Basis Gold, Steadfast, bromoxynil.

- Callisto (mesotrione) is a systemic herbicide that controls annual broadleaf weeds, including cocklebur, atriplex, lambsquarters (including triazine-resistant), giant ragweed, Pennsylvania smartweed, pigweeds, waterhemp, velvetleaf, and black nightshade. Callisto alone does not provide consistent control of common ragweed or morningglory. The addition of atrazine (1/2 pint) improves control of a number of weeds, and is required for consistent control of common ragweed and morningglory. Where corn is more than 12 inches tall and atrazine cannot be used, a mixture of Callisto plus Buctril can improve control of ragweeds.
- Mode of action: pigment inhibitor.
- Apply when weeds are less than 5 inches tall for best results. Apply with atrazine (1/2 pint) if weeds are more than 5 inches tall.
- Callisto can be applied to field corn, seed corn, and yellow (not white) popcorn up to 30 inches tall or the 8-leaf stage. Callisto plus atrazine can be applied to corn up to 12 inches tall.
- Apply with crop oil concentrate (1% v/v) plus UAN (2.5% v/v) or AMS (8.5 lb/100 gallons). Do not use methylated seed oil (MSO) or MSO blend adjuvants. To avoid injury to yellow popcorn, apply with crop oil concentrate alone (do not add fertilizer solution) after crop emergence.
- Apply in a spray volume of 10 to 30 gpa, but use a volume of at least 20 gpa if weed foliage is dense.
- To avoid severe crop injury, do not apply Callisto postemergence if the corn was previously treated with Lorsban. Do not tank-mix Callisto with organophosphate or carbamate insecticides. Do not make a foliar application of any organophosphate or carbamate insecticide within 7 days before or after a postemergence Callisto application. Callisto can be applied postemergence in a tank-mix with pyrethroid insecticides.
- To avoid crop injury, do not apply Callisto postemergence in a tank-mix with emulsifiable concentrate grass herbicides (Dual II Magnum, etc).

Herbicide	Formulation	Product Rate Range
Celebrity Plus	75.3DF	4.7 oz

Tank-mix with: Accent, atrazine, Distinct.

- Celebrity Plus is a premix of nicosulfuron (Accent) plus Distinct (dicamba plus diflufenzopyr) that controls annual grass and broadleaf weeds in corn.
- Mode of action: acetolactate synthase inhibitor (nicosulfuron), growth regulator (dicamba), auxin transport inhibitor (diflufenzopyr).
- Apply with nonionic surfactant (1 to 2 qts/100 gallons) and 28% UAN (1 to 2 qta/A) or ammonium sulfate (1 to 2 lbs/A).
- Can be applied broadcast or as a directed spray to field corn that is up to 24 inches tall or up to 6 collars (whichever comes first). As with any dicamba product, risk of corn injury increases when corn exceeds 8 to 10 inches in height. To reduce risk of injury, make sure nozzle spacing and spray boom height are set to minimize interception of spray by the corn plants.

Corn: Postemergence Herbicides — Systemic

- Where Celebrity Plus is applied to corn previously treated with soil applications of organophosphate insecticides, temporary crop injury may occur.
- Most of the guidelines and restrictions on Accent and Distinct labels also apply to this product.

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

Tank-mix with: Most other postemergence corn herbicides - see labels.

- Dicamba is sold under a number of trade names, including Banvel, Clarity, Sterling, and Oracle. Dicamba is a translocated herbicide that controls many annual broadleaf weeds, including pigweeds, ragweeds, black nightshade, cocklebur, and Pennsylvania smartweed. Control of velvetleaf can be variable. Dicamba will control or suppress perennial broadleaf weeds, especially when applied with ALS inhibitor herbicides.
- Mode of action: growth regulator.
- Apply 1/2 to 1 pint when corn is in the spike to five-leaf stage, or until corn is 8 inches tall, whichever occurs first. Do not apply more than 1/2 pint on coarse-textured soils. If the 6th true leaf is emerging from the whorl, or corn is more than 8 inches tall, a rate of 1/2 pint can be applied until corn is 36 inches tall, or until 15 days before tassel emergence. Apply as a directed spray when corn leaves prevent proper spray coverage, or sensitive crops are growing nearby.
- The 1 pint rate provides limited residual broadleaf weed control.
- Apply with 1/2 to 1 gallon per acre of liquid nitrogen fertilizer solution (28%) when velvetleaf is a target weed. Can be applied with surfactant or crop oil to improve control in dry growing conditions. Do not apply with crop oil when corn exceeds 5 inches in height.
- With any dicamba product, risk of corn injury increases when corn exceeds 8 to 10 inches in height. To reduce risk of injury, make sure nozzle spacing and spray boom height are set to minimize interception of spray by the corn plants.
- Soybeans and vegetables are extremely susceptible to dicamba drift and vapors. Apply in a spray volume of 20 gpa at a pressure of less than 20 psi to reduce drift. Do not apply where sensitive crops are growing nearby if winds over 5 MPH are moving in the direction of sensitive crops, corn is more than 24 inches tall, soybeans are more than 10 inches tall, or soybeans have begun to bloom. Do not apply Sterling/Banvel/Oracle when air temperatures on the day of application will exceed 85 degrees.

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

Tank-mix with: See labels.

- Dicamba plus atrazine is sold under a number of trade names, including Marksman, Sterling Plus, Banvel-K+atrazine, and Stratos. These products control most annual broadleaf weeds, and suppress or control perennial broadleaf weeds.
- Mode of action: photosynthesis inhibitor (atrazine), growth regulator (dicamba).
- Apply when corn is in the spike to five-leaf stage, or until corn is 8 inches tall, whichever comes first. The rate is 3 1/2 pints on medium- or fine-textured soils with at least 2 percent organic matter, and 2 pints on coarse-textured soils. Provides some residual broadleaf weed control.
- The addition of crop oil, surfactant, or liquid nitrogen fertilizer may improve control, especially when weeds are drought-stressed. Apply with nitrogen fertilizer solution if velvetleaf is a target weed. Application with crop oils may cause crop injury. Do not apply with crop oil after corn exceeds 5 inches in height.
- Precautions on spray drift, volatility, and corn injury are the same as for dicamba. See dicamba description for more information.

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Herbicide	Formulation	Product Rate Range
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Distinct	76.4DF	4 - 6 oz
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Tank-mix with: See label.

- Distinct is a premix of dicamba (Clarity) plus diflufenzopyr for control of most annual broadleaf weeds in corn. Distinct can be weak on velvetleaf, although it is more effective than dicamba alone.
- Mode of action: growth regulator (dicamba), auxin transport inhibitor (diflufenzopyr).
- Distinct can control or suppress small annual grasses that have escaped preemergence herbicide treatments. Effectiveness on grasses is variable, and can be reduced under dry conditions.
- Distinct is generally more effective than other dicamba products on perennial broadleaf weeds, and has provided excellent control of Canada thistle and hedge bindweed in OSU research.
- Apply 6 oz/A when corn is 4 to 10 inches tall, and 4 oz/A when corn is 10 to 24 inches tall. As with any dicamba product, risk of corn injury increases when corn exceeds 8 to 10 inches in height. To reduce risk of injury, make sure nozzle spacing and spray boom height are set to minimize interception of spray by the corn plants.
- Apply with nonionic surfactant (0.25% v/v) plus UAN solution (1.25% v/v) or ammonium sulfate (5 lbs/100 gallons). To avoid mixing problems, add Distinct to spray tank before adding ammonium sulfate.
- Volatility of Distinct is similar to Clarity. Take precautions to avoid contact of Distinct with sensitive plants via drift or volatility. Exposure of soybeans to Distinct via sprayer contamination or spray particle drift will result in more severe injury compared to other dicamba products.

Herbicide	Formulation	Product Rate Range
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Equip	32WDG	1.5 oz
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Tank-mix with: See label.

- Equip is a premix of foramsulfuron (Option) plus iodosulfuron plus a safener for control of annual grass and broadleaf weeds.
- Mode of action: ALS inhibitor.
- Apply broadcast up the V5 corn stage. Can be applied as a directed spray using drop nozzles when corn is up to 36 inches tall or up to the V8 stage. Do not apply to seed corn, popcorn, or sweet corn.
- Apply when broadleaf weeds are 3 to 4 inches tall and grass weeds are at the following heights: foxtails, fall panicum - up to 3 inches; barnyardgrass - up to 4 inches; quackgrass, wirestem muhly - up to 6 inches; johnsongrass, shattercane - up to 8 inches.
- Apply in a spray volume of 10 to 20 gpa with a methylated seed oil (1.5 pts/A) plus 28% UAN (1.5 to 2 qts/A) or ammonium sulfate (1.5 to 3 lbs/A). For spray volumes of 15 gpa or greater, the methylated seed oil rate can be 1% v/v.
- Do not use Equip in the same season as Thimet. Application of Equip following an at-planting Lorsban application may result in temporary crop injury. Foliar applications of an organophosphate insecticide should not occur within 7 days of Equip application.

Herbicide	Formulation	Product Rate Range
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Exceed	57DF	1 oz (1 packet per 4 acres)
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Tank-mix with: Dicamba, 2,4-D, atrazine, bromoxynil, Buctril+atrazine, dicamba+atrazine, Beacon, Accent, Steadfast, Steadfast ATZ.

- Exceed is a premix of prosulfuron (Peak) plus primisulfuron (Beacon), translocated sulfonylurea herbicides. Exceed controls annual broadleaf weeds, including velvetleaf, ragweeds, cocklebur, Pennsylvania smartweed, burcucumber, and redroot pigweed. Exceed can suppress or control small (<2 inch) annual grasses in corn, and can control or suppress perennial broadleaf weeds. Most effective control/suppression of perennials will occur when tank-mixed with 2,4-D or a dicamba product. Exceed is weak on black nightshade, annual morningglories, and yellow nutsedge. Does not control ALS-resistant weeds.
- Mode of action: ALS inhibitor.

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- Exceed can occasionally carryover and injure soybeans grown the following year. Conditions increasing the risk of carryover include high soil pH, low rainfall and soil moisture for several months following application, and late-season application. Follow these guidelines to avoid carryover: 1) avoid use where soil pH is greater than 7.8. If used where soil pH is greater than 7.8, less than one inch of rain occurs within one month of application, or less than 12 inches of rain occurs within 5 months after application, plant only corn or small grains the following year; 2) north of Interstate 70, do not plant soybeans within 18 months of application (STS soybeans can be planted 10 months after application); 3) south of I-70, soybeans can be planted 10 months after application where soil pH is less than 7.8; and 4) do not apply after June 30. See label for guidelines on rotation to other crops.
- Control of lambsquarters can be variable, especially when tall or drought-stressed. Tank-mix with 2 to 4 ounces per acre of dicamba for more consistent control of lambsquarters. Crop oil concentrate can be used when the Banvel/Clarity rate is 2 oz/A or less; use nonionic surfactant with higher rates.
- Apply when annual broadleaf weeds are 1 to 5 inches tall for best results. Exceed will control seedling johnsongrass and shattercane that are 4 to 12 inches tall.
- Apply broadcast or directed when field corn is 4 to 30 inches tall. To avoid injury and improve spray coverage on weeds, apply as a directed spray using drop nozzles when corn is more than 20 inches tall.
- For popcorn, apply as a directed spray using drop nozzles when corn plants are 10 to 30 inches tall, and before tassel emergence. For seed corn inbreds, Exceed can be applied broadcast when corn is between 4 and 20 inches tall, or until the 6-collar stage, whichever occurs first. Use drop nozzles when seed corn inbreds are 20 to 30 inches tall and before tassel emergence. Inbred lines and popcorn hybrids should be thoroughly tested for sensitivity to Exceed before treating large acreages. Do not apply to sweet corn.
- Apply in a minimum spray volume of 10 gpa. Increasing the volume to 20 gpa can improve control in dense weed infestations.
- Apply with crop oil concentrate (1 to 4 pints/A) or nonionic surfactant (1 to 2 quarts/100 gallons). Nitrogen fertilizer solution (2 to 4 quarts/A) or AMS (2 lbs/A) may be added to improve control of velvetleaf and other weeds. Crop oil concentrate is generally more effective than nonionic surfactant. Use of a methylated seed oil (Meth Oil, Priority MSO, Sun-It II, for example) may improve control when weeds are large or drought-stressed.
- Do not make a foliar postemergence or a soil application of any organophosphate insecticide within 10 days before or 7 days after Exceed application.

Herbicide	Formulation	Product Rate Range
Hornet	78.5WDG	2 to 5 oz

Tank-mix with: Dicamba, 2,4-D, atrazine, bromoxynil, Basis Gold, Accent, Aim, Stinger, Steadfast, Option, Callisto, Steadfast, Steadfast ATZ.

- Hornet is a premix of flumetsulam (Python) plus clopyralid (Stinger), translocated herbicides, that controls annual broadleaf weeds and suppresses perennial broadleaf weeds. Hornet controls ragweeds, velvetleaf, cocklebur, Pennsylvania smartweed, and small marehail, but is not effective for control of lambsquarters, pigweeds, black nightshade, and annual morningglory. The higher rates can suppress or control some perennial weeds, including dandelion and Jerusalem artichoke.
- Mode of action: ALS inhibitor (flumetsulam), growth regulator (clopyralid).
- Hornet will control the above-ground growth of Canada thistle, but may be less effective than labeled rates of Stinger for long-term control of thistle. Tank-mixing Hornet with Stinger will improve long-term control. Apply before thistle plants are in the bud stage for best results.
- Apply broadcast when weeds are 2 to 8 inches tall and field corn is up to 20 inches tall or at the 6-collar stage, whichever occurs first. Hornet can be applied as a directed postemergence application using drop nozzles to corn that is 20 to 36 inches tall.
- Apply with nonionic surfactant (1 quart/100 gallons) or crop oil concentrate (1 gallon/100 gallons). Under dry conditions, the addition of nitrogen fertilizer solution (2 1/2 gallons/100 gallons) may improve control.
- Apply in a spray volume of 10 to 40 gpa with a spray pressure of 20 to 40 psi.
- To avoid severe crop injury, do not apply to corn previously treated with Thimet. Application to corn treated with other organophosphate insecticides may cause temporary crop injury. Do not tank-mix with foliar organophosphate insecticides, or apply insecticides within 10 days before or after Hornet application.
- Do not apply to corn that shows symptoms of injury from previously applied herbicides.
- Do not apply to popcorn or sweet corn. Corn inbred lines may be injured by Hornet.

Corn: Postemergence Herbicides — Systemic

Herbicide	Formulation	Product Rate Range
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NorthStar	47DF	5 oz
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Tank-mix with: Atrazine, Accent, Resource, dicamba, dicamba+atrazine.

- NorthStar is a premix of primisulfuron (Beacon) plus dicamba (Banvel) for control of most annual broadleaf weeds and suppression or control of annual and perennial grasses. NorthStar will suppress a number of perennial broadleaf weeds. See Beacon and dicamba descriptions for more information and precautions on use.
- Mode of action: ALS inhibitor (primisulfuron), growth regulator (dicamba).
- Can be applied broadcast or directed to field corn that is between 4 and 20 inches tall. Apply using drop nozzles when corn is 20 inches (V6) up to 36 inches tall or 15 days before tassel emergence, whichever occurs first.
- For popcorn and seed corn inbreds, apply as a directed spray using drop nozzles when corn is between 10 and 36 inches tall or 15 days before tassel emergence, whichever occurs first. Inbred lines and popcorn hybrids should be thoroughly tested for sensitivity to NorthStar before treating large acreages.
- Apply with nonionic surfactant (0.25% v/v) or crop oil concentrate (1 to 4 pints/A), but do not use crop oil concentrate if corn is more than 12 inches tall. Nitrogen fertilizer solution (2 to 4 qts/A) or ammonium sulfate (2 to 4 lbs/A) may also be added.

Herbicide	Formulation	Product Rate Range
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Option	35WDG	1 1/2 to 1 3/4 oz
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Tank-mix with: Atrazine, Beacon, dicamba, Distinct, Hornet, dicamba+atrazine, NorthStar, Spirit, Exceed, Callisto.

- Option (foramsulfuron + safener) is a translocated sulfonyleurea herbicide that controls annual grasses and a few small annual broadleaf weeds. Option should generally be mixed with another herbicide that has activity on broadleaf weeds unless grass weeds are the sole target.
- Mode of action: ALS inhibitor.
- Apply broadcast until field corn is in the V6 stage. Can be applied as a directed spray using drop nozzles when corn is 16 to 36 inches tall. Do not apply to sweet corn, popcorn, or seed corn.
- Apply when grass weeds are at the following heights: foxtails, fall panicum - up to 3 inches tall; barnyardgrass - up to 4 inches; quackgrass, wirestem muhly - up to 10 inches; shattercane - up to 12 inches; johnsongrass - up to 16 inches.
- Apply is a spray volume of 10 to 20 gpa with a methylated seed oil (1.5 pts/A) plus 28% UAN (1.5 to 2 qts/A) or ammonium sulfate (1.5 to 3 lbs/A). For spray volumes of 15 gpa or more, the methylated seed oil rate can be 1% v/v.
- Do not use Option in the same season as Thimet. Application of Option following an at-planting Lorsban application may result in temporary crop injury. Foliar applications of an organophosphate insecticide should not occur within 7 days of Option application.

Herbicide	Formulation	Product Rate Range
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Permit	75DF	2/3 to 1 1/3 oz
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Tank-mix with: Dicamba, dicamba+atrazine, 2,4-D, bromoxynil, Buctril+atrazine, Atrazine, Accent, Beacon, Steadfast, Steadfast ATZ.

- Permit (halosulfuron) is a translocated sulfonyleurea herbicide that controls yellow nutsedge and annual broadleaf weeds, including velvetleaf, ragweeds, cocklebur, and redroot pigweed. Permit is weak on lambsquarters and annual morningglories. A combination of Permit plus dicamba will improve control of these weeds and control or suppress perennial broadleaf weeds. Does not control ALS-resistant weeds.
- Mode of action: ALS inhibitor.
- Apply when field corn is in the spike through layby stage and most annual weeds are 1 to 6 inches tall for best results. When

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corn is more than 24 inches tall, tank-mixes of Permit with other postemergence corn herbicide should be applied with drop nozzles to ensure weed coverage and avoid spraying directly into the whorl. Follow the most restrictive label with regard to maximum corn size when tankmixing.

- Permit can be applied broadcast (2/3 oz/A) to sweet corn and popcorn in the spike through layby stage. Two applications are allowed per year, but the second should be applied with drop nozzles. Sweet corn and popcorn hybrids should be thoroughly tested for sensitivity to Permit before treating large acreages. Do not apply to the sweet corn variety 'Jubilee'. Do not apply when corn is under stress from environmental conditions.
- For control of yellow nutsedge, apply 1 to 1 1/3 ounces/A when nutsedge is 4 to 12 inches tall. Dense populations of nutsedge may require a second application.
- Apply in a minimum spray volume of 10 gpa with nonionic surfactant (1 to 2 quarts/100 gallons) or crop oil concentrate (1 gallon/100 gallons). Include nitrogen fertilizer solution (2 to 4 quarts/A) or AMS (2 to 4 lbs/A) when velvetleaf or redroot pigweed is present.
- Tank mixtures may cause temporary crop injury, especially when the tank-mix partner is Accent or Beacon. Do not apply in a tank-mix if the crop is under stress due to drought, water saturated soils, low fertility, hail, frost, insects, or when the maximum daytime temperature is above 92 degrees.

Herbicide	Formulation	Product Rate Range
Priority	62.5DF	1 oz

Tank-mix with: Most other herbicides - see labels.

- Priority is a premix of halosulfuron (Permit) plus carfentrazone (Aim) for postemergence control of broadleaf weeds and suppression of yellow nutsedge. See Permit and Aim descriptions for more information.
- Mode of action: ALS inhibitor (halosulfuron); cell membrane disruptor (carfentrazone).
- Can be applied to field corn, popcorn, seed corn, and sweet corn from emergence up to the 8-collar stage. Weeds should be less than 4 inches tall for best results.
- Apply with nonionic surfactant (0.25% v/v). Ammonium sulfate (2-4 lbs/A) or 28% UAN (2-4 qts/100 gallons) can be added, but will increase the severity of leaf speckling from the carfentrazone.

Herbicide	Formulation	Product Rate Range
Shotgun	3.25L	2 - 3 pints

- Shotgun is a premix of atrazine plus 2,4-D for postemergence control of many broadleaf weeds in corn.
- Mode of action: photosynthesis inhibitor (atrazine), growth regulator (2,4-D).
- Apply broadcast in a minimum spray volume of 10 gpa when corn is spike to 8 inches tall, and as a directed spray when corn is 8 to 12 inches tall. Treated corn may be brittle and subject to breakage by wind during the 2 weeks following application.
- Allow 6 hours between application and rainfall.
- Follow precautions to prevent drift and volatility of 2,4-D, which will injure nearby broadleaf plants. Volatility is more likely at air temperatures greater than 85 degrees.

Herbicide	Formulation	Product Rate Range
Spirit	57DF	1 oz (1 packet per 4 acres)

Tank-mix with: Dicamba, 2,4-D, atrazine, bromoxynil, Buctril+atrazine, dicamba+atrazine, Beacon, Accent, Steadfast, Steadfast ATZ.

- Spirit is a premix of prosulfuron (Peak) plus primisulfuron (Beacon), translocated sulfonylurea herbicides. The weed control spectrum of Spirit is similar to Exceed, but Spirit is likely to be less effective on lambsquarters and a few other broadleaf weeds. Tank-mixing with dicamba, 2,4-D, or Buctril/Moxy will improve annual weed control. Most effective control/suppression of perennial broadleaf weeds will occur when tank-mixed with 2,4-D or dicamba. Spirit is weak on annual morning-

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glories and yellow nutsedge. Does not control ALS-resistant weeds.

- Mode of action: ALS inhibitor.
- Most of the guidelines and label directions for Spirit use are similar to those for Exceed.
- Follow these guidelines to avoid carryover of Spirit to subsequent crops: 1) Avoid use where soil pH is greater than 7.8. If used where soil pH is greater than 7.8, plant only field corn or small grains the following year; 2) where less than one inch of rain occurs within one month of application, or less than 12 inches of rain occurs within 5 months after application, plant only corn, small grains, or STS soybeans the following year; 3) north of Interstate 80, do not plant soybeans within 18 months of application; 4) south of I-80, soybeans can be planted 10 months after application where soil pH is less than 7.8; and 5) do not apply after June 30. See label for guidelines on rotation to other crops.
- Apply broadcast or directed when field corn is 4 to 24 inches tall. To avoid injury and improve spray coverage on weeds, apply as a directed spray using drop nozzles when corn is more than 20 inches tall.
- For popcorn, apply as a directed spray using drop nozzles when corn plants are 10 to 24 inches tall, and before tassel emergence. For seed corn inbreds, Spirit can be applied broadcast when corn is between 4 and 20 inches tall, or until the 6-collared stage, whichever occur first. Use drop nozzles when seed corn inbreds are 20 to 24 inches tall and before tassel emergence. Inbred lines and popcorn hybrids should be thoroughly tested for sensitivity to Spirit before treating large acreages. Do not apply to sweet corn.
- Apply in a minimum spray volume of 10 gpa. Increasing the volume to at least 20 gpa can improve control in dense weed infestations.
- Apply with crop oil concentrate (1 to 4 pints/A) or nonionic surfactant (1 to 2 quarts/100 gallons). Liquid nitrogen fertilizer (2 to 4 quarts/A) or AMS (2 lbs/A) may be added to improve control of velvetleaf and other weeds. Crop oil concentrate is generally more effective than nonionic surfactant. Use of a methylated seed oil (Meth Oil, Priority MSO, Sun-It II, for example) may improve control when weeds are large or drought-stressed.

Herbicide	Formulation	Product Rate Range
Starane	1.5L	2/3 pt

Tank-mix with: See labels.

- Starane (fluroxypyr) is a translocated herbicide that controls hemp dogbane, common ragweed and a few other broadleaf weeds. Due to a relatively narrow spectrum of activity, Starane should be mixed with other herbicides to improve control of specific problem weeds.
- Mode of action: growth regulator.
- Apply broadcast up to the V5 stage of field corn and when weeds are less than 8 inches tall. Applications when corn is past the V5 stage should be made as a directed spray using drop nozzles.
- Crop injury, including stem curvature, stunting, and brace root injury can occur with some corn hybrids when Starane is applied as a broadcast treatment. Hybrids susceptible to phonomy injury may also be susceptible to injury from Starane.

Herbicide	Formulation	Product Rate Range
Steadfast	75DF	3/4 oz

Tank-mix with: Distinct, Stinger, atrazine, dicamba, Marksman, Hornet, Callisto, Exceed, Spirit, Yukon, Permit.

- Steadfast is a 2:1 premix of nicosulfuron (Accent) plus rimsulfuron, translocated sulfonylurea herbicides, that controls annual and perennial grasses, including foxtails, fall panicum, quackgrass, and shattercane. Steadfast will control large crabgrass up to one inch tall. Steadfast also controls small annual morningglory, pigweed, Pennsylvania smartweed, and sunflower. Application of Steadfast with Distinct, Clarity, or Marksman will suppress or control many perennial broadleaf weeds.
- Mode of action: ALS inhibitor.
- Can be applied broadcast or as a directed spray to field corn that is up to 20 inches tall or up to 6 collars (whichever comes first).
- Do not apply to popcorn, or sweet corn, or corn grown for seed (inbreds).
- OSU research has shown it can be difficult to achieve adequate season-long weed control with a single postemergence application of herbicides with limited residual activity (such as Steadfast). Applying a reduced rate of a preplant or preemergence herbicide prior to postemergence application of Steadfast will result in more consistent control of longer duration.
- For best results, apply with crop oil concentrate (1 gallon/100 gallons spray) plus nitrogen fertilizer solution (28% - 2 quarts/

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A) or ammonium sulfate (2 lbs/A). Substituting a methylated seed oil (Meth Oil, Priority MSO, Sun-It II, for example) for crop oil concentrate can improve control under drought-stressed conditions. Nonionic surfactant (1 to 2 qts/100 gallons spray) can be used instead of crop oil if required in a tank-mix with another herbicide, but grass control may be reduced.

- Apply in a spray volume of at least 15 gpa with a pressure of 20 to 40 psi. Avoid spraying excessive amounts of herbicide directly into the corn whorl.
- Apply when grasses are at the following heights: foxtails, fall panicum, and barnyardgrass — up to 4 inches; quackgrass — 4 to 8 inches; shattercane — up to 6 inches; seedling johnsongrass — up to 8 inches.
- Control may be reduced if applied during conditions of drought stress, abnormally hot or cold weather, when nighttime temperatures are less than 40 degrees, or following periods of large day/night temperature fluctuations.
- Where Steadfast is applied to corn previously treated with soil applications of organophosphate insecticides, temporary crop injury may occur. Application of Steadfast to corn treated with Thimet may cause severe crop injury.
- Do not apply Steadfast with foliar-applied organophosphate insecticides or with Basagran, Laddok, or 2,4-D. Do not apply these materials within 7 days before through 3 days after applying Steadfast.

Herbicide	Formulation	Product Rate Range
Steadfast ATZ	89.3DF	14 oz

Tank-mix with: atrazine, dicamba, Distinct, Callisto, Hornet WDG, Exceed, Spirit, Stinger, Yukon, Permit.

- Steadfast ATZ is a premix of nicosulfuron, rimsulfuron, and atrazine for control of broadleaf and grass weeds.
- Mode of action: ALS inhibitor (nicosulfuron, rimsulfuron); photosynthetic inhibitor (atrazine).
- Can be applied to field corn up to 12 inches tall or up to and including 6 collars (whichever occurs first).
- Do not apply to popcorn, sweet corn, or corn inbreds.
- Steadfast ATZ controls many annual broadleaf and grass weeds up to 4 inches tall. A tankmix partner is required for taller weeds or broader spectrum of control.
- See atrazine and Steadfast descriptions for other information and precautions.

Herbicide	Formulation	Product Rate Range
Stinger	3L	1/4 - 2/3 pt

Tank-mix with: Bromoxynil, Buctril+atrazine, Laddok, Hornet.

- Stinger (clopyralid) is a translocated herbicide that controls ragweeds, cocklebur, jimsonweed, and Canada thistle. Controls or suppresses Jerusalem artichoke and suppresses sowthistle.
- Mode of action: growth regulator.
- Apply after corn emergence until corn is 24 inches tall in a spray volume of at least 10 gallons per acre.
- For annual weed and Jerusalem artichoke control, apply 1/4 to 1/2 pint when weeds have 5 or fewer leaves.
- For Canada thistle control, apply 1/3 to 2/3 pint when thistles are at least 4 inches tall or across, but before the bud stage. The higher rate provides more complete plant kill and better control of dense patches. Do not cultivate prior to or for 14 to 20 days following application. Although control of thistle with Stinger during the season of application may appear similar to that from other corn herbicides, Stinger provides more complete kill of the entire plant (at a greater cost).

Herbicide	Formulation	Product Rate Range
WideMatch	1.5L	1.3 pts

Tank-mix with: See labels.

- WideMatch is a premix of clopyralid (Stinger) plus fluroxypyr (Starane) for control of broadleaf weeds in corn, including hemp dogbane, ragweeds, Canada thistle, marestalk, and cocklebur.
- Mode of action: growth regulator.
- Apply broadcast up to the V5 stage of field corn and when weeds are less than 8 inches tall. Applications when corn is past the V5 stage should be made as a directed spray using drop nozzles.
- Crop injury, including stem curvature, stunting, and brace root injury can occur with some corn hybrids when WideMatch is

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applied as a broadcast treatment. Hybrids susceptible to phonomy injury may also be susceptible to injury from WideMatch.

- For most effective Canada thistle control, apply after the majority of the basal leaves have emerged and before bud stage.

Herbicide	Formulation	Product Rate Range
Yukon	67.5WG	4 to 8 oz

Tank-mix with: atrazine, Accent, Beacon.

- Yukon is a premix of halosulfuron (Permit) plus dicamba for control of most annual broadleaf weeds and yellow nutsedge. Yukon will also suppress/control some perennial broadleaf weeds, primarily during the growing season of application.
- Mode of action: ALS inhibitor (halosulfuron); growth regulator (dicamba).
- Can be applied broadcast or with drop nozzles from the spike stage through 36 inch-tall corn. Weeds should generally be less than 6 inches tall for best results. Use a rate of 6 to 8 oz for yellow nutsedge control.
- Apply with nonionic surfactant (1 to 2 quarts/100 gallons) or crop oil concentrate (1 gallon/100 gallons). Crop oil concentrate may cause injury at the higher Yukon rates. Nitrogen fertilizer solution (28% UAN, etc - 2 to 4 quarts/A) or ammonium sulfate (2 to 4 lbs/A) can be added to improve control of certain weeds or if required for another herbicide in the spray mix. Apply in a spray volume of at least 10 gpa.
- Most of the precautions and restrictions on use of Permit and Banvel apply to Yukon also. See Permit and Banvel descriptions for more information.

Herbicide	Formulation	Product Rate Range
2,4-D LV Ester	Various	0.17 - 0.25 lb ai/A
2,4-D Amine	Various	0.34 - 0.5 lb ai/A

Tank-mix with: Atrazine, dicamba, bromoxynil, Beacon, Sencor, Permit, Exceed.

- Mode of action: growth regulator.
- Controls many annual broadleaf weeds, including ragweeds, cocklebur, lambsquarters, and pigweed. Will control or suppress perennial broadleaf weeds, especially when applied with Beacon, Exceed, Spirit, or Permit.
- For best results, apply when weeds are small.
- If corn is more than 8 inches tall, use drop nozzles to reduce the risk of crop injury. Do not apply from the tasseling stage to the dough stage.
- Use precautions to prevent drift. The ester forms of 2,4-D can volatilize and injure nearby susceptible plants, including soybeans and vegetable crops. Amine formulations are less volatile than ester formulations, and should generally be used for postemergence applications in corn.
- Injury may result when applied to corn growing rapidly under high temperatures and high humidity. Corn may be brittle for 7 to 10 days after application, and is susceptible to stalk breakage from high winds or cultivation.

Clearfield Corn: Postemergence Herbicides

Herbicide	Formulation	Product Rate Range
Lightning	70DF	1.28 oz

Tank-mix with: Bromoxynil, dicamba, 2,4-D, dicamba+atrazine, Distinct. atrazine, Shotgun, Laddok S-12, Buctril+atrazine.

- Lightning is a premix of imazethapyr (Pursuit) plus imazapyr for postemergence use on field corn hybrids that are tolerant to Pursuit and other imidazolinone herbicides. Use only on hybrids labeled as "Clearfield" or "imidazolinone-tolerant".
- Mode of action: ALS inhibitor.
- Lightning is similar to Pursuit in weed control spectrum, but has longer residual activity and is more effective on lambsquarters. Control of common and giant ragweed is variable. Tank-mixes of Lightning with Distinct will improve control of ragweeds, lambsquarters, and perennial broadleaf weeds. Lightning does not control ALS-resistant weeds when applied alone.
- OSU research has shown it can be difficult to achieve adequate season-long weed control with a single postemergence application of herbicides with limited residual activity. Applying Lightning with atrazine or following a reduced rate of a preplant or preemergence herbicide will result in more consistent control of longer duration. In fields with heavy grass pressure, use of a preemergence grass herbicide prior to postemergence use of Lightning is recommended.
- Apply before most annual weeds exceed 3 inches in height. Cocklebur, pigweed, shattercane, and seedling johnsongrass can be up to 8 inches tall. For control or suppression of Jerusalem artichoke, apply when plants are 6 to 10 inches tall.
- Apply with nonionic surfactant (1 quart/100 gallons spray) plus nitrogen fertilizer solution (1 to 2 quarts/acre) or ammonium sulfate (2.5 lbs/A). Control of drought-stressed weeds will be maximized when the higher rates of fertilizer are used.
- Apply broadcast to corn up to 20 inches tall or the V6 stage, and as a directed spray until 45 days before harvest. Broadcast applications of Lightning when corn is more than 20 inches tall or past the V6 stage can result in poor kernel set and reduced yield. When tank-mixing Lightning with other herbicides, always follow the more restrictive label with regard to spray additives, maximum crop size, and other precautions.
- Control may be reduced when weeds are growing slowly under cold or dry conditions. If possible, wait for rain and resumption of active weed growth before applying Lightning. If air temperatures reach or stay below 50 degrees F for 10 or more hours, delay application for 48 hours from the time temperatures increase above 50 degrees F.
- Thimet may be applied only in a band where Lightning will be applied postemergence.

Liberty Link Corn — Postemergence Herbicides

Herbicide	Formulation	Product Rate Range
Liberty	1.67L	28 - 34 oz

Tank-mix with: Most other corn herbicides - see labels.

- Liberty (glufosinate) is a contact, broad-spectrum herbicide for postemergence use only on Liberty Link (glufosinate-resistant) corn.
- Mode of action: glutamine synthetase inhibitor.
- Liberty controls many annual grass and broadleaf weeds up to 4 to 8 inches tall when applied at a rate of 28 to 34 oz per acre. Mixing with atrazine improves control of many weeds, including pigweeds, waterhemp, velvetleaf, annual morningglories, and lambsquarters, and provides several weeks of residual control.
- Maximum height for grass weeds at the 32 oz/A rate: barnyardgrass, crabgrass, yellow foxtail, fall panicum - 3 inches; woolly cupgrass, shattercane, and green, giant, and robust foxtails - 6 inches; volunteer corn - 10 inches. Yellow foxtail and crabgrass should be treated prior to tiller initiation for best results.
- Maximum height for broadleaf weeds at the 32 oz/A rate: lambsquarters, pigweeds, waterhemp - 4 inches; velvetleaf - 5 inches; burcucumber, chickweed, cocklebur, marestalk, annual morningglories, black nightshade, ragweeds, and Pennsylvania smartweed - 6 inches.
- Liberty plus atrazine (1 lb ai/A) will control or suppress some perennial weeds, including dandelion, Canada thistle, Jerusalem artichoke, and wirestem muhly. Liberty has activity on above-ground growth only, so regrowth of perennials may occur and retreatment may be necessary.
- Apply with ammonium sulfate (3 lbs/A or 17 lbs/100 gallons). Do not use surfactants or crop oils with Liberty when applied alone or in tank-mixes.
- Apply broadcast from corn emergence until corn is 24 inches tall or has 7 collars, whichever occurs first. Apply as a directed spray using drop nozzles when corn is 24 to 36 inches tall.
- OSU research indicates that Liberty is most effective in a combined preemergence plus postemergence program, where the preemergence herbicide will provide control of grass and broadleaf weeds for several weeks after corn planting. Examples of preemergence herbicides used in this approach include Balance plus atrazine, simazine + atrazine, and reduced rates of premix products such as Epic, Bicep, Degree Xtra, etc. Postemergence applications of Liberty in this program should include atrazine (1 lb ai/A) where possible.
- Apply in a minimum of 15 gpa with a pressure of 30 to 40 psi. Use a volume of 20 gpa in dense weed/crop canopies. Flat fan nozzles are recommended.
- Liberty is most effective when applied under warm, sunny conditions. Effectiveness may be reduced if applied when heavy dew, fog and mist/rain are present, or if weeds are under stress due to drought, cool temperatures, or extended periods of cloudiness. To avoid reduced control of velvetleaf and lambsquarters, apply between dawn and two hours before sunset.

Herbicide	Formulation	Product Rate Range
Liberty ATZ	4.3L	40 - 48 oz

Tank-mix with: most other postemergence corn herbicides - see label.

- Liberty ATZ is a premix of Liberty (glufosinate) plus atrazine for postemergence use only on Liberty Link (glufosinate-resistant) corn. See Liberty description for more information on use of this herbicide combination.
- Mode of action: glutamine synthetase inhibitor (glufosinate); photosynthesis inhibitor (atrazine).
- Apply from corn emergence until corn is 12 inches tall.

Roundup Ready Corn — Postemergence Herbicides

Herbicide	Formulation	Product Rate Range
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Expert	4.88L	2.5 - 3.75 qts
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Tank-mix with: Roundup WeatherMax

- Expert is a premix of glyphosate, s-metolachlor (Dual II Magnum), and atrazine that can be applied postemergence to Roundup Ready corn. This application controls emerged weeds and provides residual activity for later-emerging weeds.
- Mode of action: EPSP synthase inhibitor (glyphosate), photosynthesis inhibitor (atrazine), shoot meristem inhibitor (s-metolachlor).
- Can be applied until corn reaches a height of 12 inches. Apply when weeds are 4 inches tall or less to minimize weed competition with corn.
- Reduced rates of this product can be used, but may need to be mixed with additional amounts of glyphosate for adequate control of emerged weeds.
- The addition of ammonium sulfate (17 lbs/100 gallons) is not required, but can improve effectiveness when using hard water or when weeds are growing under adverse environmental conditions.

Herbicide	Formulation	Product Rate Range
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Field Master	4L	2 - 4 qts
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Tank-mix with: Roundup WeatherMax

- Field Master is a premix of glyphosate, acetochlor (Harness), and atrazine that can be applied postemergence to Roundup Ready corn. This application controls emerged weeds and provides residual activity for later-emerging weeds.
- Mode of action: EPSP synthase inhibitor (glyphosate), photosynthesis inhibitor (atrazine), shoot meristem inhibitor (acetochlor).
- Can be applied until corn reaches a height of 11 inches. Apply when weeds are 4 inches tall or less to minimize weed competition with corn.
- Reduced rates of this product can be used, but may need to be mixed with additional amounts of Roundup WeatherMax for adequate control of emerged weeds.
- The addition of ammonium sulfate (17 lbs/100 gallons) is not required, but can improve effectiveness when using hard water or when weeds are growing under adverse environmental conditions.

Herbicide	Formulation	Product Rate Range
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Ready Master ATZ	4L	1.5 - 2 qt
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Tank-mix with: Atrazine, Harness, Micro-Tech

- Ready Master ATZ is a premix of atrazine plus glyphosate that controls emerged weeds and provides residual broadleaf weed control. Can be applied postemergence in Roundup Ready corn only.
- Mode of action: photosynthesis inhibitor (atrazine), EPSP synthase inhibitor (glyphosate).
- Apply when weeds are 2 to 4 inches tall. Use the higher rate for control of fall panicum and Pennsylvania smartweed, in dense weed populations, and where targeting perennial weeds.
- Apply in a spray volume of 10 to 25 gpa before corn exceeds 12 inches in height.
- The addition of ammonium sulfate (17 lbs/100 gallons) is recommended when tank-mixing with residual corn herbicides, when weeds are subject to stress from cool temperatures or other factors, and when hard or high pH water is used as the carrier.

Herbicide	Formulation	Product Rate Range
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Roundup Ready Corn — Postemergence Herbicides

Glyphosate

Various

0.56 - 0.75 lb acid/A

Tank-mix with: See labels.

- Glyphosate is a translocated herbicide that controls emerged annual and perennial grass and broadleaf weeds. Table 22 contains a list of currently available glyphosate products. Variations in the formulation may result in differences in product rate, adjuvant recommendations, and rainfastness. Users should consult labels and local product use guides for more specific information. Apply postemergence only to corn hybrids designated as Roundup Ready.
- Mode of action: EPSP synthase inhibitor.
- Most glyphosate products can be applied broadcast or directed from corn emergence through the 8-collar stage or until corn is 30 inches tall, whichever occurs first. A number of glyphosate products can be applied to Roundup Ready Corn 2 (Roundup Ready 603 corn) up to 48 inches tall with drop nozzles adjusted to keep spray out of corn whorls.
- The general recommendation on most labels for the initial postemergence application is a rate of 0.75 lbs of glyphosate acid per acre when weeds are less than 4 to 8 inches tall (see Table 22 for product rates). Sequential applications are allowed. Maximum use rates per application and the total amount that can be applied postemergence in one season varies with product and the type of Roundup Ready corn. Higher rates are allowed on Roundup Ready Corn 2 (Roundup Ready 603 corn), compared to other types of Roundup Ready corn.
- OSU research shows that a single postemergence application of glyphosate is not likely to provide adequate weed control except where weed populations are extremely low. One of the following strategies is recommended for consistent control: 1) application of a preplant or preemergence herbicide (at approximately half the labeled rate) prior to postemergence glyphosate application, or 2) early postemergence application of glyphosate in a tank-mix with herbicides that provide residual control (atrazine, Harness Xtra, Bicep, etc). Maximum height of corn at the time of application varies with the tank-mix partner.
- Velvetleaf is most easily controlled when less than 4 inches tall and actively growing. Large velvetleaf can be difficult to control with glyphosate, especially when drought-stressed. The addition of ammonium sulfate (8.5 to 17 lbs/100 gallons) will improve control of velvetleaf and some other weeds. Ammonium sulfate will also improve control when using hard water, when daytime air temperatures are 55 degrees or less, and when tank-mixing with Bullet, Micro-tech, or Partner.
- Annual morningglory, groundcherry, lambsquarters, and Pennsylvania smartweed are more difficult to control than other annual weeds, and glyphosate should be applied when weeds are less than 6 inches tall for best results.
- Control of perennial weeds will require higher rates than annual weeds. Application when perennials are in the bud to bloom stage (or boot to seedhead for grasses) will provide the most complete control of the entire plant. Minimum size of various perennial weeds for most effective control through the growing season: quackgrass, Canada thistle, wirestem muhly, and yellow nutsedge - 6 inches; field bindweed and common milkweed -12 inches; johnsongrass and hemp dogbane - 18 inches.
- Apply in a spray volume of 5 to 20 gpa. Using a volume of 15 to 20 gpa, selecting the appropriate nozzles, and reducing spray pressure will reduce the potential for spray drift. Take precautions to reduce spray drift, since corn, soybeans, and other sensitive crops are likely to be growing in areas surrounding treated fields.

Corn: Harvest Aids

Herbicide	Formulation	Product Rate Range
Glyphosate	Various	Up to 1.12 lbs glyphosate acid (ground application) Up to 0.75 lbs glyphosate acid (aerial application)

- Many glyphosate products can be applied as a preharvest treatment to control perennial and annual weeds in corn. Consult labels for specific recommendations on use rate, adjuvant use, and rainfast intervals.
- Preharvest applications of glyphosate may provide a good opportunity to control perennial weeds because their growth is undisturbed compared to postharvest applications.
- Mode of action: EPSP synthase inhibitor.
- Apply when grain moisture is 35 percent or less. Corn should be physiologically mature (black layer formed) with maximum kernel fill complete. Apply at least 7 days before harvest.
- Depending upon the glyphosate product, the label prohibits or recommends avoiding preharvest application to corn grown for seed, due to the potential for a reduction in germination or vigor.

Herbicide	Formulation	Product Rate Range
Gramoxone Max	3L	1.3 pt

- Gramoxone Max (paraquat) may be used for drying weeds in field corn, seed corn, and popcorn just before harvest. Apply when corn is mature - after the black layer has formed at the base of the kernels.
- Mode of action: cell membrane disruptor.
- Mature cocklebur and lambsquarters are tolerant of Gramoxone and may not desiccate completely.
- For aerial application, use a spray volume of 5 gallons per acre; for ground application, use 20 gallons per acre. Add nonionic surfactant (0.25% v/v) or crop oil concentrate (1% v/v).
- Apply at least 7 days before harvest.

Soybeans: Soil-Applied Herbicides — Preplant Incorporated Only

Table 6. Grazing and Forage (Silage, Hay, etc.) Intervals for Herbicide-Treated Corn

This table is a guide for grazing and feeding herbicide-treated corn, and shows the time that should occur between herbicide application and grazing or harvest for silage. For premixes or combinations not listed below, the minimum interval equals the longer of the two intervals for each individual product in the mix. Always consult herbicide labels for specific limitations.

Herbicide	Grazing	Forage (silage, etc.)
2,4-D	7 days	7 days
Accent SP	30 days	30 days
Aim	none	none
Atrazine	21 days	21 days
Axiom	none	none
Balance Pro	none	none
Basagran	12 days	None
Basis Gold/Basis	30 days	30 days
Beacon	30 days	45 days
Bicep II Magnum/Cinch ATZ	30 days	30 days
Bromoxynil	30 days	30 days
Callisto	Do not graze	45 days
Celebrity Plus	32 days	32 days
Define	None	None
Degree	21 days	21 days
Degree Xtra	21 days	21 days
Dicamba	Past "milk" stage	Past "milk" stage
Dicamba+atrazine	Past "milk" stage	Past "milk" stage
Distinct	32 days	32 days
Dual II Magnum/Cinch	30 days	30 days
Epic	None	None
Equip	45 days	45 days
Exceed	30 days	40 days
Expert	60 days	60 days
Field Master	56 days	56 days
FulTime	21 days	21 days
Gramoxone Extra (at planting)	None	None
Guardman Max	40 days	40 days
Harness	21 days	21 days
Harness Xtra	21 days	21 days
Hornet	85 days	45 days
Keystone	21 days	21 days
Laddok	21 days	21 days
Lariat/Bullet	21 days	21 days
Lasso/Micro-Tech	None	None
Liberty	70 days	60 days
Liberty ATZ	30 days	40 days
Lightning/Pursuit	45 days	45 days
Lumax/Lexar	45 days	45 days
Northstar	30 days	45 days
Option	45 days	45 days
Outlook	60 days	60 days
Parallel	30 days	30 days
Permit	30 days	30 days
Princep/simazine	Do not graze	None
Priority	30 days	30 days
Prowl/Pendimax	None	None

Table 6. (continued)

Herbicide	Grazing	Forage (silage, etc.)
Python	85 days	85 days
Ready Master ATZ	50 days	50 days
Resource	28 days	28 days
Roundup WeatherMax, Glyphomax, other glyphosates	50 days	50 days
Sencor	60 days	60days
Shotgun	21 days	21 days
Spirit	30 days	40 days
Stalwart C, Stalwart Xtra	30 days	30 days
Starane	47 days	47 days
Steadfast	30 days	30 day
Steadfast ATZ	60 days	60 days
Surpass/Topnotch	21 days	21 days
Stinger	40 days	40 days
Touchdown	50 days	50 days
WideMatch	47 days	47 days
Yukon	30 days and past "milk" stage	30 days and past "milk" stage

Table 7. Rainfast Intervals, Spray Additives, and Maximum Crop Size for Postemergence Corn Herbicides

This table shows the required time interval between herbicide application and rainfall and summarizes label recommendations for spray additives and maximum crop stage. Check herbicide labels for additive rates. Information in this table applies to field corn only. Use the following key for spray additives:

SURF = nonionic surfactant
 COC = crop oil concentrate
 DASH = BASF spray adjuvant
 UAN = 28% nitrogen solution
 AMS = ammonium sulfate
 MSO = Methylated seed oil

Herbicide	Rainfast Interval (hours)	Spray additives/Maximum Crop Size
2,4-D Amine	6-8	No additives. Broadcast up to 8-inch corn; directed spray before tassel stage.
2,4-D Ester	2-3	No additives. Broadcast up to 8-inch corn; directed spray before tassel stage.
Accent	4	MSO, COC or SURF (Addition of UAN or AMS is recommended). Broadcast up to 6 collars or 20-inch corn; directed spray up to 10 collars or 36-inch corn.
Accent + Atrazine	4	MSO or COC + UAN or AMS. Apply before corn is 12 inches tall.
Accent + dicamba	6-8	SURF. Addition of UAN or AMS is recommended. Broadcast before corn is 8 inches tall; directed spray up to 24-inch corn.
Accent + bromoxynil	4	SURF. UAN, 10-34-0 or AMS is recommended. Broadcast up to 6 collars or 20-inch corn; directed spray up to 10 collars or 36-inch corn.
Accent + dicamba/atrazine	6-8	SURF. Addition of AMS or UAN is recommended. Apply before corn is 8 inches tall.
Aim	1	SURF. AMS or UAN may be added if required by tank-mix partner. Do not use COC or tank-mix with EC formulations of other crop protection chemicals except as specifically directed by label. Apply up to 8-collar corn.
Atrazine	2	MSO or COC. Apply before corn is 12 inches tall.
Basagran	8	COC, MSO, UAN, or AMS or COC or MSO + UAN or AMS, depending on weed species present.
Basis	4	MSO, COC, or SURF + UAN or AMS. Apply before corn reaches the 3 collar stage.
Basis Gold	4	MSO or COC. Addition of UAN, 10-34-0, or AMS is recommended. Apply before 12-inch corn or before 6 collars, whichever is more restrictive.
Basis Gold + dicamba	6-8	MSO or COC. Addition of UAN, 10-34-0, or AMS is recommended. Apply before 12-inch corn or before 6 collars, whichever is more restrictive.
Beacon	4	MSO, COC, or SURF (UAN or AMS may be added). Broadcast 4 to 20-inch corn; directed spray before tassel emergence.
Bromoxynil	1	No additives. Apply before tassel emergence.
Bromoxynil+atrazine	2	No additives. Apply before corn is 12 inches tall.
Callisto	1	COC + UAN or AMS. Apply up to 30-inch or 8-leaf corn.
Callisto + atrazine	2	COC + UAN or AMS. Apply before 12-inch corn.
Celebrity Plus	4	SURF + UAN, 10-34-0, or AMS. Broadcast up to 6 collars or 24-inch corn.
Dicamba	6-8	Add UAN if velvetleaf is present. SURF, COC, or UAN may be added under dry conditions. Do not apply with COC when corn height exceeds 5 inches. Broadcast up to 5th-leaf stage or 8-inch corn; directed spray up to 36-inch corn.
Dicamba/atrazine	6-8	Add UAN if velvetleaf is present. SURF, COC, or UAN may be added under dry conditions. Do not apply with COC when corn height exceeds 5 inches. Apply broadcast up to 5-leaf stage or 8-inch corn.
Distinct	4	SURF + UAN or AMS. Apply 6 oz/A up to 10-inch corn, 4 oz/A up to 24-inch corn.
Equip	2	MSO +UAN or AMS. Broadcast up to 12 inch-corn or V4 stage, whichever occurs first. Directed spray up to 36 inch-corn or V8 stage.
Exceed	4	MSO, COC, or SURF. UAN or AMS may be added. Broadcast from 4 to 20-inch corn; directed spray up to 30-inch corn.
Exceed + Accent	4	MSO, COC, or SURF. UAN or AMS may be added. Broadcast up to 20-inch corn; directed spray up to 36-inch corn.
Exceed or Spirit + dicamba	6-8	SURF. (If 1/8 pt/A of dicamba is used, then COC may be added in place of SURF) Broadcast 4 to 12-inch corn; directed spray up to 24-inch corn.
Exceed or Spirit + 2,4-D	6-8	SURF. Do not add UAN or 10-34-0. Broadcast 4 to 8-inch corn; directed spray up to 24-inch corn.
Exceed + bromoxynil	4	SURF. Do not add UAN. Broadcast 4 to 20-inch corn; directed spray up to 30-inch corn.
Glyphomax, Glyphomax Plus	1	AMS may be added. Apply up to 8 collar or 30-inch Roundup Ready corn.
Hornet	2	SURF, COC, or MSO. UAN or AMS may be added under extremely dry conditions. Broadcast up to 20-inch corn or 6 collars.
Hornet + bromoxynil	6	SURF (or COC if allowed by bromoxynil label). UAN or AMS may be added under extremely dry conditions. Broadcast up to 6 collars or 20-inch corn. Do not use this tank-mix if target weeds are biennials or perennials.
Laddok	8	MSO, COC, UAN, AMS, DASH, or combinations of these. Apply before corn is 12 inches tall.

Table 7. (continued)

Herbicide	Rainfast Interval (hours)	Spray additives/Maximum Crop Size
Liberty	4	AMS. Broadcast up to 24-inch or 7-collar corn, whichever comes first; directed spray on 24 to 36 inch corn
Liberty ATZ	4	AMS (3.0 pounds/A) . Apply before 12-inch corn.
Lightning	1	SURF + UAN, 10-34-0 or AMS. Broadcast up to V6 or 20-inch corn; directed spray up to 45 days before harvest.
Lightning + atrazine	2	SURF + UAN, AMS, or 10-34-0. Apply before 12-inch corn.
Lightning + dicamba/atrazine	6-8	SURF + UAN, AMS, or 10-34-0. Apply before 8-inch corn.
Lightning + Distinct	4	SURF + UAN, 10-34-0 or AMS. Broadcast up to V6 or 20-inch corn.
Northstar	4	SURF, COC or MSO up to 12-inch corn. Only SURF between 12 and 36-inch corn. UAN or AMS may be added. Broadcast 4 to 20-inch corn; directed spray up to 36-inch corn.
Option	4	MSO + UAN or AMS. Apply broadcast up to 16-inch or V5 stage; directed spray up to 36-inch corn.
Permit	4	SURF, MSO, or COC. UAN or AMS may be added. Apply through layby stage of corn.
Permit + Accent	4	SURF, MSO, or COC. The addition of UAN or AMS is recommended. Broadcast up to 24-inch corn; directed spray up to 36-inch corn.
Permit + dicamba	6-8	SURF. Broadcast up to 36-inch corn; directed spray after 8-inch corn will decrease injury.
Permit + 2,4-D	6-8	SURF. Broadcast up to 8-inch corn; directed spray through layby stage of corn.
Priority	6-8	SURF. AMS or UAN may be added. Broadcast or directed spray up to 8-collar stage.
Ready Master ATZ	2	AMS may be added. Apply up to 12-inch Roundup Ready corn.
Resource	1	COC. UAN or AMS may be added to improve control of certain species. Apply up to the 10-leaf stage.
Roundup WeatherMax	0.5	AMS may be added. Apply up to 8 collar or 30-inch Roundup Ready corn.
Shotgun	6	No additives. Apply before 12-inch corn.
Spirit	4	COC, MSO or SURF.UAN or AMS may be added. Broadcast 4 to 20-inch corn; directed spray up to 24-inch corn or after 6 collar corn.
Spirit + Accent	4	COC, MSO or SURF.UAN or AMS may be added. Broadcast 4 to 20-inch corn; directed spray up to 24-inch corn.
Spirit + bromoxynil	4	SURF. Do not add UAN. Broadcast 4 to 20-inch corn; directed spray up to 24-inch corn.
Starane	1	An adjuvant can be used if required by tank-mix partner. Broadcast up to the V5 stage; directed spray after the V5 stage.
Steadfast	4	COC, MSO, or SURF + UAN or AMS. COC or MSO is preferred over SURF. Broadcast up to and including 6 collars or 20-inch corn
Steadfast ATZ	4	COC, MSO, or SURF + UAN or AMS. COC or MSO is preferred over SURF. Broadcast up to and including 6 collars or 12-inch corn
Stinger	6-8	No additives. Up to 24-inch corn.
Touchdown	1	SURF and/or AMS may be added. Up to V8 stage of Roundup Ready corn.
WideMatch	6	No additives. Broadcast up to the V5 stage; directed spray after the V5 stage.
Yukon	4	SURF or COC. UAN or AMS may be added. Apply broadcast or directed up to 36-inch corn.

Table 8. Herbicides Labeled for Use on Field Corn, Seed Corn, Popcorn, and Sweet Corn

	Field Corn			
	Field Corn	Grown For Seed	Popcorn	Sweet Corn
2,4-D	Y	Y ⁵	Y ⁵	Y
Accent	Y	Y ^{5, 8}	Y ^{1, 5, 8}	N
Aim	Y	Y ⁹	Y	Y ⁵
Atrazine	Y	Y	Y	Y
Axiom	Y	Y	N	N
Balance Pro	Y	Y ⁵	N	N
Basagran	Y	Y	Y	Y
Basis	Y	N	N	N
Basis Gold	Y ⁶	N	N	N
Beacon	Y ⁵	Y ^{5, 7}	Y ^{5, 7}	N
Bicep II Magnum/Cinch ATZ	Y	Y	Y	Y
Bromoxynil	Y	Y ^{2, 5}	Y ²	N
Callisto	Y	Y	Y ¹⁰	N
Celebrity Plus	Y	N	N	N
Define	Y	Y	N	N
Degree	Y	Y	Y	N
Degree Xtra	Y	Y	Y	N
Dicamba	Y	Y ⁵	Y ⁵	N
Dicamba+atrazine	Y	Y ⁵	Y ⁵	N
Distinct	Y	N	Y	N
Dual II Magnum/Cinch	Y	Y	Y	Y
Epic	Y	Y ⁵	N	N
Equip	Y	N	N	N
Exceed	Y ⁵	Y ^{5, 7}	Y ^{5, 7}	N
Expert	Y	Y	Y	Y
Field Master	Y	Y	Y	N
FulTime	Y	Y	Y	N
Guardman Max	Y	Y	Y	Y ⁵
Harness	Y	Y	Y	N
Harness Xtra	Y	Y	Y	N
Hornet	Y	Y ⁵	N	N
Keystone	Y	Y ³	Y	N
Laddok	Y	Y	Y	Y
Lariat/Bullet	Y	Y	Y	Y
Lasso/Micro-Tech	Y	Y	Y	Y ⁴
Lumax/Lexar	Y	Y	Y ¹⁰	N
Northstar	Y ⁵	Y ^{5, 7}	Y ^{5, 7}	N
Option	Y	N	N	N
Outlook	Y	Y	Y	Y ⁵
Parallel	Y	Y	Y	N
Permit	Y	Y	Y	Y ⁵
Princep/simazine	Y	N	N	N
Priority	Y	Y	Y	Y ⁵
Prowl	Y	Y	Y	Y
Pendimax	Y	N	N	N
Python	Y	Y ⁵	N	N
Resource	Y	Y	N	N
Sencor	Y	N	N	N
Shotgun	Y	N	N	N
Spirit	Y ⁵	Y ^{5, 7}	Y ^{5, 7}	N
Stalwart C/Stalwart Xtra	Y	Y	Y	N
Starane	Y	N	N	Y
Steadfast/Steadfast ATZ	Y	N	N	N
Stinger	Y	Y ⁵	N	N
Surpass/Topnotch	Y	Y	Y	N
WideMatch	Y	N	N	Y
Yukon	Y	Y	N	N

1 Do not apply to any white popcorn inbred or hybrid unless approved by seed supplier.

2 Do not apply prior to 3-leaf corn stage.

3 Do not use on corn seed stock such as "Breeders," "Foundation," or "Increase."

4 Do not make postemergence application of Partner or Microtech to sweet corn.

5 Risk of injury - check with seed supplier or chemical representative for sensitivity of inbreds/hybrids.

6 Injury may occur on field corn hybrids with a Relative Maturity (RM) rating of less than 88 days or on waxy, Hi-Lysine, or food grade corn.

7 Can be used if spray is directed using drop nozzles when seed corn is between 4 and 20 and 4 and 30 inches tall for Spirit and Exceed, respectively, when popcorn is between 10 and 24 and 10 and 30 inches tall for Spirit and Exceed respectively, and when seed corn and popcorn are between 10 and 36 and 10 and 48 inches tall for Northstar and Beacon, respectively. All products must be applied before tassel emergence.

8 Do not apply if corn is greater than 20 inches tall or exhibits 6 collars.

9 Apply as directed spray only. Avoid herbicide application into the corn whorl.

10 Yellow popcorn only.

Table 9. ALS Herbicide and Organophosphate Insecticide Use Precautions

This table is a guide to using ALS-inhibiting herbicides on "normal" and "Clearfield" field corn if an organophosphate (OP) insecticide is used at planting. Do not tank-mix an OP insecticide with an ALS-inhibitor as severe injury will occur. Read the herbicide label before applying OP insecticides postemergence if using ALS-inhibitors.

Definitions and Abbreviations:

Do not use = do not apply the herbicide if corn has been previously treated with soil insecticide.

NR = not recommended to apply the herbicide if corn has been previously treated with soil insecticide.

TI = Temporary injury may occur if the herbicide is applied to corn previously treated with soil insecticide.

Y = The herbicide can be used with nearly no risk of injury when applied to corn previously treated with soil insecticide.

Herbicide	Soil-applied Organophosphate Insecticides				
	Counter 20CR (in furrow)	Counter 20CR (banded)	Thimet/ phorate	Lorsban	Aztec
Accent	Do not use	NR	TI	TI	Y
Basis	Do not use	NR	NR	TI	TI
Basis Gold	Do not use	NR	NR	TI	Y
Beacon	Do not use	NR	TI	TI	TI
Celebrity Plus	Do not use	NR	TI	TI	Y
Exceed	Do not use	NR	TI	TI	TI
Equip	Do not use	See labels	Do not use	TI	Y
Hornet (preemergence)	Do not use	Do not use	Do not use	TI ¹	TI ¹
Hornet (postemergence)	Do not use	Do not use	Do not use	TI	TI
NorthStar	Do not use	NR	TI	TI	TI
Option	Do not use	Do not use	Do not use	TI	Y
Permit	Y	Y	Y	Y	Y
Priority	Y	Y	Y	Y	Y
Python	Do not use	Do not use	Do not use	TI ¹	TI ¹
Spirit	Do not use	NR	TI	TI	TI
Steadfast/Steadfast ATZ	Do not use	NR	NR	TI	Y
Yukon	Y	Y	Y	Y	Y
Clearfield CORN Only					
Lightning	Do not use	TI	Do not use ²	TI	Y

¹ The soil insecticide should be applied in a T-band or a band to avoid potential crop injury.

² Do not use herbicide if soil insecticide is applied in furrow. Herbicide may be used if soil insecticide is applied in a band, but temporary corn injury may still occur.