

Annual Broadleaf Weed Control in Winter Wheat

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This NebGuide discusses preventive, cultural and chemical weed control in winter wheat. The best weed control is obtained by using a combination of these methods.

Winter and summer annual broadleaf weeds have an important economic impact on Nebraska winter wheat. They compete for water, light, space and nutrients, reducing Nebraska winter wheat yields by an estimated 10 percent each year. The dollar loss, with wheat at \$3 per bushel, is approximately \$20 million per year in Nebraska. Weeds also slow harvest and increase combine repair costs. Producers may be docked at the elevator for excessive grain moisture and/or weed seeds in wheat.

In 1982, only 11 percent of the winter wheat acres in Nebraska were sprayed with herbicides to control weeds. In 1987, 29 percent were sprayed. By 1998, however, approximately 60 percent were sprayed. Effective weed control in winter wheat can eliminate losses due to weeds and increase net returns.

Success with reduced and no-till programs is improved when winter wheat stubble remains weed-free after harvest. Allowing weeds to go to seed will cause problems in future crops. These potential problems underscore the importance of broadleaf weed control in winter wheat. An effective weed control program considers the entire cropping system. This approach involves the use of preventive, cultural and chemical weed control methods.

Preventive Weed Control

Prevention, or stopping the advancement of weed infestations, is an important part of a total weed management program. It requires diligence from the producer and offers a low cost, effective control. Some rules of preventive weed control are:

1. Use crop seed that is weed free.
2. Clean tractors, implements, trucks and combines before moving them from infested to clean fields.
3. Keep uncropped areas (fencelines and field borders) weed free.

4. Do not allow livestock to move directly from infested to clean areas.
5. Prevent weed seed production in all areas.

Cultural Weed Control

Cultural weed control involves manipulating the crop/weed environment so that conditions are favorable for crop plants, but unfavorable for weeds. Crop competitiveness and crop rotation are two important cultural control practices in winter wheat production.

Crop competition involves establishing a vigorous crop which can compete more effectively than weeds for water, light, space and nutrients. Several factors contribute to competitive crops, including proper seedbed preparation, adequate fertilizer, high quality crop seed, careful variety selection, and proper rate, date and depth of seeding. In a properly established, healthy winter wheat crop, it is difficult for summer annual weeds to survive, and the result is high winter wheat yields.

Crop rotations that include late spring seeded crops break the life cycle of problem winter annual broadleaf weeds such as tansy mustard and field pennycress, and allow the use of tillage or herbicides that may not be feasible in a winter wheat monoculture. Adapted rotational grain crops include corn, grain sorghum, proso millet, soybean and sunflower, depending on location.

Chemical Weed Control

Several herbicides provide excellent broadleaf weed control with minimal wheat injury. However, some varieties are more sensitive to herbicides than others. Injury varies with herbicide, variety and growth stage. Research has not been conducted on the herbicide sensitivity of many of the varieties currently planted. The following are fundamentals that should be considered before selecting a herbicide treatment:

1. Identify the problem weed(s).
2. Spray when weeds are small and actively growing. Spray at the proper winter wheat growth stage for the herbicide used.

Table I. Broadleaf Weed Response to Postemergence Herbicides.

Herbicide	Blue Mustard (10) [§]	Knotweed (3)	Field Pennycress (10)	Horseweed (5)	Kochia (5)	Kochia, ALS-resistant (5)	Lambsquarters (5)	P. Smartweed (3)	Redroot Pigweed (2)	R. Thistle (5)	Shepherdspurse (10)	Sunflower (5)	Tansy Mustard (10)	Wild Buckwheat (4)	Prickly Lettuce (10)	Waterhemp (3)	Wild Vetch (8)	Crop Safety ²
Aim + 2,4-D	8	7	9	-	9	9	8	-	8	8	9	8	9	8	9	8	1	2
Ally	9	4	9	7	6	1	7	4	8	6	9	7	9	5	8	7	1	1
Ally + 2,4-D	10	7	10	6	9	6	10	6	10	8	10	10	10	6	10	9	6	2
Ally + Dicamba*	9	7	10	6	10	7	10	9	10	9	10	9	10	7	10	9	8	3
Ally + Starane	9	4	10	7	10	8	7	4	8	6	9	7	9	5	8	7	1	1
Amber	9	4	9	7	7	1	6	5	8	6	9	8	9	8	8	7	1	1
Amber + 2,4-D	10	6	10	6	9	6	10	6	10	8	10	9	10	8	10	9	6	2
Amber + Dicamba*	9	7	10	6	10	7	10	9	10	9	10	10	10	9	10	9	8	3
Amber + Starane	9	4	9	7	10	8	6	5	8	6	9	8	9	8	8	9	1	1
Dicamba*+ 2,4-D	6	8	10	6	10	10	9	10	10	9	10	10	10	7	8	9	8	4
Beyond (fall applied) ¹	1	1	9	1	1	1	1	1	1	1	9	1	9	1	1	1	1	2
Bronate Advanced	7	8	9	7	10	10	8	8	8	7	9	8	9	8	8	7	6	2
Curtail	9	9	10	9	8	8	10	10	10	8	9	10	9	9	10	9	9	2
Curtail M	7	8	9	9	8	8	8	9	8	7	9	8	9	9	8	7	8	1
Express + 2,4-D	9	7	10	6	9	6	9	6	7	8	7	7	7	7	9	8	6	1
Finesse	9	4	9	7	5	1	8	5	8	5	9	6	9	6	8	7	1	1
Finesse + 2,4-D	9	7	10	6	9	6	10	6	10	8	10	9	10	7	10	9	6	2
Finesse + Dicamba*	9	7	10	6	10	7	10	9	10	9	10	9	10	8	10	9	8	3
Harmony Extra+ 2,4-D	9	6	10	7	9	6	9	8	9	8	10	8	10	8	9	8	5	1
Maverick (fall applied)	5	2	9	6	3	1	3	2	4	3	9	3	9	2	8	3	1	1
MCPA	4	4	7	4	5	5	7	6	6	6	8	6	8	4	6	5	5	1
Olympus (fall applied)	8	-	9	-	-	-	-	-	5	-	9	-	9	-	-	-	-	1
Olympus Flex (fall applied)	8	-	9	-	-	-	-	-	5	-	9	-	9	-	-	-	-	1
Peak	8	6	9	7	5	1	6	8	8	6	9	8	9	6	8	7	1	1
Peak + 2,4-D	10	7	10	7	9	6	10	8	10	8	10	10	10	6	10	9	6	2
Peak + Dicamba*	9	7	10	7	10	7	10	9	10	9	10	9	10	9	10	9	8	3
Rave	9	7	10	6	10	7	10	9	10	9	10	10	10	9	10	9	8	3
2,4-D	7	6	9	5	6	6	9	8	9	8	9	9	9	4	9	8	7	2

Response ratings:

Ratings are for light to moderate weed populations, favorable conditions and weed growth stage as specified on product label. High weed populations, adverse conditions or large weeds will reduce control.

- 10 — 96-100%
- 9 — 90-95%
- 8 — 85-90%
- 7 — 80-84%
- 6 — 70-79%
- 5 — 60-69%
- 4-2 — less than 60%
- 1 — 0

¹For use in Clearfield wheat varieties only.

²Crop ratings of 3 or less result in no yield loss; adding liquid nitrogen may considerably reduce crop safety for some herbicide combinations.

[§]Weed Competitive Index (CI) is a term used to describe the relative competitiveness of weed species, and is expressed as a range of 10.0. See University of Nebraska–Lincoln Extension Circular *EC130, Weed Management Guide* for additional information.

*Dicamba is the active ingredient in Banvel, Clarity, Sterling and several other herbicides. The rates and information provided here are based on the same 4 lb/gal acid equivalent formulation found in Banvel, Clarity and Sterling.

3. Use proper spray equipment that is in good condition and not contaminated with previously used herbicides.
4. Calibrate the sprayer to ensure application accuracy.
5. Read and follow directions on the herbicide label.
6. Know your rotational plans to avoid herbicide carryover problems to sensitive crops.
7. Be aware that crop disasters such as winter injury, hail or disease occur and previously applied residual herbicides may limit the choices for recropping.

Herbicides recommended for broadleaf weed control in winter wheat are Aim (carfentrozone-ethyl), Ally XP (metsulfuron), Amber (triasulfuron), 2,4-D, Banvel (dicamba), Bronate Advanced (bromoxynil + MCPA), Clarity (dicamba),

Curtail (clopypalid + 2,4-D), Express XP (tribenuron), Finesse (metsulfuron + chlorsulfuron), Harmony Extra XP (thifensulfuron + tribenuron), Peak (prosulfuron), Rave (triasulfuron + dicamba) and Sterling (dicamba). Some of these products should be combined to control a wider spectrum of broadleaf weeds in winter wheat. Herbicide combinations are also recommended for management of potential herbicide resistance development by weeds. Ally XP, Amber, Express XP, Finesse, Harmony Extra XP and Peak are sulfonylurea herbicides and are ALS-AHAS inhibitors.

Use *Table I* to select herbicide treatments to control your weed problem. Specific use rates for selected herbicides are found in *Table II*. See University of Nebraska–Lincoln Extension Circular *EC130, Weed Management Guide*, for additional information.

Table II. Wheat wheat broadleaf weed control.

<i>Herbicide</i>	<i>Rate Per Acre</i>	<i>Application Time</i>	<i>Remarks and Approximate Cost Per Acre Broadcast</i>
Aim EW + 2,4-D Ester (4L)	0.5-1.0 oz 0.25-0.50 pt	Wheat from 4 tillers to joint stage	Add UAN at 2-4 gallons/100 gallons or AMS at 4 lb/A. Cost: \$3.40-\$6.80.
Ally or Amber or Finesse or Peak	0.10 oz 0.28-0.35 oz 0.2-0.4 oz 0.25-0.50 oz	In fall after 2-leaf stage	Effective control on mustards and pennycress. Some wheat varieties are more sensitive than others to fall application. Add surfactant. Cost: Ally \$2.55; Amber \$2.50-\$3.15; Finesse \$3.10-\$6.20; Peak \$3.00-\$6.00.
Ally or Amber or Finesse or Peak + 2,4-D Ester (4L)	0.10 oz 0.28-0.35 oz 0.2-0.4 oz 0.25-0.50 oz 0.25-0.50pt	Early spring from 4 tillers to joint stage	Add surfactant at 1-2 qt/100 gal. If the spray solution contains liquid fertilizer, do not add surfactant. Cost: Ally + 2,4-D \$3.05-\$3.50; Amber + 2,4-D \$3.00-\$4.10; Finesse + 2,4-D \$3.60-\$7.15; Peak + 2,4-D \$3.50-\$6.95.
Ally or Amber + Starane	0.10 oz 0.28-0.35 oz 0.50 pt	Spring, before boot stage; weeds less than 4" tall	Provides excellent control of kochia, including ALS-resistant kochia, with excellent crop safety. Add surfactant at 1-2 qt/100 gal. Cost: Ally + Starane \$9.45; Amber + Starane \$9.40-\$11.00.
2,4-D Amine (4L) or 2,4-D Ester (4L)	1.0-1.5 pt 0.50-0.75 pt	Early spring, from 4 tillers to joint stage	Do not spray winter wheat until well tillered. Spray broadleaf weeds as soon as good growing conditions occur. Cost: \$0.95-\$2.25.
Bronate Advanced	0.8-1.2 pt	Wheat from 3-leaf to boot	Most broadleaf weeds should be in 2-4 leaf stage or mustards in early rosette stage. Cost: \$6.55-\$9.80.
Dicamba* + 2,4-D Amine (4L)	2-3 oz 0.50-0.75 pt	Spring, 4 tillers to joint stage	Controls most troublesome broadleaf weeds. Do not apply with fertilizer solutions. Cost: \$1.95-\$3.55.
Curtail	2.0 pt	Before boot stage	Plant only small grain, field corn or sugarbeet the following year. Cost: \$10.00.
Express or Harmony Extra XP + 2,4-D Ester (4L)	0.25-0.33 oz 0.30-0.60 oz 0.25-0.50 pt	Wheat to joint stage; weeds less than 4" tall	Add a nonionic surfactant at 1 qt/100 gallons. Any crop can be planted 60 days after application. If the spray solution contains liquid fertilizer, do not add surfactant. Cost: Express + 2,4-D \$5.40-\$7.40; Harmony Extra + 2,4-D \$4.70-\$9.35.
Starane + 2,4-D Ester (4L)	0.5-0.67 pt 0.25-0.50 pt	Wheat 4-leaf to joint; weeds less than 8"	Provides excellent control of kochia. Cost: \$7.40-\$10.15.
Rave	2.4-4.0 oz	Early spring from 4 tillers to joint stage	Add surfactant at 1-2 pt/100 gal. Cost: \$3.60-\$6.00.

Many broadleaf weeds commonly found in Nebraska winter wheat fields can be controlled at a modest price with amine or low volatile ester formulations of 2,4-D. Generally, ester formulations of 2,4-D provide better broadleaf weed control than amine formulations because they are oil soluble and readily penetrate plant foliage. Amine formulations are water soluble and do not penetrate foliage as easily, resulting in reduced control of weeds such as kochia and Russian thistle. However, amine formulations provide greater crop safety than ester formulations.

Winter wheat must be between four tillers and the joint stage when 2,4-D is applied. In Nebraska, winter wheat generally is in the proper growth stage for 2,4-D application in March to early May, depending on planting date, the season, and location. Winter wheat planted Sept. 10 should be ready

to spray by March 1, but wheat planted Oct. 1 may not be adequately developed until April 1 or later.

Winter wheat is considered fully tillered when it has six to nine tillers; however, the number of tillers depends on the seeding rate and date. Wheat injury and yield loss can be significant if 2,4-D or other herbicides are misapplied.

Winter wheat yields were reduced more than 20 percent when 2,4-D was applied in the fall to winter wheat with two to four leaves (*Table III*). Winter wheat yields also were reduced with spring applications. To reduce injury with 2,4-D use low rates and apply it in early spring to fully tillered wheat.

Table III. Winter wheat yield reduction in response to herbicides applied at four growth stages in absence of weeds.

Treatment	-----Growth stage at application-----				
	Rate	Fall	Tillering	Boot	Headed
	lb/A	-----% yield reduction-----			
2,4-D amine	0.50	14	10	12	5
2,4-D amine	0.75	24	16	22	20
2,4-D ester	0.25	13	13	6	4
2,4-D ester	0.50	30	15	23	22
Buctril	0.25	3	1	2	8
Buctril	0.50	0	1	14	12
Dicamba	0.125	0	0	14	7
Dicamba	0.25	3	3	50	3
Dicamba + 2,4-D amine	0.09 + 0.5	4	3	28	7
2,4-D amine	0.5	4	3	28	7
Buctril + MCPA	0.25	0	0	4	6

Adapted from Robinson and Fenster, 1973. *Agro. J.* 65:749-751.

Dicamba and 2,4-D are combined to control a wider spectrum of broadleaf weeds, including wild buckwheat (which is not controlled by 2,4-D alone). Dicamba plus 2,4-D must be applied to well tillered wheat and before jointing to avoid crop injury.

The sulfonylurea herbicides and Curtail have soil persistence and will control germinating broadleaf weeds for about four weeks after application. A surfactant (at 0.25 percent v/v) should be added to the spray solution whenever the sulfonylurea herbicides are used, unless liquid fertilizer is being combined with the herbicide. Ally XP, Amber, Finesse or Peak alone (without 2,4-D) can be applied in the fall to control winter annual broadleaf weeds.

Among the weeds that may or have become resistant to the sulfonylurea herbicides are kochia, Russian thistle and prickly lettuce. The use of 2,4-D (4 lb/gal) at 1/2 pint per acre applied with Ally XP, Amber, Finesse or Harmony Extra XP and a surfactant improves weed control and helps prevent resistant weed development. Higher rates of 2,4-D and surfactant may injure the wheat.

The sulfonylurea herbicides have rotational restrictions of one to 36 months that limit their use in areas where susceptible crops are grown in rotation with wheat. This is especially important when the crop is lost to hail or other crop failures.

The degradation of sulfonylurea herbicides in soil is slowed by high soil pH. Some of the sulfonylurea herbicides should not be applied to soils with a pH greater than 7.9 to avoid the risk of rotational crop injury. Producers should follow label directions carefully and determine rotational plans before using these products.

Wild buckwheat has become an increasing problem in winter wheat fields. Wild buckwheat is best controlled when herbicides are applied before it produces vines. Herbicides with short residuals applied before wild buckwheat germinates will not provide adequate control.

Liquid Nitrogen Fertilizers and Herbicides

Producers have combined liquid nitrogen fertilizers (UAN - 28 and 32 percent) and herbicides to control weeds and fertilize the crop with one application. Do not add surfactant to the liquid fertilizer-herbicide mixture. In some situations the winter wheat showed evidence of crop injury when sprayed with these mixtures. When wheat is under stress, spraying herbicides with UAN may cause yield reduction regardless of the crop stage. Adding sulfur increases crop injury.

An alternative to this program may be to strip band (20 inches) nitrogen fertilizer, if needed, as soon as field conditions permit in the spring and apply the herbicide later. The advantages of strip banding over broadcast for nitrogen fertilizer application are probably great enough to pay for the second application.

Harvest Aids

Ally + 2,4-D amine (4L), 2,4-D ester (4L) and glyphosate are registered for spraying winter wheat prior to harvest (check labels for rates and timing). Not all brands of 2,4-D are labeled for this use.

Winter wheat must be treated after the dough stage and treated at least seven days before harvest. Wheat sprayed with 2,4-D while the wheat nodes are green may result in stem breakage. A 10-day preharvest interval is needed for wheat sprayed with Ally + 2,4-D amine(4L).

One year, thousands of acres were sprayed with 2,4-D prior to harvest. Many treated fields had unsatisfactory desiccation of the weeds, plus many complaints were received on drift to susceptible crops, including corn. Most of these fields should have been sprayed during the tillering stage. Growers should examine fields early and treat where weed densities justify.

Summary

Weeds cause yield and quality losses in Nebraska's winter wheat. Producers can implement weed management systems that include preventive, cultural and chemical control methods to prevent these costly losses. Herbicide treatments are available to control broadleaf weeds in winter wheat at reasonable costs. Producers should read and follow directions on the herbicide label to ensure the safe and effective use of herbicides. For the most current herbicide recommendations see University of Nebraska-Lincoln Extension Circular *EC130, Guide for Weed Management*.

To simplify technical terminology, trade names sometimes may be used. No endorsement of products is intended nor is criticism implied of products not mentioned.

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