

2009 Chemical Weed Control

***for Field Crops,
Pastures, Rangeland,
and Noncropland***



***Kansas State University
Agricultural Experiment Station
and Cooperative Extension Service***

SELECTING AND APPLYING HERBICIDES

Protective Clothing and Equipment Guide

Pesticides kill. We wouldn't use them if they didn't. The problem is, chemicals that kill insects, diseases, and plants can cause illness in human beings in larger doses. Chemicals may not look all that harmful, but overexposure can be as dangerous as putting your arm into a hay baler. However, the damage may take longer to show up. That's what makes pesticide safety different from, say, tractor or combine safety. Very few people die of acute pesticide poisoning. But it is possible to end up in a hospital emergency room because of a severe reaction that may suddenly occur after years of repeated exposure to a particular chemical.

It is impossible to determine precisely the number of people who may suffer chronic, irreversible effects from pesticide exposure. These effects may include cancer, birth defects, and some types of nervous system disorders. Although cause-effect links between particular substances and cancer or birth defects are difficult to confirm, the sensible course of action is to give your health and that of your family the benefit of the doubt. Play it safe.

If you use pesticides, the best ways to minimize your exposure are to wear personal protective equipment and follow safe mixing, loading, application, and disposal procedures. Your risk of harmful health effects from pesticide exposure depends on two things: (1) the **toxicity** of the chemical and (2) how much of it you are **exposed** to. The National Agricultural Chemicals Association uses the formula: Risk = Toxicity + Exposure.

You can be exposed to chemicals in three ways. **Ingestion**, or swallowing, is the most common cause of acute poisonings. **Inhalation**, or breathing, is the most toxic of the ways that you can be exposed to pesticides because anything absorbed by the lungs goes directly into the bloodstream. **Dermal absorption**, or skin contact, is the route through which farmers get most of their exposure to pesticides.

To avoid pesticide exposure, don't eat, drink, smoke, or go to the bathroom while working with pesticides—not until you have washed your face and hands thoroughly with detergent and water. **Wear personal protective equipment.**

Hat



Hats, especially wide-brimmed ones, help keep pesticide splashes off your scalp, neck, forehead, and ears, all of which absorb pesticides rapidly. The hat should be plastic with a plastic headband. A regular seed cap or an absorbent headband, such as elastic or leather, will absorb pesticides and recontaminate you every time you wear it.

Goggles or Full Face Shield



Get chemical splash goggles or a full face shield to protect your eyes from splashing. Never wear contact lenses when working with chemicals.

Clothes

Wear denim overalls and a long-sleeved work shirt. Preferably, you should wear coveralls over them. There are also disposable garments available.

Gloves

The hands and forearms are contaminated by pesticides more often than any other

part of the body. That's why you need chemical-resistant gloves, preferably ones that extend at least halfway to your elbow. **Avoid leather gloves** because leather absorbs pesticides and is impossible to decontaminate.

Use **unlined** gloves made of neoprene, nitrile, or natural rubber. Latex does not protect against concentrated chemicals. Avoid gloves with lining, because the lining can absorb the pesticide and re-expose you every time you use them. Unless you are working overhead, such as when spraying fruit trees, wear your sleeves outside the gloves.

Check gloves for leaks before you use them by filling them with water and squeezing. Wash them with water and detergent as soon as you're done. Wash the outsides while you still have them on, then take them off and turn them inside out to wash the insides.

NOTE:

All pesticide protective clothing should be used only for pesticide protection, not for rain protection or any other purposes. Wash every piece of protective equipment after every use, using heavy-duty liquid detergent and hot water with lots of rinsing.

Respirator

To prevent inhalation of pesticides, wear a chemical cartridge or canister respirator equipped with cartridges specially formulated to filter out pesticides. Dust masks are not effective. Chemical filters must be replaced every 8 hours of normal use, more frequently if you are working in high humidity or breathing hard. Cartridge respirators can run less than \$25, and the replacement filters less than \$15 a pair. Alternatively, you can use a full-face-shielded canister respirator. Canister filters are more expensive but last longer.



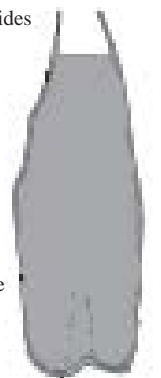
Respirators should be worn during mixing and loading of any pesticide and during application of highly toxic ("Danger - Poison") pesticides.

If you smell pesticide when you put on the respirator, throw the filters away, even if they are brand new. Then wash the respirator thoroughly with detergent and water because it could be contaminated. Insert new filters and start over. Better to lose a few dollars than be contaminated, your life is not worth the gamble.

For grain silo fumigation or other oxygen-poor environments, you must have a supplied-air respirator or self-contained breathing apparatus.

Rubber Apron

The area of the body that absorbs pesticides the most rapidly is not the palm of the hand, nor even your scalp or forehead, but the scrotum. For instance, parathion shows 11.8% absorption into the palm and 36.3% absorption into the forehead but is **absorbed 100%** by the scrotum if it comes into contact with it! At this rate, you suffer the same effect as if parathion were injected directly into your bloodstream. **This is why a rubber apron is critical.** You may prefer to use disposable Tyvek coveralls.



Rubber Boots

These should be neoprene, nitrile, or natural rubber. Leather absorbs pesticides! Wear boots, not overshoes, because pesticide can get inside overshoes and contaminate your shoes. Wear pant cuffs on the outside of the boots.



Read The Label

Each herbicide used on raw agricultural products must be registered and must have a residue tolerance established by the Registration Division, Environmental Protection Agency. Check the label and select only herbicides that may be used legally.

CHEMICAL WEED CONTROL FOR FIELD CROPS, PASTURES, RANGELAND, AND NONCROPLAND, 2009

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INTRODUCTION

To control weeds effectively, select control methods carefully, and use them properly. Chemicals, tillage, crop competition, cropping rotation, mowing, and fire are alternative weed control methods that may be used alone or in combination. Available time, labor, equipment, and other costs as well as types of weeds and areas infested need to be considered when planning a weed control program.

To increase efficiency of crop production, use weed control practices in conjunction with other crop and soil management practices such as planting high-quality seed, planting at the optimum rate and date, and maintaining optimum soil fertility.

This publication provides suggestions for chemical weed control in several major crops. For crops not listed, consult your local Research and Extension agricultural agent.²

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² In the following tables, common names are listed first, followed by trade names to help identify herbicides. No endorsement is intended, nor is any criticism implied of similar products not mentioned. The rate of application is given in pounds of active ingredient and amount of product.

Proper Use of Herbicides

- 1. Selection** – Choice of a herbicide depends on the crop being grown, expected weed infestation, soil type, desired duration of control, crop use, crop sequence, and cost. Be sure the herbicide selected has been registered for use on the crop to be grown. Rotation of crops and herbicides is recommended to avoid enhanced herbicide degradation, herbicide residue buildup, and herbicide-resistant weed problems and to manage troublesome weeds.
- 2. Label** – READ AND FOLLOW DIRECTIONS AND PRECAUTIONS. The label designates the herbicide, lists the amount of active ingredient, and gives recommendations and precautions. By following recommendations and observing precautions, you minimize the danger of crop injury; reduce the hazards to people, animals, and susceptible plants; and increase the probability of satisfactory weed control.
- 3. Registered Uses** – Do not use a herbicide unless directions for applying it to your crop are given on the label. At the time of printing, herbicides named in this publication were registered for uses suggested.
- 4. Herbicide Combinations** – Some herbicides have been formulated in combination and are available as a “premix.” Some herbicides can be mixed together by the applicator and applied as a “tank mix.” More weed species can be controlled by using herbicides in combination than separately. Because the rate of each herbicide usually is reduced in the combination, crop injury and herbicide carry-over can be reduced. NOTE: If a tank mix is used, follow all use limitations on labels of all products in the combination.
- 5. Application Rates** – Use only the rate recommended for your soil. Do not exceed the rate specified on the label. A rate higher than the recommended rate is illegal and can result in illegal residues in the harvested crop. Excessive rates also can injure the crop or carry over to injure the following crop. Apply only at the recommended stage of crop and/or growth. When a combination of herbicides is being used, the lower rates may not control tolerant species (e.g., sunflower, velvetleaf, morningglory, or cocklebur).
- 6. Carrier** – Water is the most commonly used carrier for herbicides. Liquid fertilizers can be used as carriers for most soil-applied herbicides and a few foliar-applied herbicides. Before mixing a herbicide with a liquid fertilizer (as recommended on some herbicide labels), **check the compatibility** of the herbicide with the carrier. Check by mixing a small amount of the herbicide and carrier in the approximate proportion to be used in the field. Shake or agitate the mixture vigorously. Allow it to stand for 5 minutes. If an initial separation or a settling out occurs in the herbicide-fertilizer mixture but disappears after vigorous shaking, the chemicals can be used in the same spray tank, if you maintain adequate agitation while spraying. If a precipitate forms, the mixture flakes, or the two chemicals will not stay mixed when agitated, the materials should not be mixed together in the same spray tank.
- 7. Drift** – Minimize drift and possible damage to susceptible plants by applying chemicals when the wind is light (less than 10 mph). Check wind direction to avoid drift toward susceptible crops. Smoke can be a valuable tool to assist in determining wind characteristics and in checking for the presence of temperature inversions. Refer to the product label for specific environmental precautions.
- 8. 2,4-D and Other Growth Regulator Herbicides** – Susceptible plants and crops often are damaged by improper use of systemic, foliage-applied herbicides, such as 2,4-D. Each year, local Research and Extension agents, horticulturists, and weed control specialists receive questions and complaints regarding twisted and distorted plants. Misapplication and other misuse of herbicides like 2,4-D cause much of the plant damage. **Prevent damage from 2,4-D or other growth-regulator herbicides to your own or your neighbor’s susceptible plants by following these rules:**
 - *Use a growth-regulator herbicide, such as 2,4-D, only when specifically needed. In some cases, other herbicides effectively control broadleaf weeds with fewer hazards.
 - *Amine salt formulations have low volatility and present less risk of injury to nearby susceptible plants than ester formulations. If the ester formulation must be used, apply a low-volatile ester formulation. High-volatile ester formulations, especially of 2,4-D, release vapors or fumes rapidly at about 80°F; low-volatile ester formulations release vapors at about 90°F.
 - *Apply all formulations on days when the winds are less than 10 mph and temperature inversions are unlikely. Spray drift from 2,4-D can injure susceptible plants several miles away. Some of the most susceptible plants are cotton, tomatoes, and grapes.
 - *Use one sprayer for these herbicides and another for other pesticides, unless the sprayer can be cleaned thoroughly.
- 9. Equipment** – Clean equipment immediately after using. If a sprayer has been used for herbicides, clean it thoroughly before using it to spray insecticides or fungicides. Refer to page 11 for general directions for cleaning spray equipment and to product label for specific cleaning requirements.
- 10. Storage** – Store herbicides in original containers - never in unmarked containers. If possible, store in a locked cabinet, room, or building away from food, feed, seed, and fertilizers. Follow label directions for storage conditions.

11. Disposal – Empty containers made of glass, metal, or plastic should be rinsed three times with water prior to disposal. Use the rinse water in the spray tank. After the rinsing, containers should be punctured, broken, or crushed and then disposed of properly. Disposal in a sanitary landfill is permissible, if in accordance with local regulations.

Combustible containers can be burned (if permitted by the instructions on the label and local ordinances) or disposed of in a sanitary landfill. Do not burn pesticide containers near residential areas or where persons can come in contact with the smoke. Always stand upwind when burning pesticide containers; the smoke may contain toxic vapors.

Large metal drums should be triple rinsed and sent to a barrel-reconditioning company, if possible, or taken to a sanitary landfill. Consider the use of returnable, minibulk containers. Never reuse empty pesticide containers for any other purpose.

Specific information on disposal can be obtained from your county Sanitary Landfill director or your local Research and Extension agricultural agent.

Factors Affecting Chemical Weed Control

A given herbicide may vary in effectiveness from year to year or place to place.

Factors affecting performance of soil-applied herbicides include:

- Kinds of weeds
- Rate of application
- Method and uniformity of application
- Solubility of herbicide
- Uniformity and depth of incorporation
- Rainfall
- Breakdown by light
- Soil type
- Soil organic matter
- Soil pH
- Calcium carbonate content of the soil
- Volatility of herbicide
- Herbicide resistance

Factors affecting performance of foliage-applied herbicides include:

- Kinds of weeds
- Rate of application
- Method and uniformity of application
- Spray retention on leaves
- Washing off of spray by rainfall
- Relative humidity and temperature
- Stage and rate of weed growth
- Spray adjuvants
- Tank mix partners
- Volatility of herbicides
- Drift-control agents
- Herbicide resistance

Knowledge of such factors will help to determine optimum plant, soil, and weather conditions for applying each herbicide. Such information usually can be ob-

tained from the label, the dealer, or your local Research and Extension agricultural agent.

Herbicide Resistance

Weed species and different biotypes within species vary in susceptibility to herbicides. A weed population that initially is susceptible to a herbicide but contains a small percentage of resistant biotypes may develop gradually into a resistant population. Selection for resistance is most likely with the repeated use of long-residual herbicides that provide nearly complete control of the susceptible biotypes. Thus, the herbicide eliminates susceptible types, and the proportion of resistant plants increases until the weed population can no longer be controlled adequately with that herbicide. Kochia, waterhemp, and Palmer amaranth have developed resistance to atrazine, ALS-inhibiting herbicides, and other classes of herbicides in certain areas of Kansas. Selection for herbicide-resistant weed populations can be minimized by using crop rotations, herbicide rotations, mixtures of herbicides with different modes of action, and integrated pest management (IPM). Use of these practices reduces exposure to herbicides and the selective pressure favoring resistant biotypes. Failure to follow these guidelines and label recommendations in areas where resistance has occurred may lead eventually to loss of effectiveness of otherwise useful herbicides.

Herbicide Mode of Action

Herbicides can be classified into “families” on the basis of chemical similarities and mode of action. The mode of action is the process by which a chemical kills or suppresses plant growth. Herbicides of the same chemical family usually have the same mode of action. Different chemical families of herbicides also may have the same mode of action. Repeated use of the same herbicide, herbicides of the same family, or herbicides having the same mode of action eventually can lead to enhanced degradation, weed species shifts, herbicide resistance, increased carryover, and crop injury. Using herbicides of different modes of action in tank mixes and in rotation, along with other cultural weed control practices, will help prevent these problems from occurring. Refer to the following list for the various herbicide families and modes of action.

Amino Acid Inhibitors

ALS-AHAS inhibitors:

- Imidazolinone family - Arsenal, Plateau, Pursuit, Raptor, Scepter, Contain, Beyond
- Sulfonylurea family - Accent, Afinity, Ally, Amber, Basis, Beacon, Cimarron, Classic, Equip, Escort, Express, Finesse, Glean, Harmony SG, Harmony Extra, Maverick, Olympus, OlympusFlex, Option, Osprey, Oust, Peak, Permit, PowerFlex, Spirit, Steadfast, Synchrony, Telar
- Sulfonamide family - Python, FirstRate

EPSP inhibitor:

- Amino acid derivative family - glyphosate, Roundup, Touchdown, and others

Cell Membrane Disruptors

Bipyridilium family - Gramoxone Inteon, Diquat
Diphenylether family - Ultra Blazer, Cobra, Phoenix, Reflex, Flexstar, ET
N-Phenylphthalimide family - Resource, Cadet
Aryl-Triazolinone family - Spartan, Aim, Valor, Encompass

Growth Regulators

Benzoic acid family - Banvel, Clarity, Sterling, Distinct, dicamba, Status
Phenoxy family - 2,4-D, 2,4-DB, MCPA, MCPP, 2,4-DP
Pyridine family - Tordon, Stinger, Remedy, Garlon, Starane, Milestone

Lipid Synthesis Inhibitors

Aryloxyphenoxypropionate family - Fusilade DX, Assure II, Fusion, Targa
Cyclohexanedione family - Poast, Poast Plus, Select, Volunteer, Section

Nitrogen Metabolism Inhibitors

Phosphorylated amino acid family - Liberty, Ignite 280

Photosynthetic Inhibitors

Triazine family - atrazine, Sencor, Princep, Evik, Pramitol
Phenylurea family - Lorox, Karmex, Spike
Uracil family - Sinbar, Hyvar

Nitrile family - Buctril, Moxy, Bromox, Brox
Benzothiadiazole family - Basagran

Pigment Inhibitors

Isoxazolidinone family - Command
Isoxazole family - Balance, Callisto, Impact, Laudis, Huskie
Pyridazinone family - Zorial

Seedling Growth Inhibitors

Carbamothioate family - Eradicane, Eptam, Sutan+
Acid amide family - Lasso, Micro-Tech, Dual II
MAGNUM, Define, Outlook, Propel, Surpass, Harness, Degree, Topnotch, Intro
Dinitroaniline family - Treflan, Trust, Prowl, Acumen, Sonalan, Balan
For further information on herbicide families and modes of action, refer to K-State Research and Extension publication C-715, Herbicide Mode of Action.

Soil Residues

Some herbicides remain active in the soil for only a few days; others may persist for more than a year. Residual toxicity depends on (1) chemical structure, solubility, adsorption, and degradation; (2) texture, organic matter content, and pH of the soil; (3) rate applied; (4) environmental conditions, especially soil moisture and temperature; and (5) weed and crop species. **Read the label to determine residual toxicity and limitations, if any, on cropping sequence.**

HERBICIDE APPLICATION

Liquid and granular applications are the most common methods of applying herbicides. Sprayers are available in various types and sizes, each designed for a specific application. The types of sprayers used by applicators include hand-operated sprayers, low-pressure boom sprayers, and special sprayers for selective application of crop protection products. Granular applicators are also used to apply a variety of crop protection products to control weeds. Available units include row or band applicators for covering a variety of swath widths.

Better application equipment and new techniques that allow for smaller dosages of crop protection products and that reduce drift and residue have become increasingly important in minimizing harmful effects of crop protection products on the environment.

Low-pressure Field Sprayers

Applicators typically use low-pressure sprayers more than any other kind of application equipment for applying crop protection products. Tractor-mounted, pull-type, and self-propelled sprayers are available in many models and for a large variety of prices. Spray pressures used typically range from 15 to about 50 pounds per square inch (psi), and application rates can vary from less than 5 to more than 100 gal/acre (GPA). All low-pressure sprayers have several basic components: a pump, a tank, an agitation system, a flow-control assembly, and a

distribution system. At the end of the distribution system is the spray nozzle.

Nozzle Types

Selection of the correct type and size of spray nozzle is essential for each application. The nozzle determines the amount of spray applied to an area, the uniformity of the application, the coverage of the sprayed surface, and the amount of drift. You can minimize the drift problem by selecting nozzles that give the largest droplet size while providing adequate coverage at the intended application rate and pressure. Although nozzles have been developed for practically every kind of spray application, only a few types – extended range flat-fans, Turbo flooding flat-fans, Turbo flat-fans, venturi flat-fans, and drift reduction pre-orifice flat-fans – are commonly used in the application of crop protection products. An emphasis in nozzle design over the past few years has resulted in a vast improvement in spray quality.

Spray nozzle assemblies consist of a body, cap, check valve, and nozzle tip. Various types of bodies and caps (including color-coded versions) and multiple nozzle bodies are available with threads as well as quick-attaching adapters. Nozzle tips are interchangeable in the nozzle cap and are available in a wide variety of materials, including hardened stainless steel, stainless steel, brass, ceramic, and various types of plastic. Hard-

ened stainless steel and ceramic are the most wear-resistant materials, but they are also the most expensive. Stainless steel tips have excellent wear resistance with either corrosive or abrasive materials. Plastic tips are resistant to corrosion and abrasion and are proving to be very economical tips for applying crop protection products. Brass tips have been very common, but they wear rapidly when used to apply abrasive materials, such as wettable powders, and are corroded by some liquid fertilizers. Other types should be considered for more extensive use. See Table 1 for nozzle nomenclature information.

Variables Affecting Application Rate

Three variables affect the amount of spray material applied per acre: (1) nozzle flow rate, (2) ground speed of the sprayer, and (3) width sprayed per nozzle. To calibrate and operate a sprayer properly, you must understand how each of these variables affects sprayer output.

The nozzle flow rate varies with the size of the tip, the nozzle pressure, and the density of the spray liquid. Installing a nozzle tip with a larger orifice, increasing the pressure, and decreasing the density of the spray liquid all increase the flow rate. To increase the nozzle output, you must multiply the pressure by the square of the desired increase in flow rate. In other words, doubling the pressure will not double the nozzle flow rate. To double the flow rate, you must increase the pressure 4 times. For example, to double the flow rate of a nozzle from 0.2 gal/minute at 10 psi to 0.4 gal/minute, the pressure must be increased to 40 psi (4×10).

Pressure changes should not be used to make major adjustments in the application rate. To obtain a uniform spray pattern and minimize drift, you should maintain the operating pressure within the recommended range for each nozzle. The pressure can be changed, however, to correct for minor variations in flow rate resulting from nozzle wear.

The spray application rate varies inversely with the ground speed. Doubling the ground speed (mph) of the sprayer reduces the gallons of spray applied per acre (GPA) by one-half. For example, a sprayer applying 20 GPA at 4 mph would apply 10 GPA if the speed were increased to 8 mph while the pressure remained constant.

Many low-pressure field sprayers have a metering system that maintains a constant application rate while operating over a range of travel speeds. All metering systems now in use, such as ground-driven piston pumps, electronic feedback control systems, and various centrifugal pump arrangements, vary the nozzle pressure to compensate for changes in travel speed, keeping the application rate constant. Although all the systems work over a wide range of travel speeds, the spray nozzle limits the range of speeds at which precise application can be obtained. Because of the possibilities for dramatic pressure increases while using such systems, there is a serious potential for spray drift occurrence.

To regulate the flow in proportion to travel speed, the rate of increase in nozzle pressure must vary with the square of the rate of increase in speed. For example, if the sprayer is traveling at 4 mph at a nozzle pressure of 20 psi, increasing the speed to 8 mph will require increasing the nozzle pressure to 80 psi to maintain the same flow volume. Remember, a fourfold change in pressure drastically reduces the droplet size, which may result in increased drift. The pattern width and distribution pattern may also be affected. For uniform application, the travel speed should be held as nearly constant as possible, even when using controlled metering systems.

To apply crop protection products accurately, you must maintain the proper ground speed. Do not rely on a conventional speedometer as an accurate indicator of speed. Slippage of the drive wheels can result in speedometer errors of 20% or more. Electronic kits and radar guns give more accurate readings because they do not depend on the drive wheels for speed measurements. Changes in tire size also affect speedometer readings, and the accuracy of all speedometers should be checked periodically.

The effective width sprayed per nozzle also affects the spray application rate. Doubling the effective width sprayed per nozzle decreases the gallons per acre (GPA) applied by one-half. For example, if you are applying 20 GPA with flat-fan nozzles on 20-inch spacings, changing to flooding nozzles with the same flow rate on 40-inch spacings will decrease the application rate from 20 GPA to 10 GPA.

Calibration

Accurate calibration is the only way to know how much chemical is applied. Even with the current widespread use of electronics to monitor and control the application of crop protection products, a thorough sprayer calibration procedure is essential to ensure against misapplication. Failure to calibrate a sprayer can injure your crop, cause pollution, and waste money. In addition to calibrating the sprayer at the start of the season, you should recalibrate regularly. Abrasive pesticide formulations can wear nozzle tips, resulting in an increased nozzle flow rate and the development of poor spray patterns.

To obtain uniform coverage, you must consider the spray angle, spacing, and height of the nozzle. The height must be readjusted for uniform coverage with various spray angles and nozzle spacings. Do not use nozzles with different spray angles on the same boom for broadcast spraying. Be sure the nozzle tips are clean. If necessary, clean with a soft bristle brush. A nail, wire, or pocket knife can damage the tip and ruin the uniformity of the spray pattern. While the sprayer is running, observe each spray tip for any distortions in the patterns.

Worn or partially plugged nozzles produce nonuniform patterns. Misalignment of nozzle tips is a common cause of uneven coverage. The boom must be level at all times to maintain uniform coverage. Skips and

uneven coverage will result if one end of the boom is allowed to droop. A good method for determining the exact nozzle height that will produce the most uniform coverage is to spray on a warm surface, such as a road, and observe the drying rate. Streaks in the spray pattern should be obvious. Replace nozzles that are not performing correctly.

When you are convinced that the sprayer is operating properly, you are ready to calibrate. There are many methods for calibrating low-pressure sprayers, but they all involve the use of the variables in the following equations. Any technique for calibration that provides accurate and uniform application is acceptable. No single method is best for everyone.

The calibration method described below has four advantages. First, it allows you to select the number of gallons to apply per acre and to complete most of the calibration before going to the field. Second, it provides a simple means for frequently adjusting the calibration to compensate for changes due to nozzle wear. Third, it can be used for broadcast, band, directed, and row crop spraying. This method requires a knowledge of nozzle types and sizes and the recommended operating pressure ranges for each type of nozzle used. Finally, when using the method below the applicator will have a better understanding of how each variable will affect the application rate. As each of the variables change, the influence on the rate (gallons per acre) is apparent.

The gallons of spray applied per acre can be determined by using the following equation:

$$\text{(Equation 1) } \text{GPA} = \frac{\text{GPM} \times 5,940}{\text{mph} \times W}$$

GPM = output per nozzle in gallons per minute

mph = ground speed in miles per hour

W = effective width sprayed per nozzle in inches

5,940 = a constant to convert gallons per minute, miles per hour, and inches to gallons per acre

The size of the nozzle tip will depend on the application rate (GPA), ground speed (mph), and effective width sprayed (W) that you plan to use. Some manufacturers advertise "gallon-per-acre" nozzles, but this rating is useful only for standard conditions (usually 30 psi, 4 mph, and 20-inch spacing). The gallons-per-acre rating is useless if any one of your conditions varies from the standard.

A more exact method for choosing the correct nozzle tip is to determine the gallons per minute (GPM) required for your conditions. Then select nozzles that provide this flow rate when operated within the recommended pressure range. By following the five steps described below, you can select the nozzles required for each application well ahead of the spraying season.

Step 1. Select the spray application rate in gallons per acre (GPA). Pesticide labels recommend ranges for various types of equipment. The spray application rate is the gallons of carrier (water, fertilizer, etc.) and pesticide applied per treated acre.

Step 2. Select or measure an appropriate ground speed in miles per hour (mph) according to existing field conditions. Do not rely on speedometers as an accurate measure of speed. Slippage and variation in tire sizes can result in speedometer errors of 20% or more. If you do not know the actual ground speed, you can easily measure it. (Instructions for measuring ground speed are given below).

Step 3. Determine the effective width sprayed per nozzle (W) in inches.

For broadcasting spraying, W = the nozzle spacing

For band spraying, W = the band width

For row-crop applications, such as spraying from drop pipes or directed spraying,

$$W = \frac{\text{row spacing (or band width)}}{\text{number of nozzles per row (or band)}}$$

Step 4. Determine the flow rate required from each nozzle in gallons per minute (GPM) by using a nozzle catalog, tables, or the following equation. Using Equation 2 allows the applicator to determine flow rates for each application scenario needed for the application season. This can be done before the application season begins, thus not interfering with critical time available during the application time.

$$\text{(Equation 2) } \text{GPM} = \frac{\text{GPA} \times \text{MPH} \times W}{5,940}$$

GPM = gallons per minute of output required from each nozzle

GPA = gallons per acre from Step 1

mph = miles per hour from Step 2

W = inches sprayed per nozzle from Step 3

5,940 = a constant to convert gallons per minute, miles per hour, and inches to gallons per acre

Step 5. Select a nozzle that will give the flow rate determined in Step 4 when the nozzle is operated within the recommended pressure range. You should obtain a catalog of available nozzle tips. These catalogs can be obtained free of charge from equipment dealers or nozzle manufacturers. If you decide to use nozzles that you already have, return to Step 2 and select a speed that allows you to operate within the recommended pressure range.

Broadcast application:

Example 1. You want to broadcast a preplant incorporated herbicide at 15 GPA (Step 1) at a speed of 7 mph (Step 2), using TurboFlood nozzles spaced 40 inches apart on the boom (Step 3). What TurboFlood nozzle tip should you select?

The required flow rate for each nozzle (Step 4) is:

$$\text{GPM} = \frac{\text{GPA} \times \text{mph} \times W}{5,940}$$

$$\text{GPM} = \frac{15 \times 7 \times 40}{5,940} = \frac{4,200}{5,940} = 0.71$$

The nozzle that you select must have a flow rate of 0.71 GPM when operated within the recommended pressure range of 10 to 40 psi. Table 2 shows the GPM at various pressures for several Spraying Systems TF nozzles. For example, the Spraying Systems TF-5 nozzle has a rated output of 0.71 GPM at 20 psi (Step 5). This nozzle could be installed for this application.

Herbicide Band Applications for Cost-Effective Weed Control

Band applications of herbicides can reduce costs for postemergence and preemergence weed control treatments. In band applications, the treated acre is the acres actually sprayed and, depending on the row spacing and the band width, is some fraction of the total field acres. Remember, herbicides are applied in bands at the same rate of active ingredients per treated acre as in broadcast applications. Treating a field with 30-inch rows in 15-inch bands has the effect of reducing the herbicide cost by one-half.

When banding soil-applied herbicides to control weeds in row crops, use spray tips designed for band application. They are commonly referred to as “even flat spray” tips and are designated in the nozzle nomenclature with the letter ‘E’ (see Table 1). Even flat spray tips are designed to apply a uniform pattern on the target across the width of the angle. Extended range flat spray tips, on the other hand, are designed to apply a tapered edge pattern and thus would not uniformly cover the targeted band width. For even spray tips, the nozzle spray angle and height above the target will determine the spray width.

Band applications can also be used to apply postemergence materials. To obtain thorough coverage to all plant material it may be necessary to direct the spray in a multi-nozzle arrangement around and over the top of the plant. Special band-application row kits or drops are available for this purpose. Special attention should be given when using a multiple nozzle kit to properly calibrate for the correct nozzle orifice size.

Band application-over the row:

Example 2: You want to apply a preemergence herbicide in a 15-inch band over each 30-inch corn row. The desired application rate is 15 GPA at 7.5 mph. Which even flat-fan nozzle should you select?

The required flow rate is:

$$\text{GPM} = \frac{\text{GPA} \times \text{mph} \times \text{W}}{5,940}$$

$$\text{GPM} = \frac{15 \times 7.5 \times 15}{5,940} = \frac{1,687.5}{5,940} = 0.28$$

The nozzle that you select must have a flow rate of 0.28 GPM when operated within the recommended pressure range. The Spraying Systems TP8003E or AI9503E nozzles shown in Table 3 has a rated output of 0.28 GPM at approximately 35 psi. Either of these nozzles could be used for this application.

Now that you have selected and installed the proper nozzle tips (Steps 1 to 5) you are ready to complete the calibration of your sprayer (Steps 6 to 10 below). Check the calibration every few days during the season or when changing the crop protection products being applied. New nozzles do not lessen the need to calibrate because some nozzles “wear in,” increasing their flow rate more rapidly during the first few hours of use. Once you have learned the following method, you can check application rates quickly and easily.

Step 6. Determine the required flow rate for each nozzle in ounces per minute (OPM). To convert GPM (Step 4) to OPM, use the following equation:

$$\text{(Equation 3) OPM} = \text{GPM} \times 128 \text{ (1 gallon} = 128 \text{ ounces)}$$

From Example 1, the required flow rate = 0.71 GPM
 $\text{OPM} = 0.71 \times 128 = 91$

From Example 2, the required flow rate = 0.28 GPM
 $\text{OPM} = 0.28 \times 128 = 36$

Step 7. Collect the output from one of the nozzles in a container marked in ounces. Adjust the pressure until the ounces per minute (OPM) collected is the same as the amount that you determined in Step 6. Check several other or all of the nozzles to determine if their outputs fall within 5% of the desired OPM.

If it becomes impossible to obtain the desired output within the recommended range of operating pressures, select larger or smaller nozzle tips or a new ground speed, then recalibrate. It is important for spray nozzles to be operated within the recommended pressure range. The range of operating pressures is indicated at the nozzle tip. Line losses, nozzle check valves, etc., may require the main pressure gauge at the boom or at the controls to read much higher.

Step 8. Determine the amount of pesticide needed for each tankful or for the acreage to be sprayed. Add the pesticide to a partially filled tank of carrier (water, fertilizer, etc.). Then add the carrier to the desired level with continuous agitation. Examples for determining the amount of pesticide to add to the tank are illustrated later.

Step 9. Operate the sprayer in the field at the ground speed you measured in Step 2 and at the pressure you determined in Step 7. You will be spraying at the application rate you selected in Step 1. After spraying a known number of acres, check the liquid level in the tank to verify that the application rate is correct.

Step 10. Check the nozzle flow rate frequently Adjust the pressure to compensate for small changes in nozzle output due to nozzle wear or variations in other spraying components. Replace the nozzle tips and recalibrate when the output has changed 5% or more from that of a new nozzle, or when the pattern has become uneven.

Remember, to apply crop protection products accurately you must maintain the proper ground speed. Because speedometers do not always provide an accurate measure of speed, you may want to check the accuracy of the speedometer with an electronic kit or radar gun. If your sprayer does not have a speedometer or if your speedometer is not accurate, you must measure the speed at all of the settings that you plan to use in the field. By measuring and recording the ground speed at several gear and throttle settings, you will not have to remeasure speed each time you change settings.

To measure ground speed, lay out a known distance in the field you intend to spray or in another field with similar surface conditions. Suggested distances are 100 feet for speeds up to 5 mph, 200 feet for speeds from 5 to 10 mph, and at least 300 feet for speeds above 10 mph. At the engine throttle setting and in the gear you plan to use during spraying with a half-loaded sprayer, determine the travel time between the measured stakes in each direction. Average these speeds and use the following equation to determine ground speed.

$$\text{Speed (mph)} = \frac{\text{distance (feet)} \times 60}{\text{time (seconds)} \times 88}$$

$$1 \text{ mph} = 88 \text{ feet per 60 seconds}$$

Example: After measuring a 200-foot course – with the appropriate throttle settings, gear, and a half-loaded tank – you discover that 22 seconds are required for the first pass and 24 seconds for the return pass.

$$\text{Average time} = \frac{22 + 24}{2} = 23 \text{ seconds}$$

$$\text{MPH} = \frac{200 \times 60}{23 \times 88} = \frac{12,000}{2,024} = 5.9$$

Once you have decided on a particular speed, record the throttle setting and drive gear used.

Mixing Pesticide Formulations

To determine how much pesticide to add to your spray tank, you must know (1) the recommended pesticide application rate, (2) the capacity of the spray tank, and (3) the calibrated output of the sprayer.

Follow the label instructions or university recommendations to determine the rate at which to apply the pesticide. The rate is usually indicated in pounds per acre for wettable powders, and in pints, quarts, or gallons per acre for liquids. Sometimes the recommended rate is given in pounds of active ingredient per acre (lb ai/acre) rather than the amount of product per acre. In these cases, you must convert the quantity of active ingredient to the corresponding quantity of the actual product.

You should verify that the sight gauge marks are accurate for your spray tank. Misapplication often occurs because tank capacities are measured inaccurately. To determine tank capacity, add measured volumes of water (5 to 50 gal) and mark the level on the gauge as you fill the tank. You can use flow meters to measure the quantity of water as it flows into the tank. Flow meters

are much easier to use than containers when calibrating sight gauge marks on large tanks.

The calibrated output of your sprayer determines the number of gallons that will be applied per acre. Pesticide labels recommend ranges of application rates for various types of equipment. Sometimes crop protection products are applied in fertilizer solutions. In these cases, the desired fertilizer application rate determines the number of gallons per acre that must be applied. Also, most fertilizers are more dense than water and will have different flow characteristics. Adjustments for differences in flow rate are required to achieve the calibrated application rate.

Once you have figured out the exact capacity of your tank and have calibrated your sprayer accurately, you can determine how many acres you can spray with every tankful of spray solution. Divide the number of gallons the tank holds by the number of gallons you intend to apply to each acre. The amount of pesticide to add to the tank is determined by multiplying the number of acres sprayed per tankful by the recommended pesticide application rate. The following examples illustrate this procedure.

Example (Dry Formulation): An atrazine recommendation calls for 1.5 lb ai/acre. You have purchased AAtrex 90DF (90% dry flowable). Your sprayer has a 400-gal tank and is calibrated to apply 20 gal/acre. How much AAtrex should you add to the spray tank?

Step 1. Determine the number of acres you can spray with each tankful.

$$\frac{\text{tank capacity (gal/tank)}}{\text{spray rate (gal/acre)}} = \frac{400}{20} = 20 \text{ acres/tankful}$$

Step 2. Determine the number of pounds of pesticide product needed per acre. Since not all of the atrazine in the bag is an active ingredient, you will obviously have to add more than 1.5 lb of the product to each “acre’s worth” of water in your tank. To determine how much more, divide the percentage of active ingredient (in this case, 90) into the total (100).

$$1.5 \text{ lb ai/acre} \times \frac{100}{90} = 1.5 \times 1.11 = 1.66 \text{ lb product/acre}$$

For each “acre’s worth” of water in the tank, you will need 1.66 lb of product to apply 1.5 lb ai/acre.

Step 3. Determine the amount of pesticide to add to each tankful. With each tankful you will cover 20 acres (Step 1), and you want to apply 1.66 lb of product per acre (Step 2).

$$20 \text{ acre} \times 1.66 \text{ lb/acre} = 33.3 \text{ lb product per tankful}$$

Example (Liquid Formulation): A trifluralin recommendation calls for 1 lb ai/acre. You have purchased

Treflan 4E (4 lb/gal formulation). Your sprayer has a 500-gal tank and is calibrated to deliver 20 GPA. How much Treflan should you add to the spray tank?

Step 1. Determine the number of acres that you can spray with each tankful.

$$\frac{\text{tank capacity (gal/tank)}}{\text{spray rate (gal/acre)}} = \frac{500}{20} = 25 \text{ acres/tankful}$$

Step 2. To determine the amount of product needed per acre, divide the recommended amount of active ingredient per acre by the concentration of the formulation.

$$\frac{1 \text{ lb ai/acre}}{4 \text{ lb ai/gal}} = 1/4 \text{ gal/acre}$$

Step 3. Determine the amount of pesticide to add to each tankful. You will cover 25 acres with each tankful (Step 1), and want to apply 1/4 gal (1 qt) of product per acre (Step 2).

$$25 \text{ acre} \times 1 \text{ qt/acre} = 25 \text{ qt (6.25 gal) Treflan/tankful}$$

Example (Adjuvant): It is often recommended that a small amount of an adjuvant, such as a spreader-sticker or a surfactant, be added to the chemical you plan to spray. The amount to be added is frequently given as percent concentration.

If you use an adjuvant at 0.5% concentration by volume, how much should you add to a 500-gal tank?

Solution 1:

$$1\% \text{ of } 100 \text{ gal} = 1 \text{ gal (} 100 \times 0.01 = 1)$$

$$0.5\% \text{ of } 100 \text{ gal} = 0.5 \text{ gal}$$

$$\text{You will need } 0.5 \text{ gal for } 100 \text{ gal, or } 2.5 \text{ gal for } 500 \text{ gal (} 0.5 \times 5 = 2.5).$$

Solution 2:

$$0.5\% = \frac{0.5}{100} = 0.005$$

$$0.005 \times 500 \text{ gal} = 2.5 \text{ gal adjuvant per } 500\text{-gal tank}$$

Table 1. Explanation of Typical Nozzle Numbering Systems

Extended Range Flat-fan	XR 11004	XR - Extended Range Flat-fan
Turbo Flat-fan	TT 11004	TT- Turbo Flat-fan
Venturi Flat-fan	AI 11004	AI - Air-induction/Venturi Flat-fan 110 - 110 degree fan angle 04 - 0.4 gal/minute flow rate at 40 psi
Even-fan	TP8002E AI 9502E	E - Even spray pattern 80 - 80 degree fan angle, 95 degree fan angle 02 - 0.2 gal/minute flow rate at 40 psi
Turbo Flooding	TF-4	TF - Turbo Flood 4 - 0.4 gal/minute flow rate at 10 psi
Turf Flood	TTJ04	TTJ - Turbo Turf Flood 4 - 0.4 gal/minute flow rate at 40 psi
Turbo Flooding	QCTF 40	QCTF - Quick attach Turbo Flood 40 - 4.0 gal/minute at 10 psi

Table 2. Turbo Flooding Flat-Fan Nozzle Chart

Spraying Systems Orifice Designation	Liquid Pressure (PSI)	Capacity	
		gal/min (GPM)	oz/min (OPM)
TF-2	10	.20	26
	20	.28	36
	30	.35	45
	40	.40	51
TF-2.5	10	.25	32
	20	.35	45
	30	.43	55
	40	.50	64
TF-3	10	.30	38
	20	.42	54
	30	.52	67
	40	.60	77
TF-4	10	.40	51
	20	.57	73
	30	.69	88
	40	.80	102
TF-5	10	.50	64
	20	.71	91
	30	.87	111
	40	1.00	128
TF-7.5	10	.75	96
	20	1.1	136
	30	1.3	166
	40	1.5	192
TF-10	10	1.0	128
	20	1.4	180
	30	1.7	221
	40	2.0	256

Table 3. Banding and Directed Application Nozzle Chart

Spraying Systems Orifice Designation	Liquid Pressure (PSI)	Capacity	
		gal/min (GPM)	oz/min (OPM)
TP8001E	30	0.087	11
	40	0.10	13
	50	0.11	15
	60	0.12	15
TP80015E, AI95015E	30	0.13	17
	40	0.15	19
	50	0.17	22
	60	0.18	23
	70	0.20	26
TP8002E, AI9502E	80	0.21	27
	30	0.17	22
	40	0.20	26
AI9525E	50	0.22	28
	60	0.24	31
	70	0.26	33
	80	0.28	36
	30	0.22	28
TP8003E, AI9503E	40	0.25	42
	50	0.28	36
	60	0.32	41
	70	0.33	42
	80	0.35	45
TP8004E, AI9504E	30	0.26	33
	40	0.30	38
	50	0.34	44
	60	0.37	47
	70	0.40	51
TP8005E, AI9505E	80	0.42	54
	30	0.35	45
	40	0.40	51
	50	0.45	58
	60	0.49	63
TP8006E, AI9506E	70	0.53	68
	80	0.57	73
	30	0.43	55
	40	0.50	64
	50	0.56	72
TP8008E, AI9508E	60	0.61	78
	70	0.66	84
	80	0.71	91
	30	0.52	67
TP8010E	40	0.60	77
	50	0.67	86
	60	0.73	93
	30	0.69	88
TP8010E	40	0.80	102
	50	0.89	114
	60	0.98	125
	30	0.87	111
TP8010E	40	1.00	128
	50	1.12	143
	60	1.22	156
	30	1.00	128

CLEANING SPRAY EQUIPMENT

Clean your spray equipment immediately after use. Some crops can be damaged or killed by traces of herbicides that are left in the sprayer after cleaning. It usually is wise to have separate spray equipment for herbicides, insecticides, and fungicides.

You can clean spray equipment quickly with a suspension of activated charcoal in water. Triple rinse the sprayer, and then spray the water on a target area. Use at least a third of a tank of water. Then suspend activated charcoal in water for subsequent rinsing. For each 10 gal of water, add 1/4 lb activated charcoal and 1/4 to 1/3 lb laundry detergent. Agitate this mixture vigorously to distribute the charcoal throughout the water. Wash the equipment for 2 minutes by swirling the charcoal suspension around in the tank so that it reaches all parts. Pump some of the liquid through the hose and nozzles.

Then drain the tank and rinse the equipment with clean water. Do this away from areas where rinse water might contaminate water supplies or animal feed.

For phenoxy herbicides, a 1% ammonia-water solution is effective. Follow the general instructions above, but soak the equipment for 24 hours. Refer to the product label for specific cleaning requirements. Some herbicides may require special procedures to prevent inadvertent contamination.

Pumps should be cleaned and lubricated after each use. They can be filled with oil to prevent rust or corrosion (use radiator rust inhibitor if the pump contains rubber parts or seals). Do not leave oil in hoses. Antifreeze should be used when winterizing to prevent freeze damage.

PROTECT YOUR WATER SUPPLY

1. Avoid contamination of wells and surface water sources by keeping pesticide storage, handling, mixing, and cleanup operations at least 300 feet away from them. The use of a nurse tank for a water supply and to mix chemicals at the application site is recommended. When pesticide storage, handling, and mixing must be within 300 feet of wells and surface watercourses, anticipate accidents and provide protection. Have a lined collection and containment area for any spills and leaks that may occur.
2. Prevent back siphoning by keeping the end of the water supply hose above the sprayer tank water level at all times. Alternatively, anti-backflow devices of various types are available for installation in your water supply line.
3. Triple rinse containers of liquid pesticide formulations, and use rinsings as diluents in subsequent spray applications. Puncture the container to render it useless. One way to dispose of small amounts of excess herbicide is to apply it at labelled rates to a set-aside field. Never drain leftover chemicals or rinses from equipment near or into ditches, streams, ponds, or other water sources.
4. In case of herbicide spillage, keep people away and confine the spill. If it starts to spread, dike it up with soil. Use absorbent material, such as soil, sawdust, or cat litter, to soak up the spill. Shovel all contaminated material into a leak-proof container and dispose of it as you would pesticide waste. Do not hose down the area, because this spreads the chemical. Contact the Kansas Department of Health and Environment or your local Research and Extension agricultural agent for more information.
5. For emergency assistance with major spills, call the toll-free CHEMTREC hotline 1-800-424-9300 day or night. This number is for emergencies only.
6. Many herbicides adhere to soils. Protect watercourses with grass buffer strips at least 50 feet in width to trap soilborne herbicides.
7. Additional suggestions include: Follow label directions; calibrate sprayer properly; use integrated weed management approaches (e.g., crop rotation, cultivation, competitive crops); and use short-residual herbicides. Also, identify high risk areas, such as sandy soils, high pH soils, and areas where the water table is near the soil surface. Use pesticides with minimum potential for surface and groundwater contamination in these sensitive areas.

HERBICIDE TERMS AND DEFINITIONS

Acid equivalent (AE). The theoretical yield of parent acid from the active ingredient content of a formulation.

Active ingredient (AI). The agent in a product primarily responsible for the intended herbicidal effects and shown as the active ingredient on the herbicide label.

Adjuvant. Any substance in a herbicide spray mixture that reduces handling and mixing problems or enhances the effectiveness of the herbicide.

Antagonism. Reduced activity of one or more pesticides when applied in combinations.

Antidote. A compound added to certain herbicides to increase their safety on certain crops, e.g., EPTC plus antidote makes Eradicane, which is safe to use on corn.

Band treatment. Application to a continuous restricted area such as on or along a crop row rather than over the entire field area.

Broadcast treatment. Application of a herbicide over an entire field area.

Carrier. A liquid or solid substance used to dilute or suspend a herbicide during its application.

Contact herbicide. A herbicide that causes localized injury where it contacts plant tissue. Not translocated.

Crop oil. A mixture of nonphytotoxic, paraffin-based petroleum oil with 2 to 5% emulsifier. Used as an adjuvant.

Crop oil concentrate. A mixture of 80 to 85% nonphytotoxic, paraffin-based petroleum oil and 15 to 20% emulsifier. Used as an adjuvant to increase foliar uptake.

Defoliant. A chemical that causes the leaves to drop from a plant.

Desiccant. Any substance or mixture of substances used to accelerate the killing or drying of plant tissue.

Dry flowable (DF). A highly concentrated granule designed to break up and disperse in water in a manner similar to that of wettable powders. Requires agitation.

Dry soluble (DS). A dry formulation that forms a solution when added to water.

Emulsifiable concentrate (EC). A single-phase liquid system that forms an emulsion when mixed with water. Requires mild agitation to maintain the emulsion.

Emulsion. One liquid suspended as minute globules in another liquid (for example, oil dispersed in water).

Flowable formulation. A two-phase concentrate that contains solid herbicide suspended in liquid and is capable of suspension in water. Requires only moderate agitation.

Foliar application. Application of a herbicide to the foliage of plants.

Granule (G). An inert material with a low concentration (usually 5 to 15% active ingredient) of pesticide impregnated into it or on the surface and designed to be spread directly on the soil.

Growth stage for cereal crops.

- (1) Tiller or Tillering—when additional shoots are developing from the crown.
- (2) Joint or Jointing—when stem internodes begin elongating.
- (3) Boot or Booting—when growth of the developing spike or panicle swells the upper leaf sheath.
- (4) Head or Heading—when the seed head is emerging or has emerged from the sheath.

Growth stage for corn and sorghum. Three different measures are commonly used:

Plant height = height of freestanding plants.

Leaf number = total number of leaves, including the newest leaf that is at least half extended.

V-Stage = vegetative stage, according to the newest leaf whose leaf collar is visible.

Example: V3 = corn (or sorghum) plant with three leaf collars visible.

Herbicide. A chemical used to control, suppress, or kill plants or severely interrupt their normal growth processes.

Incorporate. To mix or blend a herbicide into the soil.

LD₅₀. The dose (quantity) of a chemical calculated to be lethal to 50% of the organisms in a specific test situation. It is expressed in weight of the chemical (mg) per unit of body weight (kg). The toxicant may be fed (oral LD₅₀), applied to the skin (dermal LD₅₀), or administered in the form of vapors (inhalation LD₅₀). Measures acute, not chronic, exposure.

Low-volatile ester (LVE). Any ester with a high molecular weight (like butoxy-ethanol, iso-octyl, or propylene glycol butyl ester) that is less volatile than the low molecular weight esters (such as methyl, ethyl, propyl, isopropyl, butyl, amyl, and pentyl esters). Low-volatile esters are less likely than high-volatile esters to injure plants by vapor drift.

Persistent herbicide. See residual herbicide.

Pesticide. A chemical that destroys or suppresses pests (plants, pathogens, or animals).

Phytotoxic. Injurious or lethal to plants or seedlings.

Postemergence (POST). Applied after the specified weed or planted crop emerges.

Postplant incorporated. Applied and incorporated into the soil after the crop is planted.

Premix. A commercial product consisting of two or more herbicide active ingredients formulated for the convenience of the applicator.

Preemergence (PRE). Applied before the specified weed or crop emerges.

Preplant application. Applied on the soil surface before seeding or transplanting.

Preplant incorporated (PPI). Applied and tilled into the soil before seeding or transplanting.

Rate. The amount of active ingredient, acid equivalent, or product applied per unit area or other treatment unit.

Residue. That quantity of a herbicide remaining in or on the soil, plant parts, animal tissues, whole organisms, or surfaces.

Residual herbicide. A soil-applied herbicide that remains active over a period of time until broken down into compounds not toxic to seedlings or plants. Duration of activity (persistence) depends mainly on the chemistry of the herbicide but also can be influenced by rainfall, soil pH, and temperatures. Herbicide persistence must be taken into account when planning rotation of crops.

Seed safener. A chemical applied to crop seed to protect the seedling from injury caused by certain herbicides.

Selective herbicide. A chemical that is more toxic to some plant species than others.

Soil application. Application of a herbicide primarily to the soil surface rather than to vegetation.

Spot treatment. Application of a herbicide to localized area(s) of a whole unit (i.e., treating spots or patches of weeds in a larger field).

Spray drift. Movement of airborne spray from the intended area of application.

Surfactant. A material that favors or improves the emulsifying, dispersing, spreading, wetting, or other surface-modifying properties of liquids.

Susceptibility. Death or growth reduction of a plant in response to a herbicide treatment.

Synergism. A complementary action of two or more chemicals such that the total effect is greater than the sum of the independent effects. (Opposite of antagonism.)

Tank mix. Mixing of two or more pesticides or agricultural chemicals in a spray tank at application time.

Total vegetation control. Applying single or multiple herbicides at one time or in sequence to provide

preemergent and/or postemergent control of all plants. The term usually refers to noncrop areas.

Toxicity. The degree to which a given substance injures plants or animals. Toxicity is classified as acute (immediate) or chronic (long term). Toxicity varies with species, age, sex, nutritional state, method of administration, and chemical formulation. (See LD₅₀.)

Translocated herbicide. A herbicide that moves within the plant. Translocated herbicides can be either phloem-mobile or xylem-mobile, but the term frequently is used in a more restrictive sense to refer to herbicides that are moved in the phloem, e.g., from the foliage to the growing points of roots and shoots.

Vapor drift. The movement of chemical vapors from the area of application. Some herbicides, when applied at normal rates and normal temperatures, have vapor pressures that change them into vapor form, which may seriously injure susceptible plants away from the application site. Note: Injuries from vapor drift and spray drift often are difficult to distinguish.

Vegetable oil. A mixture of crop-origin oil plus emulsifier for use as an adjuvant to enhance herbicide absorption.

Volatility. The ability of a compound to evaporate or vaporize (change from a liquid to a gas) at ordinary temperatures when exposed to air.

Water dispersible or soluble film. Water-dissolvable film packaging that allows direct placement of a herbicide package into a spray tank.

Water dispersible granule (WDG). See dry flowable.

Wettable powder (WP). A finely divided dry formulation that can be suspended readily in water. Requires agitation.

Wetting agent. A substance that reduces interfacial tensions and causes spray solutions or suspensions to make better contact with treated surfaces. (See surfactant.)

NAMES, TOXICITIES, AND PERSISTENCE OF HERBICIDES IN/ON SOILS

Common name	Trade name	Acute oral toxicity		Persistence in/on soils ²
		LD ₅₀ mg/kg ¹	Dermal toxicity ¹	
Acetochlor	Harness, Surpass, TopNotch, Volley, Keystone, Confidence, Breakfree, SureStart	1,942	Moderately irritating	8 to 12 weeks
Acifluorfen	Ultra Blazer	1,300	Moderately irritating	Half-life, 2 to 4 weeks
Alachlor	MicroTech, Partner, Intrro, Alachlor	2,000	Slightly irritating	6 to 10 weeks
Ametryn	Evik	1,750	Mildly irritating	1 to 3 months
Aminopyralid	Milestone	Above 5,000	Mildly irritating	Half-life, 25 to 35 days
Atrazine	AAtrex, Atrazine	5,100	Mildly irritating	About 1 year or more
Benefin	Balan	Above 10,000	Nonirritating	4 to 5 months
Bentazon	Basagran	1,100	LD ₅₀ > 2,500 mg/kg	Nonpersistent
Bromacil	Hyvar	5,200	Irritating	More than 1 season
Bromoxynil	Broclean, Buctril, Moxy, Bromox, Brox	440	Mildly irritating	No soil residue
Carfentrazone	Aim	5,143	LD ₅₀ > 4,000 mg/kg	2 to 4 weeks
Chlorimuron	Classic	Above 5,000	LD ₅₀ > 2,000 mg/kg	2 to 4 weeks
Chlorsulfuron	Glean, Telar DF, Report	5,545	LD ₅₀ > 3,400 mg/kg	Half-life, 4 to 6 weeks
Clethodim	Select, Volunteer, Arrow, Trigger, Section	3,610	LD ₅₀ > 5,000 mg/kg	1 month
Clomazone	Command, Commit	2,077	LD ₅₀ > 2,000 mg/kg	Half-life, 15 to 45 days
Clopyralid	Stinger, Curtail, Hornet, SureStart, Clopyr	4,500	LD ₅₀ > 2,000 mg/kg	Half-life, 12 to 70 days
Cloransulam	FirstRate	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 13 to 28 days
Dicamba	Banvel, Clarity, Sterling Blue, Oracle, Rifle, Distinct, Status	2,900	Mildly irritating	3 to 12 weeks
Dimethenamid-P	Outlook, Propel	1,570	Slightly irritating	Half-life, 2 to 5 weeks
Diquat	Reglone, Diquat	230	LD ₅₀ > 400 mg/kg	Persistent but biologically unavailable
Diuron	Karmex, Direx	3,400	Mildly irritating	About 1 season or more
EPTC	Eptam	1,652	LD ₅₀ ≈ 10,000 mg/kg	1 to 2 months
EPTC&Antidote	Eradicane	1,652	LD ₅₀ ≈ 10,000 mg/kg	1 to 2 months
Ethalfuralin	Sonalan	Above 10,000	Irritating	4 to 5 months
Florasulam	Orion	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 4.5 days
Fluazifop-P	Fusilade DX	3,328	Mildly irritating	2 months
Flufenacet	Define	2,072	LD ₅₀ > 2,000 mg/kg	2-4 months
Flumetsulam	Python, Hornet, SureStart	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 1 to 2 months
Flumiclorac	Resource	3,600	Moderately irritating	Half-life, 1 to 6 days
Flumioxazin	Valor, Encompass, Chateau, Envive	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 18 days
Fluroxypyr	Starane	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 13 to 36 days
Fluthiacet	Cadet	Above 5,000	Slightly irritating	Half-life, 1 to 2 days
Fomesafen	Reflex, Flexstar	1,499	Mildly irritating	2 to 3 months
Foramsulfuron	Option	3,881	LD ₅₀ > 5,000 mg/kg	Nonpersistent
Fosamine	Krenite S	Above 5,000	Nonirritating	Half-life, 8 days
Glyphosate	see glyphosate table	5,600	Nonirritating	Nonpersistent
Glufosinate	Liberty, Ignite 280	2,030	Slightly irritating	Nonpersistent
Halosulfuron	Permit	8,865	Nonirritating	Half-life, 1 to 2 months
Hexazinone	Velpar L	4,120	LD ₅₀ > 5,278 mg/kg	Half-life, 1 to 6 months
Imazamox	Raptor, Beyond	Above 5,000	LD ₅₀ > 5,000 mg/kg	1 to 2 months

¹LD₅₀ is a statistical estimate of the dosage necessary to kill 50% of a large population of laboratory animals under stated conditions. The lower the LD₅₀, the more toxic the chemical. The acute oral toxicities of several substances to rats (approximate LD₅₀, mg/kg of body weight) are caffeine, 200; aspirin, 1,000; and table salt, 3,000. Dermal toxicity refers to poison absorbed through the skin to produce toxic symptoms. The following are classifications of relative toxicity.

Degree of toxicity	Acute oral LD ₅₀ , mg/kg	Probable lethal dose for 150-pound person	Signal word on container
Highly toxic	Below 50	Few drops to 1 teaspoon	Danger, poison
Moderately toxic	50 to 500	1 teaspoon to 1 ounce	Warning
Slightly toxic	500 or greater	1 ounce to 1 pint or 1 pound	Caution

²Average persistence at recommended rates.

NAMES, TOXICITIES, AND PERSISTENCE OF HERBICIDES IN/ON SOILS

Common name	Trade name	Acute oral toxicity		Persistence in/on soils ²
		LD ₅₀ mg/kg ¹	Dermal toxicity ¹	
Imazapic	Plateau	Above 5,000	LD ₅₀ > 5,000 mg/kg	3 to 6 months
Imazapyr	Arsenal, Contain, Habitat	Above 5,000	LD ₅₀ > 2,148 mg/kg	3 to 12 months
Imazaquin	Scepter	Above 5,000	LD ₅₀ > 2,000 mg/kg	2 to 3 months
Imazethapyr	Pursuit	Above 5,000	LD ₅₀ > 2,000 mg/kg	2 to 3 months
Iodosulfuron	Autumn	Above 5,000	LD ₅₀ > 5,000 mg/kg	1 to 1 months
Isoxaflutole	Balance Pro	5,000	LD ₅₀ > 2,000 mg/kg	2 months
Lactofen	Cobra, Phoenix	Above 5,000	Severely irritating	4 to 6 weeks
MCPA	Several	1,000	Moderately irritating	1 to 4 weeks
Mesosulfuron	Osprey	Above 2,000	LD ₅₀ > 2,000 mg/kg	Half-life, 11 to 17 days
Mesotrione	Callisto	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 12 days
S-Metolachlor	Dual II MAGNUM, Charger Basic, Brawl, Cinch, Medal, Pennant Magnum	2,534	LD ₅₀ > 3,000 mg/kg	2 to 4 months
Metribuzin	Sencor, Dimetric, Tricor, Metri, Metribuzin	1,090-1,206	Nonirritating	Half-life, 7 to 28 days
Metsulfuron	Ally, Escort, Manor, Metgard, Valuron, Patriot, Plotter, Valuron	Above 5,000	LD ₅₀ > 5,000 mg/kg	2 to 4 weeks
Nicosulfuron	Accent, Samson	Above 5,000	Nonirritating	Half-life, 1 to 2 months
Norflurazon	Zorial	1,140	Slightly irritating	Half-life, 180 days
Oryzalin	Surflan A. S.	Above 500	LD ₅₀ > 2000	Half-life, 20 days
Paraquat	Gramoxone Inteon	120	LD ₅₀ > 480 mg/kg	Persistent but biologically unavailable
Pendimethalin	Prowl, Pendant, Acumen, Stealth, Pendimethalin	3,277	LD ₅₀ > 2,260 mg/kg	No carryover to subsequent crop
Picloram	Tordon	8,200	Mildly irritating	Varies with rate, soils, climate
Primisulfuron	Beacon	Above 5,500	Nonirritating	Half-life, 1 month
Prometon	Pramitol	2,276	LD ₅₀ = 2,260-2,500 mg/kg	Several years
Propachlor	Propachlor, Ramrod	3,500	Irritating	4 to 6 weeks
Propoxycarbazone	Olympus	Above 2,000	LD ₅₀ > 2,000 mg/kg	Half-life, 22 to 60 days
Prosulfuron	Peak, Exceed, Spirit	4,360	Nonirritating	Half-life, 4 to 6 weeks
Pyraflufen	ET	Above 5,000	LD ₅₀ > 2,000 mg/kg	Nonpersistent
Pyrasulfotole	Huskie	Above 300	LD ₅₀ > 4,000 mg/kg	1 month
Pyridate	Tough	4,700	LD ₅₀ > 2,000 mg/kg	Half-life, 1-3 weeks
Pyroxulam	PowerFlex	Above 5,000	Nonirritating	Half-life, 13 days
Quinclorac	Paramount	2,610	LD ₅₀ > 2,000 mg/kg	Up to 1 year
Quizalofop	Assure II	5,700	LD ₅₀ > 5,000 mg/kg	1 month
Rimsulfuron	Resolve, Basis, Steadfast, Require Q	Above 5,000	Nonirritating	Half-life, 10 to 20 days
Sethoxydim	Poast Plus, Poast	2,676-3,125	Nontoxic	Half-life, 4 to 11 days
Simazine	Princep, Simtrol	Above 5,000	Mildly irritating	About 1 year or more
Sodium chlorate	Defol 6	5,000	Irritating	Half-life, 200 days
Sulfentrazone	Spartan	2,689	Nonirritating	Half-life, 4 to 6 months
Sulfometuron	Oust	Above 5,000	Mildly irritating	Half-life, about 4 weeks
Sulfosulfuron	Maverick	Above 5,000	LD ₅₀ > 5,000	Half-life, 30 to 70 days

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Slightly toxic	500 or greater	1 ounce to 1 pint or 1 pound	Caution

²Average persistence at recommended rates.

NAMES, TOXICITIES, AND PERSISTENCE OF HERBICIDES IN/ON SOILS

Common name	Trade name	Acute oral toxicity LD ₅₀ mg/kg ¹	Dermal toxicity ¹	Persistence in/on soils ²
Tebuthiuron	Spike	644	Nonirritating	Half-life, more than 12 to 15 months
Tembotrione	Laudis	1,750	LD ₅₀ > 5,000 mg/kg	Half-life, 23 days:HH:
Terbacil	Sinbar	Above 5,000	LD ₅₀ > 5,000 mg/kg	Half-life, 5 to 6 months
Thifensulfuron	Harmony SG, Unity, Harass	Above 5,000	Non or slightly irritating	Half-life, 12 days
Topramezone	Impact	> 2,000	> 4,000 Nonirritating	Half-life, 14 days
Triasulfuron	Amber	Above 5,050	Nonirritating	Half-life, 4 to 12 weeks
Tribenuron	Express, Nuance	Above 5,000	LD ₅₀ > 2,000 mg/kg	Half-life, 10 days
Triclopyr	Garlon Ultra, Remedy Ultra	713	Nonirritating	Half-life, 46 days
Trifluralin	Treflan, Trust, Trilin	Above 10,000	Nonirritating	4 to 6 months
2,4-D	Several	300-1,000	Irritating	1 to 4 weeks
2,4-DB	Butyrac, Butoxone	1,960	Nonirritating	Not for soil application

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APPROXIMATE 2009 RETAIL COSTS OF HERBICIDES HARVEST AIDS, AND ADJUVANTS¹

Formulated products	Company	Active ingredient (% or lb/gal)	Approximate cost (\$/unit)	Formulated products	Company	Active ingredient (% or lb/gal)	Approximate cost (\$/unit)
AAtrex Nine-O	Syngenta	90 DF	5.20/lb	Escort XP	DuPont	60 DF	22.00/oz
Accent	DuPont	75 DF	41.30/oz	Expert	Syngenta	3.8	44.20/gal
Affinity	DuPont	50 DF	11.40/oz	Express TS	DuPont	50 SG	18.10/oz
BroadSpec				Extreme	BASF	2.17	50.55/gal
Affinity TankMix	DuPont	50 DF	8.54/oz	Finesse	DuPont	75 DF	18.90/oz
Agility SG	DuPont	67 WDG	2.52/oz	Finesse G&B	DuPont	71.7 DF	20.87/oz
Aim EC	FMC	1.9	7.20/oz	FirstRate	Dow AS	84 WDG	37.60/oz
Ally Extra SG	DuPont	71 DF	10.50/oz	Flexstar	Syngenta	1.88	135.65/gal
Ally XP	DuPont	60 DF	14.60/oz	Forefront R&P	Dow AS	3 ae	61.00/gal
Amber	Syngenta	75 WDG	10.60/oz	FulTime	Dow AS	4	39.00/gal
Assure II	DuPont	0.8	158.00/gal	Fusilade DX	Syngenta	2	206.20/gal
Atrazine 4L	Several	4	20.00/gal	Fusion	Syngenta	2.66	107.50/gal
Authority Assist	FMC	4	327.50/gal	G-Max Lite	BASF	5	75.00/gal
Authority First	FMC	70 DF	71.50/lb	Gangster	Valent	51 DF & 84 DF	127.00/lb
Authority MTZ	FMC	45 DF	18.30/lb	Garlon	Dow AS	4	101.50/gal
Autumn	Bayer CS	10 WDG	22.50/oz	Glean FC	DuPont	75 DF	20.50/oz
Axial XL	Syngenta	0.42	126.20/gal	GlyStar Plus	Albaugh	3 ae	32.00/gal
Balance Pro	Bayer CS	4	8.46/oz	Gramoxone	Syngenta	2	37.35/gal
Banvel 4	MicroFlo	4	80.00/gal	Inteon			
Basagran	MicroFlo	4	110.70/gal	Grazon P+D	Dow AS	2.54	43.50/gal
Basis	DuPont	75 DF	18.67/oz	Guardzman Max	BASF	5	57.00/gal
Beacon	Syngenta	75 WDG	37.75/oz	Halex GT	Syngenta	4.39	64.00/gal
Beyond	BASF	1	674.00/gal	Harmony Extra	DuPont	50 DF	13.10/oz
Bicep II	Syngenta	5.5	47.50/gal	SG			
Magnum				Harmony SG	DuPont	50 SG	33.38/oz
Bicep Lite II	Syngenta	6	63.00/gal	Harness	Monsanto	7	108.60/gal
Magnum				Harness Xtra	Monsanto	6	63.00/gal
Boundary	Syngenta	6.5	87.00/gal	Hoelon	Bayer CS	3	99.50/gal
Bucaneer Plus	Tenkos	3 ae	36.00/gal	Hornet WDG	Dow AS	78.5 WDG	4.69/oz
Buctril	Bayer CS	2	80.00/gal	Huskie	Bayer CS	2.16	104.80/gal
Buctril+Atrazine	Bayer CS	3	50.00/gal	Hyvar XL	DuPont	2	27.55/gal
Bullet	Monsanto	4	27.00/gal	Ignite 280	Bayer CS	2.34	73.00/gal
Butyrac 200	Albaugh	2	40.00/gal	Impact	AMVAC	2.8	22.10/oz
Cadet	FMC	0.91	10.50/oz	Intrro	Monsanto	4	27.00/gal
Callisto	Syngenta	4	665.00/gal	Karmex DF	DuPont	80 DF	7.63/lb
Canopy	DuPont	75 DF	56.00/lb	Keystone	Dow AS	5.25	50.00/gal
CanopyEX	DuPont	29.5 DF	7.21/oz	Keystone LA	Dow AS	5.5	62.00/gal
Chateau	Valent	51 WDG	121.00/lb	Lariat	Monsanto	4	27.00/gal
Cimarron	DuPont	60 DF	12.80/oz	Laudis	Bayer CS	3.5	5.17/oz
Cimarron X-tra	DuPont	67.5 DF	14.74/oz	Lexar	Syngenta	3.7	52.00/gal
Cimarron Plus	DuPont	63 DF	11.80/oz	Linex 4L	DuPont	4	81.00/gal
Clarity	BASF	4	116.20/gal	Lumax	Syngenta	3.95	67.00/gal
Classic	DuPont	25 DF	15.72/oz	Maverick	Monsanto	75 WDG	18.20/oz
ClearOut 41 Plus	CPT	3 ae	32.00/gal	MCPA ester	Several	4	25.00/gal
Cobra	Valent	2	180.00/gal	Milestone	Dow AS	2	362.00/gal
Cotoran	Griffin	4	52.50/gal	NorthStar	Syngenta	43.8 DF	2.65/oz
Crossbow	Dow AS	3	68.00/gal	Olympus	Bayer CS	70 WDG	14.18/oz
Curtail	Dow AS	2.4	51.00/gal	OlympusFlex	Bayer CS	11.25 DF	4.93/oz
Degree	Monsanto	3.8	55.75/gal	Option	Bayer CS	35 DF	11.30/oz
Degree Xtra	Monsanto	4.04	42.00/gal	Orion	Syngenta	2.37	51.25/gal
Dimetric	Winfield	75 DG	20.15/lb	Osprey	Bayer CS	4.5 WDG	3.97/oz
Distinct	BASF	76.4 WDG	52.95/lb	Outlook	BASF	6	189.20/gal
Dual II Magnum	Syngenta	7.6	130.94/gal	Paramount	BASF	75 WDG	61.72/lb
Durango DMA	Dow AS	5.4	67.00/gal	Pasture Gard	Dow AS	2	70.00/gal
Encompass	Tenkos	51 WDG	81.25/lb	Pathfinder II	Dow AS	0.75 ae	44.50/gal
Eptam	Gowan	7	43.75/gal	Peak	Syngenta	57 DF	14.65/oz
Equip	Bayer CS	32 DF	14.00/oz	Permit	Gowan	75 DF	19.85/oz

¹Approximate Retail Costs of Herbicides and Harvest Aids on December 1, 2008, were based on estimated retail prices provided by major distribution companies. Retail cost will vary depending upon volume purchased, current price structure, and other factors. Retail prices from your dealer may be higher or lower than the approximate retail costs listed in this publication. Contact your local chemical supplier regarding current retail prices.

APPROXIMATE 2009 RETAIL COSTS OF HERBICIDES HARVEST AIDS, AND ADJUVANTS¹

Formulated products	Company	Active ingredient (% or lb/gal)	Approximate cost (\$/unit)	Formulated products	Company	Active ingredient (% or lb/gal)	Approximate cost (\$/unit)
Phoenix	Valent	2	179.00/gal	Touchdown	Syngenta	5.0 ae	72.00/gal
Poast	MicroFlo	1.5	85.78/gal	HiTech			
Poast Plus	MicroFlo	1	64.75/gal	Touchdown	Syngenta	4.2 ae	76.00/gal
PowerFlex	Dow AS	7.5 WDG	3.25/oz	Total			
Prefix	Syngenta	4.34	56.45/gal	Trust	Winfield	4	25.00/gal
Princep 4L	Syngenta	4	28.35/gal	Ultra Blazer	United Phos.	2	83.33/gal
Pronone Power Pellet	Pro-Serve	75%	4.10/oz	Valor	Valent	51 WDG	87.00/lb
Prowl	BASF	3.3	38.50/gal	Valor XLT	Valent	40.3 WDG	65.00/lb
Prowl H ₂ O	BASF	3.8	42.10/gal	Velpar AlfaMax	DuPont	78 DF	14.00/lb
Pursuit	BASF	2	674.00/gal	Velpar AlfaMax Gold	DuPont	78.5 WDG	10.80/lb
Pursuit Plus	BASF	3	65.00/gal	Velpar L	DuPont	2	82.00/gal
Python	Dow AS	80 WDG	12.92/oz	WeedMaster	NuFarm	3.9	30.50/gal
Rage D-Tech	FMC	4.1	69.50/gal	Yukon	Gowan	67.5 WDG	2.76/oz
RangeStar	Albaugh	3.87	35.20/gal	2,4-D Amine		4	17.00/gal
Raptor	BASF	1	674.00/gal	2,4-D LV Ester		4	22.25/gal
Rave	Syngenta	63.8 WDG	1.88/oz	Ammonium sulfate			0.35/lb
Reflex	Syngenta	2	120.00/gal	Nonionic surfactants		80-90%	23.00/gal
Remedy Ultra	Dow AS	4	112.00/gal	Crop oil concentrates		15-20%	10.50/gal
Require Q	DuPont	59.2 WDG	3.19/oz	Methylated seed oil		15%	16.00/gal
Resolve	DuPont	25 DF	7.80/oz				
Resource	Valent	0.86	215.00/gal				
Roundup Power Max	Monsanto	4.5 ae	80.00/gal				
Roundup Weather Max	Monsanto	4.5 ae	90.00/gal				
RT 3	Monsanto	4.5 ae	65.00/gal				
Sahara	BASF	70 DG	25.00/lb				
Scepter	BASF	70 DG	4.00/oz				
Select Max	Valent	1	152.00/gal				
Sequence	Syngenta	5.25	65.00/gal				
Sonalan	Dow AS	3	41.00/gal				
Sonic	Dow AS	70 DF	77.00/lb				
Spartan	FMC	4	610.00/gal				
Spartan Advance	FMC	3.56	108.00/gal				
Spartan Charge	FMC	3.5	480.00/gal				
Spike	Dow AS	20 P	17.00/lb				
Spirit	Syngenta	57 WDG	12.70/oz				
Staple LX	DuPont	3.2	7.94/oz				
Starane	UAP	1.5	187.50/gal				
Starane Ultra	Dow AS	2.8	274.50/gal				
Status	BASF	56 WDG	3.16/oz				
Steadfast	DuPont	75 DF	27.10/oz				
Steadfast ATZ	DuPont	89 DF	23.00/lb				
Sterling Blue	Winfield Sol.	4	90.00/gal				
Stinger	Dow AS	3	510.00/gal				
Stout TM	DuPont	72.5 DF	22.50/oz				
SureStart	Dow AS	4.16	88.00/gal				
Surmount	Dow AS	1.33 ae	64.50/gal				
Surpass	Dow AS	6.4	108.50/gal				
Synchrony XP	DuPont	28.4 DG	10.44/oz				
Telar DF	DuPont	75 DF	24.25/oz				
Topnotch	Dow AS	3.2	48.35/gal				
Tordon RTU	Dow AS	1.4	55.00/gal				
Tordon 22K	Dow AS	2	135.00/gal				
Touchdown CT	Syngenta	4.2 ae	60.00/gal				

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HERBICIDE PREMIXES

Product (Manufacturer)	Ingredients
Accurate/Extra (Cheminova)	37.5% thifensulfuron, 18.8% tribenuron, and 15% metsulfuron
Affinity BroadSpec (DuPont)	25% thifensulfuron (Harmony) and 25% tribenuron (Express)
Affinity TankMix (DuPont)	40% thifensulfuron (Harmony) and 10% tribenuron (Express)
Agility SG (DuPont)	4.7% thifensulfuron (Harmony), 2.4% tribenuron (Express), 1.9% metsulfuron (Ally), and 58% dicamba (Banvel)
Ally Extra SG (DuPont)	27.3% thifensulfuron, 13.6% tribenuron (Harmony Extra), and 10.9% metsulfuron (Ally)
Authority Assist (FMC)	3.33 lb sulfentrazone (Spartan) and 0.67 lb imazethapyr (Pursuit)
Authority First (FMC)	62.1% sulfentrazone (Spartan) and 7.9% cloransulam (FirstRate)
Authority MTZ (FMC)	18% sulfentrazone (Spartan) and 27% metribuzin (Sencor)
Banvel K + Atrazine (Arysta)	1.1 lb potassium salt of dicamba and 2.1 lb atrazine per gal.
Basis (DuPont)	50% rimsulfuron and 25% thifensulfuron (Harmony)
Bicep II Magnum (Syngenta)	3.1 lb atrazine and 2.4 lb S-metolachlor (Dual II Magnum) per gal.
Bicep Lite II Magnum (Syngenta)	2.67 lb atrazine and 3.33 lb S-metolachlor (Dual II Magnum) per gal.
Bison (Winfield)	2 lb bromoxynil (Moxy) and 2 lb MCPA per gal.
Boundary (Syngenta)	5.25 lb S-metolachlor (Dual Magnum) and 1.25 lb metribuzin (Sencor) per gal.
Brash (Winfield)	1 lb dicamba and 2.87 lb 2,4-D amine per gal.
Bromox + Atrazine (MicroFlo)	1 lb bromoxynil and 2 lb atrazine per gal.
Brozine (Platte Chemical)	1 lb bromoxynil and 2 lb atrazine per gal.
Buctril + Atrazine (Bayer)	1 lb bromoxynil (Buctril) and 2 lb atrazine per gal.
Bullet (Monsanto)	2.5 lb microencapsulated alachlor (Micro-Tech) and 1.5 lb atrazine per gal.
Camix (Syngenta)	3.3 lb S-metolachlor (Dual II Magnum) and 0.33 lb mesotrione (Callisto) per gal.
Canopy (DuPont)	64.3% metribuzin and 10.7% chlorimuron (Classic)
Canopy EX (DuPont)	22.7% chlorimuron (Classic) and 6.8% tribenuron (Express)
Charger Max ATZ (Winfield)	3.1 lb atrazine and 2.4 lb S-metolachlor (Dual II Magnum) per gal.
Charger Max ATZ Lite (Winfield)	2.67 lb atrazine and 3.33 lb S-metolachlor (Dual II Magnum) per gal.
Chism (Cheminova)	48% metsulfuron and 15% chlorsulfuron
Cimarron Xtra (DuPont)	30% metsulfuron (Ally) and 37.5% chlorsulfuron (Glean)
Cimarron Max (DuPont)	1 lb dicamba and 2.87 lb 2,4-D per gal. and 60% metsulfuron co-pack ¹
Cimarron Plus (DuPont)	48% metsulfuron and 15% chlorsulfuron
Cinch ATZ (DuPont)	3.1 lb atrazine and 2.4 lb S-metolachlor (Cinch) per gal.
Cinch ATZ Lite (DuPont)	2.67 lb atrazine and 3.33 lb S-metolachlor (Cinch) per gal.
Clearmax (BASF)	1 lb imazamox (Beyond) per gal. and 4 lb MCPA per gal. co-pack ¹
Confidence Xtra (Winfield)	4.3 lb acetochlor (Harness) and 1.7 lb atrazine per gal.
Confidence Xtra 5.6L (Winfield)	3.1 lb acetochlor (Harness) and 1.5 lb atrazine per gal.
Crossbow (Dow)	2 lb 2,4-D and 1 lb triclopyr (Remedy) per gal.
Curtail (Dow)	2 lb 2,4-D and 0.38 lb clopyralid (Stinger) per gal.
Degree Xtra (Monsanto)	2.7 lb acetochlor (Degree) and 1.34 lb atrazine per gal.
Dicamba K + Atrazine (MicroFlo)	1.1 lb potassium salt of dicamba and 2.1 lb atrazine per gal.
Distinct (BASF)	20% acid of diflufenzopyr and 50% acid of dicamba (Banvel SGF)
Envive (DuPont)	9.2% chlorimuron (Classic), 29.2% flumioxazin (Valor), and 2.9% thifensulfuron (Harmony)
Equip (Bayer)	30% foramsulfuron (Option) and 2% iodosulfuron
Expert (Syngenta)	1.74 lb S-metolachlor (Dual Magnum), 2.14 lb atrazine, and 1.0 lb IPA salt of glyphosate per gal.
Extreme (BASF)	0.17 lb ae imazethapyr (Pursuit) and 2 lb glyphosate IPA salt per gal.
Field Master (Monsanto)	0.75 lb IPA salt of glyphosate (Roundup), 2 lb acetochlor (Harness) and 1.5 lb atrazine per gal.
Finesse (DuPont)	62.5% chlorsulfuron (Glean) and 12.5% metsulfuron (Ally)
Finesse Grass & Broadleaf (DuPont)	25% chlorsulfuron (Glean) and 47% flucarbazone (Everest)
ForeFront R&P (Dow)	0.33 lb ae aminopyralid (Milestone) and 2.67 lb ae 2,4-D per gal.
FulTime (Dow)	2.4 lb microencapsulated acetochlor (TopNotch) and 1.6 lb atrazine per gal.
Fusion (Syngenta)	2 lb fluazifop (Fusilade) and 0.66 lb fenoxaprop (Option II) per gal.

¹Co-packs consist of individual components packaged in separate containers or compartments and sold together.

HERBICIDE PREMIXES

Product (Manufacturer)	Ingredients
Gangster (Valent)	51% flumioxazin (Valor) and 84% cloransulam (FirstRate) co-pack ¹
GlyMix MT (Dow)	4 lb glyphosate IPA salt and 0.4 lb 2,4-D per gal.
Grazon P&D (Dow)	2 lb 2,4-D and 0.54 lb picloram (Tordon) per gal.
G-Max Lite (BASF)	2.25 lb dimethenamid-P (Outlook) and 2.75 lb atrazine per gal.
Guardsman Max (BASF)	1.7 lb dimethenamid-P (Outlook) and 3.3 lb atrazine per gal.
Halex GT (Syngenta)	2.09 lb S-metolachlor (Dual Magnum), 2.09 lb glyphosate, and 0.21 lb mesotrione (Callisto) per gal.
Harmony Extra SG (DuPont)	33.3% thifensulfuron (Harmony) and 16.7% tribenuron (Express)
Harness Xtra (Monsanto)	4.3 lb acetochlor (Harness) and 1.7 lb atrazine per gal.
Harness Xtra 5.6L (Monsanto)	3.1 lb acetochlor (Harness) and 2.5 lb atrazine per gal.
Hornet WDG (Dow)	18% flumetsulam (Python) and 60% clopyralid salt (Stinger)
Huskie (Bayer)	0.24 lb pyrasulfotole and 1.92 lb bromoxynil (Buctril) per gal.
Journey (BASF)	8.13% imazapic (Plateau) and 21.94% glyphosate
Keystone (Dow)	3 lb acetochlor (Surpass) and 2.25 lb atrazine per gal.
Keystone LA (Dow)	4 lb acetochlor (Surpass) and 1.5 lb atrazine per gal.
Krovar (DuPont)	40% bromacil (Hyvar) and 40% diuron (Karmex)
Laddok S-12 (Sipcam Agro)	2.5 lb bentazon (Basagran) and 2.5 lb atrazine per gal.
Landmark (DuPont)	50% sulfometuron (Oust) and 25% chlorsulfuron (Glean)
Lariat (Monsanto)	2.5 lb alachlor (Lasso) and 1.5 lb atrazine per gal.
Lexar (Syngenta)	1.74 lb S-metolachlor (Dual II Magnum), 1.74 lb atrazine, and 0.22 lb mesotrione (Callisto) per gal.
Liberty ATZ (Bayer)	3.34 lb atrazine and 1.0 lb glufosinate (Liberty) per gal.
Lumax (Syngenta)	2.68 lb S-metolachlor (Dual II Magnum), 0.268 lb mesotrione (Callisto), and 1 lb atrazine per gal.
Nimble (Cheminova)	50% thifensulfuron (Harmony) and 25% tribenuron (Express)
NorthStar (Syngenta)	7.5% primisulfuron (Beacon) and 43.9% sodium salt of dicamba
Olympus Flex (Bayer)	6.75% propoxycarbazone (Olympus) and 4.5% mesosulfuron (Osprey)
Orion (Syngenta)	0.033 lb florasulam and 2.34 lb MCPA per gal.
Overdrive (BASF)	20% acid of diflufenzopyr and 50% acid of dicamba
PastureGard (Dow)	1.5 lb ae triclopyr (Remedy) and 0.5 lb ae fluroxypyr (Starane) per gal.
Prefix (Syngenta)	4.34 lb S-metolachlor (Dual Magnum) and 0.95 lb fomesafen (Reflex) per gal.
Priority (Tenkoz)	12.5% carfentrazone (Aim) and 50% halosulfuron (Permit)
Propel ATZ (Rosens)	1.7 lb dimethenamid-P (Propel) and 3.3 lb atrazine per gal.
Propel ATZ Lite (Rosens)	2.25 lb dimethenamid-P (Propel) and 2.75 lb atrazine per gal.
Pursuit Plus (BASF)	2.7 lb pendimethalin (Prowl) and 0.2 lb imazethapyr (Pursuit) per gal.
Radius (Bayer)	3.57 lb flufenacet (Define) and 0.43 lb isoxaflutole (Balance Pro) per gal.
Rage D-Tech (FMC)	0.13 lb carfentrazone (Aim) and 3.93 lb ae 2,4-D ester per gal.
Range Star (Albaugh)	1 lb dicamba and 2.87 lb 2,4-D amine per gal.
Rave (Syngenta)	8.8% triasulfuron (Amber) and 50% dicamba (Banvel)
Ready Master ATZ (Monsanto)	2.0 lb glyphosate IPA salt and 2.0 lb atrazine per gal.
Redeem R&P (Dow)	2.25 lb triclopyr (Remedy Ultra) and 0.75 lb clopyralid (Stinger)
Report Extra (Cheminova)	62.5% chlorsulfuron (Glean) and 12.5% metsulfuron (Ally)
Require Q (DuPont)	6.25% rimsulfuron (Resolve) and 52.9% dicamba
Rezult B&G (BASF)	4 lb bentazon (Basagran) per gal. and 1 lb sethoxydim (Poast Plus) per gal. co-pack ¹
Sahara (BASF)	7.8% imazapyr (Arsenal) and 62.2% diuron (Karmex)
Sequence (Syngenta)	3 lb S-metolachlor (Dual Magnum) and 2.25 lb ae glyphosate per gal.
Shotgun (United Agri Products)	2.25 lb atrazine and 1 lb iso-octyl ester of 2,4-D per gal.
Spirit (Syngenta)	42.8% primisulfuron (Beacon) and 14.2% prosulfuron (Peak)
Sonic (Dow)	62.1 % sulfentrazone (Spartan) and 7.9% cloransulam (FirstRate)
Spartan Advance (FMC)	0.56 lb sulfentrazone (Spartan) and 3 lb ae glyphosate per gal.
Spartan Charge (FMC)	3.15 lb sulfentrazone (Spartan) and 0.35 lb carfentrazone (Aim) per gal.

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HERBICIDE PREMIXES

Product (Manufacturer)	Ingredients
Status (BASF)	16% acid of diflufenzopyr, 44% sodium salt of dicamba, and isoxadifen safener
Steadfast (DuPont)	50% nicosulfuron (Accent) and 25% rimsulfuron
Steadfast ATZ (DuPont)	2.7% nicosulfuron (Accent), 1.3% rimsulfuron, and 85.3% atrazine
Starane NXT (FMC)	0.58 lb fluroxypyr (Starane) and 2.33 lb bromoxynil per gal.
Starane Plus Salvo (UAP)	0.75 lb fluroxypyr (Starane) and 3 lb 2,4-D (Salvo) per gal.
Starane Plus Sword (UAP)	0.71 lb fluroxypyr (Starane) and 2.84 lb MCPA (Sword) per gal.
Storm (United Phosphorus)	2.67 lb bentazon (Basagran) and 1.33 lb acifluorfen (Blazer) per gal.
Stout (DuPont)	67.5% nicosulfuron (Accent) and 5% thifensulfuron (Harmony)
Stratos (Gharda)	1.1 lb potassium salt of dicamba and 2.1 lb atrazine per gal.
SureStart (Dow)	3.75 lb acetochlor (Surpass), 0.12 lb flumetsulam (Python), and 0.29 lb ae clopyralid (Stinger) per gal.
Surmount (Dow)	0.67 lb picloram (Tordon) and 0.67 lb fluroxypyr (Starane)
Synchrony XP (DuPont)	21.5% chlorimuron (Classic) and 6.9% thifensulfuron (Harmony)
TNT Broadleaf (Gowan)	50% thifensulfuron (Harmony) and 25% tribenuron (Express)
Tordon RTU (Dow)	3% acid equivalent picloram (Tordon) and 11.2% 2,4-D ae per gal.
Valor XLT (Valent)	30% flumioxazin (Valor) and 10.3% chlorimuron (Classic)
Velpar AlfaMax (DuPont)	35.3% hexazinone (Velpar) and 42.4% diuron (Karmex)
Velpar AlfaMax Gold (DuPont)	23.1% hexazinone (Velpar) and 55.4% diuron (Karmex)
Volley ATZ (Tenkoz)	3 lb acetochlor and 2.25 lb atrazine per gal.
Volley ATZ Lite (Tenkoz)	4 lb acetochlor and 1.5 lb atrazine per gal.
WeedMaster (BASF)	1 lb dicamba and 2.87 lb 2,4-D amine per gal.
WideMatch (Dow)	0.75 lb clopyralid (Stinger) and 0.75 lb fluroxypyr (Starane) per gal.
Yukon (Gowan)	12.5% halosulfuron (Permit) and 55% sodium salt of dicamba

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GLYPHOSATE PRODUCT COMPARISONS

Product ^a	Distributor	Salt ^b	Concentration ^c		0.75 lb ae/acre Product Rate	Surfactant Requirement	Labeled for RR ^d Crops
			Salt ai	ae			
			(lb/gal)		(oz/acre)		
Alecto 41 UL	Ritter	IPA	4	3	32	Optional	Yes
Alecto 41 HL	Ritter	IPA	4	3	32	Optional	Yes
Alecto 41 S	Ritter	IPA	4	3	32	Not Required	Yes
Buccaneer	Tenkoz	IPA	4	3	32	Recommend	Yes
Buccaneer 5	Tenkoz	IPA	5	3.7	26	Not Required	Yes
Buccaneer Plus	Tenkoz	IPA	4	3	32	Not Required	Yes
Cincho	Loveland	IPA	5.4	4	24	Recommended	Yes
Clearout 41	CPT-LLC	IPA	4	3	32	Recommend	Yes
Clearout 41 Plus	CPT-LLC	IPA	4	3	32	Not Required	Yes
Cornerstone	Winfield	IPA	4	3	32	Recommend	Yes
Cornerstone Plus	Winfield	IPA	4	3	32	Not Required	Yes
Credit	NuFarm	IPA	4	3	32	Recommend	Yes
Credit Extra	NuFarm	IPA	4	3	32	Not Required	Yes
Credit Duo	NuFarm	IPA+MA	4	3	32	Recommend	Yes
Credit Duo Extra	NuFarm	IPA+MA	4	3	32	Not Required	Yes
Crop Smart Glyphosate 41 Plus	CropSmart	IPA	4	3	32	Not Required	Yes
Duramax	Dow	DMA	5.4	4	24	Not Required	Yes
Durango DMA	Dow	DMA	5.4	4	24	Not Required	Yes
Extra Credit 5	NuFarm	IPA	5	3.7	26	Not Required	Yes
Gly-4	UCPA	IPA	4	3	32	Recommend	Yes
Gly-4 Plus	UCPA	IPA	4	3	32	Not required	Yes
Gly Star Original	Albaugh	IPA	4	3	32	Recommend	Yes
Gly Star Plus	Albaugh	IPA	4	3	32	Not Required	Yes
Gly Star 5	Albaugh	IPA	5.4	4	24	Required	Yes
GlyFlo	Micro Flo	IPA	4	3	32	Recommend	Yes
Glyphogan	MANA	IPA	4	3	32	Recommend	Yes
Glyfos	Cheminova	IPA	4	3	32	Recommend	Yes
Glyfos Xtra	Cheminova	IPA	4	3	32	Not Required	Yes
Glyphomax XRT	Dow	IPA	5.4	4	24	Not Required	Yes
Glyphosate 4	FarmSaver	IPA	4	3	32	Required	Yes
Glyphosate 41%	Helm Agro	IPA	4	3	32	Recommend	Yes
Glyphosate Original	Griffin	IPA	4	3	32	Recommend	Yes
Honcho	Monsanto	IPA	4	3	32	Recommend	No
Honcho Plus	Monsanto	IPA	4	3	32	Optional	Yes
Mad Dog Plus	Loveland	IPA	4	3	32	Not Required	Yes
Makaze	Loveland	IPA	4	3	32	Not Required	Yes
Mirage	UAP	IPA	4	3	32	Recommend	Yes
Mirage Plus	UAP	IPA	4	3	32	Optional	Yes
Rascal	Winfield	IPA	4	3	32	Recommend	Yes
Rascal Plus	Winfield	IPA	4	3	32	Not Required	Yes
Rattler	Helena	IPA	4	3	32	Recommend	No
Rattler Plus	Helena	IPA	4	3	32	Optional	Yes
Roundup Original Max	Monsanto	K	5.5	4.5	22	Optional	Yes

^a Additional glyphosate products may be available, but this list contains many of the agricultural products.

^b Glyphosate is generally formulated as one of the following salt molecules: IPA = isopropylamine; MA = monoammonium; K = potassium; DA = diammonium; or TMS = trimethylsulfonium.

^c The concentration of glyphosate salts can be expressed in terms of pounds of glyphosate salt/gallon or pounds of glyphosate acid per gallon. Because the various salts have different weights, comparing glyphosate on an acid equivalence (ae) basis provides a better comparison of the herbicidal component of the different salts.

^d RR = Roundup Ready

^e Not labeled on Roundup Ready cotton.

GLYPHOSATE PRODUCT COMPARISONS

Product ^a	Distributor	Salt ^b	Concentration ^c		0.75 lb ae/acre Product Rate	Surfactant Requirement	Labeled for RR ^d Crops
			Salt ai	ae			
			(lb/gal)		(oz/acre)		
Roundup Power Max	Monsanto	K	5.5	4.5	22	Not Required	Yes
Roundup Ultra Dry	Monsanto	MA	71.4	64.9	1.2 lb	Not Required	Yes
Roundup Weather Max	Monsanto	K	5.5	4.5	22	Not Required	Yes
RT 3	Monsanto	K	5.5	4.5	22	Optional	No
Touchdown IQ	Syngenta	DA	3.75	3	32	Not Required	Yes
Touchdown CT	Syngenta	K	5	4.2	24	Not Required	No
Touchdown Total	Syngenta	K	5	4.2	24	Not Required	Yes
Touchdown Hitech	Syngenta	K	6	5	19	Required	Yes
Traxion	Syngenta			4.1	24	Not Required	Yes
Wise Up Plus Glyphosate	MEY	IPA	4	3	32	Not Required	Yes

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^c The concentration of glyphosate salts can be expressed in terms of pounds of glyphosate salt/gallon or pounds of glyphosate acid per gallon. Because the various salts have different weights, comparing glyphosate on an acid equivalence (ae) basis provides a better comparison of the herbicidal component of the different salts.

^d RR = Roundup Ready

^e Not labeled on Roundup Ready cotton.

HERBICIDES FOR CORN

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED CORN HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds											Perennials				
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Johnsongrass Seedlings	Longspine Sandbur	Shattercane	Witchgrass	Eastern Black Nightshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed ³ + Waterhemp	Common Ragweed	Sunflower	Velvetleaf	Venice Mallow	Field Bindweed	Established Johnsongrass	
Preplant Incorporated only																								
DoublePlay	G	E	E	E	E	—	G	—	F	G-E	—	—	—	—	G	—	G	—	—	—	—	—	—	—
Preplant Incorporated or Preemergence																								
Atrazine	G-E	F-G	F	—	F-G	—	—	—	F	E	F-G	—	G	G ²	G	G	G-E ²	G	F	F	F	—	—	
Balance Pro	F-G	G	G	G	G	G	—	—	—	G	F	—	G	E	G	—	E	G	—	E	G	—	—	
Basis	G	G-E	F	G-E	G-E	—	F	E	F	P	—	—	—	G ²	E	—	E ²	—	G	G	—	—	—	
Define	G-E	E	E	E	E	F	F-G	F	E	G	—	—	—	—	F-G	—	P	—	—	—	—	—	—	
Dual II Magnum, Charger Max	G-E	E	E	E	E	P	F-G	—	E	G	—	—	—	—	F-G	—	F-G	—	—	—	—	—	—	
Hornet	G	—	—	—	—	—	—	—	—	G	E	—	G	G ²	E	G	G ²	G	E ²	E	G	—	—	
Micro-Tech	G-E	E	E	E	E	P	F-G	P-F	E	G	—	—	—	—	F-G	—	G	F	—	—	—	—	—	
Outlook, Propel	G-E	E	E	E	E	P	F-G	—	E	G	—	—	—	—	—	—	F-G	—	—	—	—	—	—	
Princep	G-E	F-G	F	—	F-G	—	—	P-F	F	G	—	—	F	—	G	G	G	G	F	F	F	—	—	
Python	G-E	—	—	—	—	—	—	—	—	G	F	—	F	F ²	E	F	G ²	G	G	E	G	—	—	
Resolve	G-E	G	F	G	E	—	—	—	—	F	F	—	F	G ²	G	F	G ²	F	—	F	—	—	—	
TopNotch, Surpass, Harness, Volley, Confidence	G-E	E	E	E	E	F	F-G	F	G-E	G	—	—	—	—	G	—	G	F	—	—	—	—	—	
<i>Formulated mixtures</i>																								
Bicep Lite II	G-E	E	E	E	E	P	F-G	P	E	E	F	F	F	F	G	F	E	F	F	P	P	—	—	
Magnum, Cinch ATZ Lite																								
Bicep II Magnum, Cinch ATZ	G-E	E	E	E	E	P	F-G	P	E	E	G	G	G	G	G	G	E	G	F	F	F	—	—	
G-Max Lite, Propel ATZ Lite	G-E	E	E	E	E	P	F-G	P	E	E	F	F	F	F	G	F	E	F	F	P	P	—	—	
Guardsman Max, Propel ATZ	G-E	E	E	E	E	P	F-G	P	E	E	G	G	G	G	G	G	E	G	F	F	F	—	—	
Lariat, Bullet	G-E	E	E	E	E	P	F-G	P	E	E	G	G	G	G	G	G	E	G	F	F	F	—	—	
Harness Xtra, Keystone, Volley	G-E	E	E	E	E	F	F-G	F	E	E	G	G	G	G	G	G	E	G	F	F	F	—	—	
ATZ, FulTime																								
Lumax, Lexar	G-E	E	E	E	E	F	F-G	F	E	E	G	E	E	E	G-E	F-G	E	G	G	E	E	—	—	
Radius	G	E	E	E	E	G	G	G	E	G	F	—	G	E	G	—	E	G	F	E	G-E	—	—	
SureStart	F	E	E	E	E	—	P	P	E	G	G	—	—	E ²	E	F	E	G	E	G	—	—	—	
Preemergence Only																								
Prowl, Pendimax, Acumen	G	G-E	G	G	G	G	G	F	G-E	—	—	—	—	F-G	F-G	—	F-G	—	—	P-F	—	—	—	
Valor	G-E	F	F	F-G	F-G	P	P	P	F	E	F	F-G	G-E	G	G-E	F-G	E	F	P	F	G-E	—	—	

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Pigweed species vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible to postemergence herbicides than other pigweed species.

HERBICIDES FOR CORN

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WEED RESPONSE TO SELECTED CORN HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds													Perennials		
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Johnsongrass Seedlings	Longspine Sandbur	Shattercane	Witchgrass	Eastern Black Nightshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed ³ + Waterhemp	Common Ragweed	Sunflower	Velvetleaf	Venice Mallow	Field Bindweed	Established Johnsongrass	
Postplant Incorporated																								
Prowl, Pendimax, Pendant	G	G-E	E	G	E	G	G	G	G-E	—	—	—	—	G	G	—	F-G	—	—	F	—	—	—	
Trifluralin	F-G	G-E	E	G-E	E	G	G	G-E	G-E	—	—	—	—	G	G	—	F-G	—	—	—	—	—	—	
Postemergence																								
Accent	G	G-E	F	G	G-E	E	G	E	—	—	—	—	G	—	—	F	G ²	—	—	—	—	—	G	
Aim	G-E	—	—	—	—	—	—	—	—	E	F	F	E	F-G	E	E	E	F	F	E	G	—	—	
Atrazine	G-E	F	F	—	G	—	—	—	G	G-E	G-E	—	E	E ²	E	E	E ²	E	E	E	E	—	—	
Banvel, Clarity, Sterling Blue	F-G	—	—	—	—	—	—	—	—	G	G-E	—	G	G	G	G	G-E	G	G	G	F	F	—	
Banvel K + Atrazine	G	—	—	—	—	—	—	—	—	G-E	E	—	G-E	E	E	E	E	E	E	G-E	G-E	F-G	—	
Basis	G	G-E	F	G-E	G-E	—	F	E	F	P	—	—	—	G ²	E	—	E ²	—	G	G	—	—	—	
Beacon	F-G	—	—	F	—	E	—	E	—	G	G	G	G	G ²	F	—	G ²	E	G-E ²	F-G	—	—	G	
Broclean, Bromil, Bucril, Moxy	E	—	—	—	—	—	—	—	—	E	E	—	G	G	G	F-G	F	G	E	F-G	G	—	—	
Brozine, Bucril + Atrazine	G-E	—	—	—	—	—	—	—	—	E	E	—	E	E ²	E	G-E	E	E	E	E	E	—	—	
Cadet	G	—	—	—	—	—	—	—	—	G	G	—	—	G	G-E	G	F-G	F	F	E	—	—	—	
Callisto	E	—	G	—	—	—	—	—	—	E	G	G	E	E	E	F	E	G	G	G-E	G	—	—	
Distinct	G	F	—	F	F	—	F	F	F	G	G-E	—	G	G	E	E	E	E	G	G	E	G	—	
Equip	G	E	G	G	G ²	E	F	E ²	G	E	E	—	G	F	E	F	G ²	E	E	E	G	—	G ²	
Glyphosate (resistant corn only)	E	G	E	E	E	E	E	E	E	G	E	—	E	G	E	G	E	G	E	G	G	G	G	
Halex GT (resistant corn only)	G-E	G	E	E	E	E	E	E	E	E	E	G	E	G	E	G	E	E	E	E	E	G	G	
Hornet	G-E	—	—	—	—	—	—	—	—	F	E	—	G	G ²	F	F	F ²	E	E ²	E	E	—	—	
Impact	E	G	G	F	F	F	—	—	—	E	G-E	—	E	G-E	E	F	E	G-E	G-E	G	F	—	—	
Laddok S-12	E	—	—	—	—	—	—	—	—	G	E	G-E	E	G	E	G-E	G	G-E	E	E	E	—	—	
Laudis	E	G	G	P	F-G	G	F	G	—	E	G-E	—	E	G-E	E	F	E	E	G-E	E	G	—	—	
Liberty (resistant corn only)	E	G	G	G	E	G	F-G	G	G	G	E	—	E	G	G	G	G	E	E	G	G	F	F	
NorthStar	G	—	—	—	F	G-E	—	G-E	—	G-E	E	E	G	G	G	F	G-E ²	E	G-E	G	—	F	F	
Option	G	E	G	G	G-E	E	F	E ²	G	G	F	—	F	—	F	P	P	F	F	G	—	—	G ²	
Priority	G	—	—	—	—	—	—	—	—	E	E	—	G	G-E	G	E	G	E	E	E	G	F	—	
Require Q	F-G	G-E	F	G-E	G-E	—	F	E	F	G	G-E	—	G	G	G	G	G-E	G	G	G	F	F	—	
Resolve	G	G-E	F	G-E	G-E	—	F	E	F	F	F	—	G	—	F	F	G ²	F	—	F	—	—	F	
Resource	G-E	—	—	—	—	—	—	—	—	—	F	—	G	—	—	F	F	G	—	E	—	—	—	
Sencor + Banvel	G-E	—	—	—	—	—	—	—	—	G-E	E	—	G-E	G-E	E	E	G-E	G-E	G-E	G-E	G-E	F-G	—	
Shotgun	F-G	—	—	—	—	—	—	—	—	E	E	E	E	G	G	E	E	E	E	E	E	F	—	
Spirit	E	—	—	—	—	G-E	—	G-E	—	G	E	E	G	E ²	G	F	G ²	E	E ²	E	E	—	F	
Steadfast	G	G-E	G	E	E	E	G	E	—	—	F	—	G	—	—	F	G ²	—	—	—	—	—	G	
Starane	G	—	—	—	—	—	—	—	—	F	G	—	—	E	P	E	P	E	G	G	G	F-G	—	
Starane NXT	G	—	—	—	—	—	—	—	—	E	E	—	G	E	G	E	F	E	E	G	G	F-G	—	

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Pigweed species vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible to postemergence herbicides than other pigweed species.

HERBICIDES FOR CORN

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED CORN HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses								Annual Broadleaf Weeds										Perennials			
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Johnsongrass Seedlings	Longspine Sandbur	Shattercane	Witchgrass	Eastern Black Nightshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed ³ + Waterhemp	Common Ragweed	Sunflower	Velvetleaf	Venice Mallow	Field Bindweed	Established Johnsongrass
Postemergence																							
WideMatch	G	—	—	—	—	—	—	—	—	F	F	—	—	F	P	F	P	F	F	G	G	F-G	—
2,4-D	F	—	—	—	—	—	—	—	—	F	F	F	G	G	F	F	F	F	F	G	G	F-G	—
Status	G-E	F	—	F	F	F	—	F	F	G	G-E	—	G	G	F	F	F	F	G	G	F	G	G
Stout	G	G-E	F	G	G-E	E	G	E	—	—	—	—	G	—	F	G	—	—	G	—	—	—	G

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Pigweed species vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible to postemergence herbicides than other pigweed species.

HERBICIDES FOR CORN

Before using products containing atrazine, you must consult the Atrazine Watershed Information Center (AWIC) to determine whether the use of atrazine is prohibited in your watershed. The AWIC can be accessed through www.atrazine-watershed.info or call 1-866-365-3014.

Atrazine Rate Limitations

All atrazine uses on cropland must conform to the maximum rate limits shown below. The “Precautionary Statements” on atrazine labels indicate required set-backs from all wells, streams, ponds, or other water sources.

For Wheat Stubble Applications In Wheat-corn-fallow Rotations

Apply a maximum of 3 lb active ingredient/acre to stubble ground following wheat harvest. Treat only once during same fallow period. See Chemical Fallow section of atrazine label for additional instructions.

For Soil Applications In Spring, Before Crop Emergence

On Highly Erodible Soils (as defined by the Natural Resources Conservation Service)

If plant residue cover at planting is 30% or more, then apply a maximum of 2 lb ai/acre as a broadcast spray.

If soil coverage is less than 30% at planting, apply a maximum of 1.6 lb ai/acre.

On Soils Not Highly Erodible

Apply a maximum of 2 lb ai/acre as a broadcast spray.

For Postemergence Applications

If no atrazine was applied before corn emergence, apply a maximum of 2 lb ai/acre broadcast. If a postemergence treatment is required following an earlier herbicide application, the total atrazine applied may not exceed 2.5 lb ai/acre per calendar year. Postemergence applications over 1 lb ai/acre are not considered Best Management Practices. Runoff loss potential is very high from mid-April through July.

Practices To Reduce Atrazine Losses In Surface Water Runoff In Central And Eastern Kansas

Corn producers who no-till plant should consider split applications of herbicides, applying about two-thirds of the rate either the previous fall or early-preplant in spring, and about one-third at planting time. The highest atrazine losses occur when intense rain storms follow atrazine application to high-residue, wet soils. Long-term weather records show that Kansas tends to have little winter precipitation, and that the probability of high-intensity storms occurring in March to mid-April is about half the probability of them occurring from mid-April through June. Therefore, fall and early-spring application has less potential for loss in surface water runoff. In addition, such applications have the advantage of controlling winter annual weeds and tend to keep fields in “plantable” condition during wet spring weather, reducing the need for preplant burndown treatments.

Corn producers who till before planting should consider preplant incorporation of atrazine and companion herbicides such as Dual II Magnum, Outlook, and Micro-Tech. Mechanically incorporating these herbicides in the top 2 inches of soil reduces potential atrazine loss in runoff by about two-thirds. Soil incorporation can be done with field cultivators, finishing disks, or spring tooth harrows at any time within 14 days before planting. Harrow attachments are recommended for the incorporation implement to avoid streaking. At planting, avoid furrowing that could move herbicide-treated soil out of the crop row.

Reduced-rate atrazine approaches for corn. Some soil-applied formulations, such as Bicep Lite II Magnum, G-Max Lite, and Lumax, contain a lower proportion of atrazine than formulations such as Bicep II Magnum, Guardsman Max, and Lexar. Also, banding preemergence herbicides reduces the amount applied per acre by one-half to two-thirds. Postemergence herbicides like Buctril/Atrazine, dicamba + atrazine, and Shotgun and many postemergence tank mixtures contain only about 0.5 lb ai/acre atrazine but still provide good control of tough broadleaf weeds such as velvetleaf, cocklebur, pigweed, morningglory, and sunflower.

Non-atrazine alternatives for corn. For certain soil types, soil-applied Sencor, Hornet WDG, Camix, or Balance Pro can substitute for part or all of the atrazine. Postemergence herbicides for corn that control many weed species and do not contain atrazine include Basis, Exceed, Liberty, Resolve, Status, and glyphosate products. Caution: some of these can be used only on genetically modified or other selected corn. Some have restrictions or cannot be used where Counter or Thimet insecticides have been used.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Acetochlor 1.6 to 2.4	2 to 3 pt Surpass or Breakfree or 2 to 3 qt TopNotch or Harness , Degree , Volley , Confidence*	Restricted-use pesticide. TopNotch and Degree are microencapsulated formulations of acetochlor. Soil activity controls most annual grass and small-seeded broadleaf weeds. Rate depends on soil type and preplant or preemergence timing. Apply and incorporate into top 2 inches of soil within 2 weeks of planting, or apply after planting but before corn emerges. Contains a safener for corn. Do not apply through irrigation system. Do not apply aerially. Do not rotate to crops other than corn, sorghum, wheat, or soybean for 12 months. Can be tank mixed with atrazine, Hornet, dicamba, and several other herbicides to enlarge spectrum of weeds controlled. Note restrictions on label for depth to groundwater. Follow label directions.
Acetochlor + Atrazine 1.65 to 2.55 + 1.1 to 1.91	2.75 to 4 qt FulTime 2.2 to 3.4 qt Breakfree ATZ or 1.4 to 2.3 qt Harness Xtra 5.6L or Degree Xtra , Keystone (LA) , Volley ATZ , Confidence Xtra*	Acetochlor and atrazine are restricted-use pesticides. The addition of atrazine will enhance annual grass and broadleaf weed control. The ratio of acetochlor to atrazine varies in the products named. For sensitive watersheds, see K-State Research and Extension publication MF-2208 for atrazine Best Management Practices. Follow atrazine rate limits and label directions. No-Till: If applied more than 30 days before planting, use split applications of 60% early preplant followed by 40% at planting. For single applications, apply within 30 days preplant up to planting time. Can be tank mixed with atrazine, Hornet, Gramoxone Inteon, glyphosate, dicamba, or 2,4-D and adjuvants to control emerged weeds. Follow atrazine rate limits and label directions.
Acetochlor + Clopyralid + Flumetsulam 0.7 to 0.93 + 0.07 to 0.095+ 0.023 to 0.03	1.5 to 2 pt SureStart	Restricted-use herbicide. SureStart herbicide is for use only on herbicide-tolerant (such as Roundup Ready or Liberty Link) field and silage corn. It may be used preplant, preemergence, or early postemergence to provide early season weed control. Note environmental hazards and application restrictions on the label, and follow label directions.
Acetochlor + EPTC 0.88 to 1.23 + 3.5 to 4.9	5 to 7 pt DoublePlay	DoublePlay is a formulated mixture of 1.4 lb acetochlor (Surpass) and 5.6 lb EPTC (Eradicane)/gal for control of annual grasses, pigweeds, and annual nightshades. It must be soil incorporated within 4 hours of application to prevent loss of the EPTC through volatilization. See label for incorporation equipment and methods. It can be applied with liquid or dry fertilizers. Do not apply aerially or through any type of irrigation system. DoublePlay is a restricted-use pesticide. Follow label directions.
Alachlor 2 to 4	2 to 4 qt Alachlor or MicroTech	A restricted-use pesticide. Controls many annual grasses and small-seeded broadleaf weeds. Apply and incorporate into the top 2 inches of soil within 7 days before planting or after planting and before corn emerges. Follow label directions.
Alachlor + Atrazine 1.5 to 4 + 0.75 to 2	2.5 to 4.5 qt Lariat or Bullet	Both are restricted-use pesticides. Lariat is a premix of alachlor and atrazine, and Bullet is a premix of microencapsulated alachlor (MicroTech) and atrazine. Apply preplant and incorporate into the top 2 inches of soil within 7 days before planting or after planting up to the time when weeds and grasses reach the 2-leaf stage and corn is 3 inches tall. For sensitive watersheds, see K-State Research and Extension publication MF-2208 for atrazine Best Management Practices. Follow atrazine rate limits and cropping and feeding limitations. No-Till: May make a single application within 30 days before planting or use split applications up to 45 days before planting. Can be tank mixed with glyphosate, Gramoxone Inteon, or 2,4-D to control emerged weeds. Do not tank mix MicroTech with glyphosate. Follow atrazine rate limits and label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Atrazine 1.6 or 2 1.6 or 2 qt	Atrazine* 4L or 1.8 or 2.2 lb Atrazine* 90DF	<p>A restricted-use pesticide. Upper rate limits depend on soil texture, percentage plant residue cover and NRCS soil erodibility classification. Controls small-seeded broadleaf weeds and helps suppress other broadleaf weeds and annual grasses. Apply preplant and incorporate or apply before corn emerges. Recropping options depend on soil pH, rate, and timing of application. Atrazine carryover is longer in higher pH soils. Caution: Because atrazine moves readily with water, surface runoff losses on fine-textured soils and leaching in coarse-textured soils can impair water quality. See K-State Research and Extension publication MF-2208 for atrazine Best Management Practices. Follow label directions for rates, cropping, and feeding limitations.</p> <p>No-Till, Fall Application: Atrazine can be applied to Kansas row-crop stubble from fall harvest to December 31 to control winter annual weeds and reduce or eliminate the need for burndown herbicide application or preplant tillage in spring. Apply with crop oil concentrate to enhance foliar activity. Tank mixing with 2,4-D LVE enhances control of dandelion and other broadleaf winter annual weeds. Can be tank mixed with Gramoxone Inteon to enhance control of cheat, downy brome, and Japanese brome. For highly erodible soils with less than 30% plant residue cover, limit fall application to a maximum of 1.6 lb. Total atrazine applications must not exceed 2.5 lb/acre per calendar year. Do not apply to frozen ground or where soil surface conditions favor wind erosion. Do not plant any crops except corn, grain sorghum, or forage sorghum in the following spring. Follow directions on 24(C) Special Local Need label for Kansas.</p> <p>No-Till, Early Preplant Application: Atrazine can be applied in spring up to 45 days before planting. If weeds are present at time of treatment, but before crop emergence, atrazine may be tank mixed with Gramoxone Inteon or glyphosate. Apply with crop oil concentrate or non-ionic surfactant to enhance foliar uptake. Avoid tillage after application. Applying about two-thirds of the atrazine dose early preplant and one-third at planting time is a Best Management Practice.</p>
Carfentrazone 0.0074 to 0.015	0.5 to 1 fl oz Aim EC	<p>No-Till: Can be applied alone or with other herbicides in fallow and preplant burndown applications to control or suppress annual broadleaf weeds. Can be tank mixed with glyphosate or paraquat to broaden burndown spectrum. Apply with nonionic surfactant or crop oil concentrate. Aim is a contact herbicide requiring thorough spray coverage of foliage. Do not exceed 2 fl oz/acre per season for all fallow, preplant, or in-crop applications to corn. Follow label directions.</p>
Carfentrazone + 2,4-D 0.008 to 0.03 + 0.25 to 1	0.5 to 2 pt Rage D-Tech	<p>No-Till: Can be applied alone or with other herbicides in fallow and preplant burndown applications. Can be tank mixed with glyphosate, paraquat, and other herbicides to broaden the weed control spectrum and to accelerate burndown. A 3- to 14-day interval is required between application and corn planting. Always apply with nonionic surfactant, crop oil concentrate, or methylated seed oil. Follow label directions.</p>
Dicamba 0.25 to 0.5	0.5 to 1 pt Clarity, Banvel, Sterling Blue	<p>After applying dicamba for weed burndown in no-till fields, it is recommended to delay corn planting 5 days for rates up to 4 fl oz/acre, and 7 days for rates from 4 to 8 fl oz/acre. Soil texture and organic matter content will also affect crop injury potential. Can be applied immediately after planting but has less potential for corn injury if application is delayed until near the spike stage. If dicamba is to be applied before corn emerges, plant corn at least 1.5 inches deep. Do not apply to coarse-textured soils (sand, sandy loam, and loamy sand) until after crop emergence. Do not harvest or use corn for dairy or beef cattle feed before the milk stage. Avoid spray or vapor drift to sensitive crops. Follow label directions.</p>

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Dicamba + Atrazine 0.28 to 0.48 + 0.5 to 0.9	2 to 3.5 pt Stratos , or Banvel K + Atrazine	No-Till: These are premixes of dicamba and atrazine (a restricted-use pesticide). They control many broadleaf weeds when applied before planting no-till corn. Do not apply to coarse-textured soils or soils with less than 2% organic matter. Contact your seed corn company before using this product on seed corn or specialty corn. Follow atrazine rate limits and label directions.
Dicamba + 2,4-D 0.25 to 0.5 + 1	0.5 to 1 pt Clarity , Banvel , Sterling Blue , or Oracle + 1 qt 2,4-D LV4	No-Till: For control of established alfalfa and annual weeds, apply when alfalfa regrowth is 6 to 8 inches tall and growing actively. Fall treatment is preferred, provided that conditions favor vigorous alfalfa growth. If alfalfa escapes occur, apply only dicamba at rate recommended on label after corn emerges. Follow label directions.
Diflufenzopyr + Dicamba 0.054 to 0.08 + 0.138 to 0.21	4 to 6 oz Distinct	Apply Distinct prior to but not sooner than 14 days before corn planting. If planting corn into legume sod, apply 6 to 8 oz of Distinct at least 21 days before corn planting. Distinct controls many broadleaf weeds and may suppress emerged annual grasses. Apply Distinct with nonionic surfactant and urea ammonium nitrate or ammonium sulfate. Follow label directions.
Dimethenamid-P 0.56 to 0.98	12 to 21 oz Outlook or Propel	Controls most grasses and some broadleaf weeds such as nightshade and pigweeds. Rate depends on soil type. Apply preplant within 2 weeks of planting and incorporate shallowly, or apply after planting up to early postemerge. Can be tank mixed with atrazine, Pursuit (imidazolinone-tolerant corn only), and other herbicides. Can be used on sweet corn, popcorn, or seed corn. Fall cereals can be planted after 4 months. Follow label directions.
Dimethenamid-P + Atrazine 0.53 to 0.98 + 1.0 to 1.9	2.5 to 4.6 pt Guardman Max or Propel ATZ	Guardman Max is a premix of dimethenamid-P (Outlook) and atrazine (a restricted-use pesticide). Apply before, during, or after planting. Can be shallowly incorporated up to 2 weeks before planting. Can be tank mixed or used in sequential programs with many other herbicides. For sensitive watersheds, see K-State Research and Extension publication MF-2208 for atrazine Best Management Practices. Follow atrazine rate limits and label directions. No-Till: Guardman Max can be applied up to 45 days preplant. For early preplant (15 to 45 days before planting) and in fields with heavy plant residues, use the highest rate recommended for the soil type and/or use a split application program in which a third of the rate is applied after planting. Tank mix with other herbicides, such as Gramoxone Inteon, glyphosate, dicamba, and 2,4-D, as appropriate, to enhance burndown of existing weeds before planting. Follow atrazine rate limits and label directions.
Dimethenamid-P + Atrazine 0.56 to 0.98 + 0.69 to 1.2	2 to 3.5 pt G-Max Lite or Propel ATZ Lite	G-Max Lite is a premix of 2.5 lb dimethenamid-P (Outlook) and 2.75 lb atrazine (a restricted-use pesticide) for use by growers wanting to reduce rates of soil-applied atrazine. Follow label directions.
Flufenacet 0.45 to 0.79	12 to 21 oz Define 60 DF 15-21 oz Define SC	Define is a selective herbicide for control of many annual grasses and some broadleaf weeds in field and seed corn. It may be shallowly preplant soil incorporated, or applied preemerge. Rate depends on soil type. Companion herbicides, such as atrazine, Sencor, or Balance Pro, are needed to achieve satisfactory control of pigweed and waterhemp. Has shown greater shattercane activity than other herbicides of similar chemistry. May be applied postemerge on corn up to V6 (6 leaf collars) stage, but does not have foliar activity on weeds. Do not apply through any type of irrigation system, and do not apply aerially. In case of crop failure, can replant with corn or soybean immediately. Rotational interval is 12 months for wheat, sorghum, sunflower, and alfalfa. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Flufenacet + Isoxaflutole 0.18 to 0.62 + 0.02 to 0.075 or 0.15 to 0.51 + 0.03 to 0.11	8 to 28 fl oz Radius or 5 to 17 Epic DF	Radius is a liquid formulation containing 3.57 lb flufenacet (Define) and 0.43 lb isoxaflutole (Balance Pro, a restricted-use pesticide)/gal, whereas Epic is a dry flowable containing 48% flufenacet and 10% isoxaflutole. Note that the proportions differ. These are restricted-use pesticides. Do not use on coarse- or medium-textured soils with pH above 7.5, and do not use on soils with less than 1.5% organic matter. See 24(c) label for Kansas counties and soils with shallow water tables where Radius or Epic is prohibited. Plant corn at least 1.5 inches deep, and be certain that soil is firmed over the seed slot. Can be used on field corn and white corn. Do not use on sweet corn, seed corn, popcorn, or high-oil hybrids. Follow label directions.
Flumetsulam 0.04 to 0.07	0.8 to 1.33 oz Python WDG	Python controls many annual broadleaf weeds. It can be preplant incorporated or applied after planting up to spike stage of corn (up to 2 inches in height but before the first leaf is unfurled). Do not apply aerially or in irrigation water. Can be tank mixed with atrazine. Can be applied in liquid fertilizer carrier before corn emergence. Do not apply to sweet corn or popcorn. Do not apply where soil pH is above 7.8. Apply to soils with less than 1.5% organic matter only if the risk of crop injury is acceptable. Any soil insecticides should be applied in a T-band to avoid an interaction with flumetsulam that could cause crop injury. Do not use if Counter insecticide has been applied. Rotate to cereal grains after 4 months, sorghum after 12 months, and sunflower after 18 months. Follow label directions.
Flumetsulam + Clopyralid 0.046 to 0.069 + 0.125 to 0.186	4 to 6 oz Hornet WDG	Hornet WDG contains 18.5% flumetsulam (Python) and 60% clopyralid salt (Stinger) for control of broadleaf weeds in corn. It may be applied preplant incorporated or preemerge. It has little or no grass activity and can be applied in combination with grass herbicides. Addition of Hornet to herbicide programs containing atrazine often enhances control of large-seeded broadleaf weeds such as velvetleaf, sunflower, and cocklebur. Do not apply where soil pH is above 7.8. Apply to soils with less than 1.5% organic matter only if the risk of corn injury is acceptable. Any soil insecticides should be applied in a T-band to avoid an interaction with flumetsulam that could cause crop injury. Hornet WDG is not to be used either soil applied or postemerge where Counter or Thimet insecticides have been used. Rotate to wheat after 4 months, soybean or alfalfa after 10.5 months, sorghum after 12 months, and sunflower after 18 months. Follow label directions. No-Till: Hornet WDG can be applied up to 30 days preplant. If weeds are present, apply with glyphosate, Gramoxone Inteon, or 2,4-D according to weed spectrum, and adjuvant. Can be applied in liquid fertilizers. Supplemental label allows aerial application. Follow label directions.
Flumiclorac 0.014 to 0.028	2 to 4 fl oz Resource	No-Till: Resource can be tank mixed with glyphosate products to increase speed of burndown activity before planting field corn or soybean. Resource is a contact herbicide requiring thorough spray coverage of the foliage. West of U.S. Highway 75, always apply with 1 qt/acre of crop oil concentrate plus ammonium sulfate water conditioner for glyphosate. Follow label directions.
Flumioxazin 0.064	2 oz Valor	Apply to the soil surface 14 to 28 days prior to planting corn in a no-till or minimum-till system only. Controls several broadleaf weeds including pigweeds and nightshade. Glyphosate or 2,4-D should be tank mixed to control emerged weeds. Valor can be tank mixed with atrazine or metribuzin. Do not rotate to wheat for 1 month or to alfalfa or oats for 8 months after application. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Glyphosate	Glyphosate* (See glyphosate table)	No-Till: Use to control annual weeds up to 6 inches tall and some perennial weeds in fallow fields or before corn emergence. Application in 3 to 10 gal/acre spray is more effective than in higher gallonage. Condition spray water with 1 to 2%, by weight, of spray-grade ammonium sulfate (9 to 17 lb/100 gal water) before adding glyphosate products to the tank. Some glyphosate products contain little or no adjuvant, so check label requirements carefully. Dust on plants can decrease performance. Usually applied with 2,4-D or dicamba to enhance control of certain broadleaf species. Follow label directions.
Iodosulfuron 0.001875	0.3 oz Autumn	Autumn is a burndown herbicide only. It should be applied after fall harvest and up to 30 days prior to planting field corn. Do not apply to frozen ground. Best results are obtained when applied to actively growing weeds. A 2,4-D tank mix partner is recommended. Required spray adjuvants are crop oil concentrate at 1% v/v and 1 to 2 qt/acre UAN fertilizer or 1.5 to 3.0 lb/acre ammonium sulfate. Rotate to sorghum after 9 months and alfalfa or sunflower after 18 months. Follow label directions.
Isoxaflutole 0.047 to 0.12	1.5 to 3.75 fl oz Balance Pro	Balance Pro is a restricted-use pesticide. In Kansas, it is prohibited in 11 counties: Barton, Edwards, Harvey, Kiowa, McPherson, Pawnee, Pratt, Reno, Rice, Sedgwick, and Stafford. It is prohibited on fields that contain vulnerable sandy loam, loamy sand, or sand soils if the water table is less than 25 feet below the soil surface. See 24(c) label for list of vulnerable soils. Balance Pro can be preplant incorporated shallowly or surface applied in field corn. Do not incorporate deeper than 2 inches. Rate depends on soil texture, organic matter, pH, and application timing. Use on clay knolls, eroded hillsides, terracing with scraped exposed subsoil, and areas of coarse soils of less than 1.5% organic matter or pH greater than 7.5 may result in adverse crop response. When applied preemerge to medium soils with pH greater than 7.5, reduce the rate by 0.25 fl oz from the recommended rate. Balance Pro may be tank mixed with many grass and broadleaf herbicides. Do not apply aerially or through any type of irrigation system. Corn seed must be planted at least 1.5 inches deep, completely covered with soil, and the seed furrow firmed. The rotational interval is 4 months for wheat, 6 months for soybean, sorghum or sunflower, and 10 months for alfalfa. Follow label directions. No-Till: May be soil surface applied up to 21 days before planting field corn and up to 30 days before planting when used in a planned sequential application program such as Balance Pro followed by Liberty, Buctril, or other postemerge herbicides. When applied with crop oil concentrate or methylated seed oil, Balance Pro controls labeled weeds less than 3 inches in height. Tank mix with other burndown herbicides to control a broader spectrum of weeds or larger weeds. Tank mix with other residual herbicides to extend the spectrum and duration of control. Follow label directions.
Metribuzin 0.094 to 0.25	2 to 5.33 oz Sencor DF, Dimetric DF	Sencor is a triazine herbicide that can be used in field corn to replace or reduce the amount of atrazine needed for control of broadleaf weeds. It can be tank mixed with many other herbicides for late preplant or preemerge use in corn. Do not use in coarse-textured soils, soils containing less than 1.5% organic matter, or soils with pH of 7.0 or higher. Do not mechanically incorporate into soil. Follow label directions.
Paraquat 0.5 to 1.0	2 to 4 pt Gramoxone Inteon	Gramoxone Inteon is a formulation designed to reduce the amount of paraquat absorbed after accidental ingestion. Paraquat, a restricted-use pesticide, is a nonselective, nonresidual contact herbicide often used for preplant burndown of weeds. Apply in clean water or nitrogen fertilizer solutions to thoroughly cover actively growing weeds 1 to 6 inches tall. Rate depends on weed size. Dust on plants decreases paraquat activity. Tank mixing with triazine herbicides and crop oil concentrate in water carrier enhances weed burndown. When nitrogen fertilizer is the carrier, use nonionic surfactant instead of crop oil concentrate. Follow label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Pendimethalin 0.75 to 1.5	1.8 to 3.6 pt Pendimax, Pendant, Acumen, or Prowl 3.3EC or 2 to 4 pt Prowl H₂O	Controls grasses more effectively than broadleaf weeds. Apply at planting or after planting but before weeds or corn emerge. Do not mechanically incorporate into soil because serious crop injury can occur. Corn must be planted at least 1.5 inches deep. Winter wheat can be planted in the fall, 4 months after application. Can be tank mixed with many grass herbicides and atrazine. Follow label directions.
Rimsulfuron + Thifensulfuron 0.0104 to 0.0315 + 0.0052 to 0.0158	0.33 to 1.0 oz Basis	Apply Basis in the fall (.033 to 0.5 oz) with 2,4-D ester before the ground freezes to control winter annual weeds and provide some residual weed control of later emerging winter annuals or early emerging spring annual weeds. Early spring applications up to 1.0 oz of Basis can be applied on heavy textured soils. Do not use on fields intended to be planted to popcorn, sweet corn, or field corn for seed production. Field corn can be planted in the spring following a fall application of Basis. Basis can be applied up to 7 days prior to planting corn for burndown of emerged weeds. To control emerged weeds, apply Basis with a crop oil concentrate or a nonionic surfactant and an ammonium nitrogen fertilizer. Tank mixing with herbicides registered for corn having a different mode of action may help control ALS-resistant weed species. Follow label directions.
S-metolachlor 1 to 1.9	1 to 2 pt Dual II Magnum, Cinch, Charger Max or 6 to 16 lb Dual II G Magnum	Controls many annual grass and small-seeded broadleaf weeds. Preplant surface apply up to 45 days before planting corn, apply preplant and shallowly incorporate into the top 2 inches of soil within 14 days before planting, or apply before corn emerges. Small grains can be planted 4.5 months after treatment. Follow label directions.
S-metolachlor + Atrazine 0.78 to 1.56 + 1 to 2	1.3 to 2.6 qt Bicep II Magnum, Charger Max ATZ, Cinch ATZ	These are formulated mixtures of 3.1 lb atrazine (a restricted-use pesticide) and 2.4 lb S-metolachlor/gal. Use the lower rate for expected light weed infestations and the higher rate for heavy weed infestations. Use with shallow preplant incorporation or surface apply after planting and before grasses and broadleaf weeds are at 2-leaf stage and corn is 5 inches tall. For sensitive watersheds, see K-State Research and Extension publication MF-2208 for atrazine Best Management Practices. Follow atrazine rate limits and label directions.
1.27 to 1.56 + 1.6 to 2	No-Till: 2.1 to 2.6 qt Bicep II Magnum, Cinch ATZ	No-Till: Apply two-thirds the recommended rate as a split treatment 30 to 45 days before planting and the remainder at planting. Applications made less than 30 days before planting may be either a split or single treatment. May apply in fluid fertilizer with nonionic surfactant to burn down labeled weeds up to 2-leaf stage. To control larger weeds, tank mix with Gramoxone Inteon, glyphosate, etc. Follow atrazine rate limits and label directions.
S-metolachlor + Atrazine 0.8 to 1.58 + 0.63 to 1.27	0.95 to 1.9 qt Bicep Lite II Magnum, Charger Max ATZ Lite, Cinch ATZ Lite	These are formulated mixtures of 2.67 lb atrazine (a restricted-use pesticide) and 3.33 lb S-metolachlor/gal for use by growers wanting to reduce rates of soil-applied atrazine. Follow label directions.
S-metolachlor + Atrazine + Glyphosate 1.1 to 1.6 + 1.3 to 2.0 + 0.47 to 0.70	2.5-3.75 qt Expert	No-Till: Expert is a premix of the active ingredients in Bicep II Magnum (a restricted-use pesticide) and glyphosate. Typical use rate is 3 qt/acre. Use as a burndown of existing weeds and residual weed control. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
S-metolachlor + Mesotrione + Atrazine 1.68 to 2 + 0.17 to 0.2 + 0.63 to 0.75	2.5 to 3 qt Lumax	Lumax is a premix of 2.68 lb S-metolachlor (Dual II Magnum), 0.268 lb mesotrione (Callisto), and 1 lb atrazine (a restricted-use pesticide). Use rate depends on soil organic matter content. Apply up to 14 days before planting or preemergence. Controls a wider spectrum of weeds than Bicep, especially velvetleaf, pigweed, and waterhemp, if properly activated. Can rotate to winter wheat 4.5 months after application; to cotton, soybean or sorghum the following spring. Application to sands and loamy sands where the water table is near the surface may result in groundwater contamination. Follow atrazine rate limits and label directions. No-Till: May be tank mixed with Gramoxone Inteon, glyphosate, or a 2,4-D product (see 2,4-D label for restrictions) for preplant burndown of existing weeds. May be applied in liquid fertilizer before corn emerges. Follow label directions.
S-metolachlor + Mesotrione + Atrazine 1.3 to 1.5 + 0.17 to 0.19 + 1.3 to 1.5	3 to 3.5 qt Lexar	Lexar is a premix of 1.74 lb S-metolachlor (Dual II Magnum), 1.74 lb atrazine (a restricted-use pesticide) and 0.22 lb mesotrione (Callisto)/gal. Use rate depends on soil organic matter content. Apply up to 14 days before planting. The higher atrazine content than Lumax should give improved control of morningglory and cocklebur. Do not rotate to winter wheat following corn. Do not rotate to crops other than corn, cotton, soybean, or sorghum the spring following application. No-Till: May be tank mixed with Gramoxone Inteon, glyphosate, or a 2,4-D product (see 2,4-D label for restrictions) for preplant burndown of existing weeds. May be applied in liquid fertilizer before corn emerges. Follow label directions.
Simazine 1 to 2	1 to 2 qt Princep 4L, Simtrol, Simazine 4L or 1.1 to 2.2 lb Princep Caliber 90, Simazine 90DF	Has more residual grass activity than atrazine and is less water soluble. Usually applied late preplant or preemergence at about 1 lb/acre. Do not soil incorporate. Does not have foliar activity. Can be used on sand, silt, and loam soils that are low in organic matter. Has longer carryover than atrazine. Follow label directions.
Thifensulfuron 0.014 to 0.028	0.45 to 0.9 oz Harmony SG , or 0.3 to 0.6 oz Unity or Harass	Apply preplant until corn emergence for burndown of certain broadleaf weeds. Generally tank mixed with burndown herbicides for broader spectrum weed control. Apply with nonionic surfactant or crop oil concentrate plus ammonium nitrogen fertilizer additives. Follow label directions.
2,4-D 1 to 1.5	2 to 3 pt of 4 lb/gal 2,4-D*	Numerous formulations of 2,4-D are available. Weedar 64 contains 3.8 lb/gal dimethylamine salt. Savage is a dry soluble formulation containing 95% dimethylamine salt. Weedone 638, Weedone LV4, and Weedone LV6 contain 2.8 lb, 3.8 lb, and 5.7 lb/gal, respectively, of the butoxyethyl ester. Hi-Dep contains 3.8 lb/gal of the dimethylamine and diethanolamine (mixed amine) salts. Salvo and SEE 2,4-D LV4 contain 5 lb and 3.8 lb/gal, respectively, of iso-octyl ester. Application rates, spray volumes, and timings differ with company and formulation. Apply 3 to 5 days after planting but before corn emerges. Can control broadleaf weeds for several weeks. Do not use on sandy soils. Avoid spray or vapor drift to sensitive crops. Follow label directions.
LAY-BY AND POSTEMERGENCE INCORPORATED (PREEMERGENCE TO WEEDS)		
Pendimethalin 0.75 to 1.5	1.8 to 3.6 pt Pendimax, Pendant, Acumen or Prowl 3.3EC or 1.5 to 3 pt Prowl H₂O	Pendimethalin will not control emerged weeds. Apply to cultivated or otherwise weed-free soil when corn is 4 inches tall to lay-by. Apply over the top, or use drop nozzles if foliage prevents spray coverage of soil. Thoroughly incorporate into top 1 inch of soil with cultivation or with adequate irrigation or rainfall within 7 days after application. Can be applied with atrazine to corn from 4 to 12 inches tall. Do not apply more than 2.5 lb atrazine/acre per calendar year. Do not allow grazing or feed forage from treated areas for 21 days after treatment. Follow label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
LAY-BY AND POSTEMERGENCE INCORPORATED (PREEMERGENCE TO WEEDS)		
S-metolachlor 0.67 to 2	0.67 to 2 pt Dual II Magnum, Charger Max, Cinch	Will not control emerged weeds. Apply to cultivated or otherwise weed-free soil to extend the duration of weed control. For corn from 5 to 40 inches tall, apply to base of plants. Can be applied with AAtrex on corn up to 12 inches tall, but do not exceed the maximum of 2.5 lb atrazine/acre per calendar year. Can be applied through center-pivot irrigation. Follow label directions.
Trifluralin 0.75 to 1	1.5 to 2 pt of 4 lb/gal generic trifluralin	Trifluralin will not control emerged weeds. Apply to cultivated or otherwise weed-free soil after field corn is 8 inches tall. Apply over the top, or use drop nozzles if foliage prevents spray coverage of soil. Incorporate with sweep or rolling cultivator and move soil over base of corn plants. Trifluralin can be applied through chemigation systems to field corn from V2 stage (2 leaf collars visible) up to 30 inches tall. Apply with 0.5 to 1 inch irrigation water to incorporate. Can be tank mixed with atrazine (a restricted-use pesticide) for over-the-top application to corn 8 to 12 inches tall. Do not apply more than 2.5 lb atrazine/acre per calendar year. See label for additional precautions.
POSTEMERGENCE		
Acetochlor	Breakfree, Harness, Degree, Surpass, TopNotch, Volley, Confidence	Acetochlor and premixes containing acetochlor can be applied postemerge to corn up to 11 inches tall. It can be tank mixed with many postemerge herbicides. Acetochlor has no postemerge activity, so its role is to enhance residual weed control. Emerged weeds must be controlled with cultivation or the companion herbicide. Use only water as a carrier to avoid crop injury. Follow label directions.
Atrazine 1 to 2 1 to 2 qt	Atrazine* 4L or 1.1 to 2.2 lb Atrazine* 90 DF	A restricted-use pesticide. The 2 lb/acre rate is permissible only when no atrazine was applied before corn emergence. Apply with crop oil concentrate in water before grasses, broadleaf weeds, and corn exceed 1.5, 4, and 12 inches in height, respectively. Do not apply in liquid fertilizer carrier after corn emerges because injury can occur. Do not plant treated field to crops other than corn (or sorghum in northeastern Kansas) during the same season. Postemerge atrazine rates over 1 lb/acre are not considered Best Management Practices because of high runoff potential in surface water in sensitive watersheds (see K-State Research and Extension publication MF-2208). See label for directions, rates, recropping, and feeding limitations.
Bentazon + Atrazine 0.43 to 0.75 + 0.43 to 0.75	1.33 to 2.33 pt Laddok S-12	Laddok S-12 is a premix of bentazon (Basagran) and atrazine (a restricted-used pesticide). Controls broadleaf weeds. Apply when weeds are small and growing actively and before they reach size limits listed on label. Both bentazon and postemerge atrazine are contact herbicides; thorough spray coverage is required. Always add crop oil concentrate, Dash HC, UAN, or spray-grade ammonium sulfate solution as adjuvant. Do not apply to corn taller than 12 inches. Do not cultivate 5 days before or after application. Do not allow grazing or feed treated forage for 21 days. Laddok application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces the potential for runoff loss. Follow atrazine rate limits and label directions.
Bentazon + Atrazine + 2,4-D LVE	1.33 to 2.33 pt Laddok S-12 + 0.25 pt 4 lb/gal 2,4-D LVE*	Adding 2,4-D to Laddok S-12 improves control of field bindweed, swamp smartweed, common sunflower, velvetleaf, and pigweeds. Apply to field corn when fully emerged but before the fifth leaf is visible. Add UAN, but not crop oil concentrate, as adjuvant. Do not apply to corn taller than 12 inches. This is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces the potential for runoff loss. Follow atrazine rate limits and label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Bromoxynil 0.25 to 0.38	1 to 1.5 pt Broclean, Buctril, Bromox, or Moxy	Apply bromoxynil when broadleaf weeds are small and growing actively but before they reach size limits listed on the label. Contact action requires thorough coverage. Bromoxynil is safer for corn than 2,4-D or dicamba. No residual activity. Can be tank mixed with atrazine, Callisto, dicamba, or 2,4-D. Do not feed forage or allow grazing within 30 days of treatment. Follow label directions.
Bromoxynil + Atrazine 0.13 to 0.38 + 0.25 to 0.75	1 to 3 pt Brozine, Buctril+Atrazine*	Atrazine is a restricted-use pesticide. These premixes of 1 lb bromoxynil and 2 lb atrazine/gal control many seedling broadleaf weeds. Use up to two applications per season when weeds are small and actively growing but before they reach size limits listed on labels. Apply after 3- to 4-leaf stage but before corn exceeds 12 inches in height. Can be tank mixed with dicamba to increase control of pigweeds, kochia, and field bindweed. Tank mixing with up to 8 fl oz 2,4-D increases control of devilsclaw and field bindweed but increases potential for crop injury. Can be tank mixed with Accent for shattercane control. Bromoxynil plus atrazine application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces the potential for runoff loss. Do not feed forage or allow grazing within 30 days of treatment. Follow label directions.
Carfentrazone-ethyl 0.0074	0.5 fl oz Aim EC	Carfentrazone helps control black nightshade, velvetleaf, lambsquarter, pigweed, and morningglory when applied to actively growing plants 1 to 4 inches tall. Can be broadcast applied to corn with up to 8 leaf collars. For corn from 9 to 14 leaf collars, apply with drop nozzles. Always apply with nonionic surfactant at 0.25% v/v. Substituting 1% v/v crop oil concentrate is permissible for very dry soil conditions, but leaf speckling on treated corn may increase. Can be tank mixed with other postemerge corn herbicides to broaden the weed spectrum and increase the level of control. For tank mixes, follow application and rotation guidelines of the more restrictive partner. Thorough and uniform spray coverage is needed for best results. Any crop can be planted after 30 days following application. Follow label directions.
Carfentrazone-ethyl + Halosulfuron 0.0074 + 0.031	1 oz Priority	1 oz Priority premix is equivalent to 0.5 fl oz Aim EC plus 2/3 oz Permit. Can be applied to corn with up to 8 leaf collars. Always apply with nonionic surfactant at 0.25% v/v. Substituting 1% v/v crop oil concentrate is permissible for very dry soil conditions, but leaf speckling on treated corn may increase. Will suppress yellow nutsedge and should be applied early in the crop growth window. Follow label directions.
Clopyralid 0.12 to 0.25	0.33 to 0.67 pt Stinger	Can be applied to corn from emergence until 24 inches tall, primarily for Canada thistle control. Apply to thistle plants at least 4 inches in diameter or tall but before the bud stage. Do not cultivate Canada thistle patches within 2 weeks before or after Stinger application. Can be tank mixed with 2,4-D. Follow label directions.
Dicamba 0.25 to 0.5	0.5 to 1 pt Clarity, Banvel, Sterling Blue, or Oracle	Controls most broadleaf annual weeds. Best when applied before weeds are 3 inches tall. For corn from the spike stage through 8 inches, apply up to 1 pt/acre. Reduce the rate to 0.5 pt if corn is growing on coarse-textured soils. Apply up to 0.5 pt until corn is 36 inches tall or until 15 days before tassels emerge, whichever is earlier. Can be tank mixed with Exceed, Permit, and many other herbicides. Do not apply when temperature on the day of application is expected to exceed 85°F. Do not apply when soybean is growing nearby, if corn is more than 24 inches tall, soybean is more than 10 inches tall, or soybean has begun to bloom. Avoid spray or vapor drift to sensitive crops. See label for additional precautions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Dicamba + Atrazine 0.28 to 0.48 + 0.5 to 0.9	2 to 3.5 pt Stratos , or Banvel K + Atrazine	These are mixtures of dicamba and atrazine (a restricted-use pesticide) that can be applied to corn from the spike stage until the 5-leaf stage. Use drop nozzles if corn is more than 8 inches tall. Do not apply to corn over 12 inches tall. Use lower rate for coarse-textured soils. Do not use with adjuvants or liquid fertilizers, except as directed on labels. Can be tank mixed with Outlook, Harness, Surpass, or pendimethalin, but these residual herbicides have no foliar activity. When tank mixing with Accent, add 1 qt nonionic surfactant/100 gal spray mixture and 1 gal/acre UAN. Dicamba plus atrazine application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces the potential for runoff loss. Follow atrazine rate limits.
Diflufenzopyr + Dicamba 0.054 to 0.08 + 0.138 to 0.21	4 to 6 oz Distinct	Distinct combines diflufenzopyr and the sodium salt of dicamba (Banvel SGF). It controls many broadleaf weeds, including ALS- and triazine-resistant biotypes. It also has a herbistatic effect, suppressing growth of emerged annual grasses up to 3 inches tall. Do not apply to corn less than 4 inches tall. Use 6 oz/acre on 4- to 10-inch corn. Use 4 oz/acre on 10- to 24-inch corn (use of drop nozzles encouraged). On 24- to 36-inch corn, drop nozzles are required. Always apply with nonionic surfactant at 1 qt and UAN at 5 qt/100 gal spray. Can be tank mixed with Accent or atrazine. Tank mixing with growth-regulator herbicides, e.g. 2,4-D, is not recommended. Follow label directions.
Diflufenzopyr + Dicamba 0.053 to 0.11 + 0.138 to 0.275	5 to 10 oz Status	Status combines diflufenzopyr and dicamba with isoxadifen, a safener. It may be broadcast applied over corn from 4 to 36 inches tall. Always apply with nonionic surfactant, methylated seed oil, or crop oil concentrate plus a nitrogen source such as 5 qt/100 gal of UAN or 5 to 17 lb/100 gal of spray-grade ammonium sulfate (AMS). When using AMS, dissolve Status in the tank before adding AMS. May be tank mixed with glyphosate for resistance management. May be aerially applied west and inclusive of Highway 81 in Kansas. Follow label directions.
Dimethenamid-P 0.56-0.98	12 to 21 oz Outlook or Propel	Dimethenamid-P alone, or in a Guardsman Max premix, can be applied postemerge to corn up to 12 inches tall. Dimethenamid-P has no foliar activity, so its role is strictly to enhance residual weed control. Emerged weeds must be controlled with cultivation or the companion herbicide. Use only water as a carrier to avoid crop injury. Follow label directions.
Flumetsulam + Clopyralid 0.023 to 0.058 + 0.063 to 0.156	2 to 5 oz Hornet WDG	Hornet is a mixture of 18.5% flumetsulam (Python) and 60% clopyralid salt (Stinger) that may be applied to corn up to V6 stage. It is taken up by weed seedlings through both foliage and roots. Use rate depends on weed size and the duration of residual soil activity desired. Hornet WDG can be tank mixed with numerous postemerge herbicides to broaden the weed-control spectrum, but do not tank mix with Basagran, Laddok, or Lightning. Hornet WDG is not to be used, either soil applied or postemerge, where Counter or Thimet insecticides have been used, as severe crop injury may occur. Always apply with 1% crop oil concentrate, 1% methylated seed oil, or a quality nonionic surfactant at 0.25% (1 qt/100 gal), depending on the tank mix partner. In addition, 2.5% (2.5 gal/100 gal) UAN can be added to enhance weed control under extremely dry growing conditions, but do not use liquid fertilizer carrier. Rotate to wheat after 4 months, soybean or alfalfa after 10.5 months, sorghum after 12 months, and sunflower after 18 months. Supplemental label allows aerial application. Follow label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Flumiclorac 0.013 to 0.040	2 to 6 oz Resource	Resource is used mainly in tank mixes to enhance velvetleaf control. It can be applied from the V2 to V10 stages (2 to 10 leaf collars visible) of corn. Use 2 oz for velvetleaf up to 4-leaf stage, and 4 oz for velvetleaf at 6-leaf stage. Resource tank mixed with atrazine, Accent, Beacon, or similar products must be applied with 1 pt/acre crop oil concentrate or methylated seed oil, and AMS at 2.5 lb/acre or UAN at 1 qt/acre can be added. Resource mixed with 2,4-D amine, Stinger, or dicamba must be applied with 0.25% nonionic surfactant. Resource mixed with Buctril, 2,4-D ester, or dicamba + atrazine must be applied without the addition of an adjuvant. See label for mixing order recommendations and directions for drop nozzle application. Do not tank mix Resource with Tough herbicide, which is severely antagonistic. Follow label directions.
Fluroxypyr 0.125	0.67 pt Starane	Starane can be applied to field corn as a broadcast application by either ground or air. Use of a high quality adjuvant is recommended for improved weed control, especially in hot, dry conditions. Apply to field corn up to and including the V5 stage of growth. Starane can be tank mixed with other herbicides registered for postemerge application to corn. Follow label directions.
Fluroxypyr + Bromoxynil 0.064 to 0.125 + 0.25 to 0.5	14 to 2.4 fl oz Starane NXT	Starane NXT can be applied to field corn as a broadcast application by either ground or air, from emergence (low use rates) through and including the V5 stage. May be tank mixed with other labeled corn herbicides, but spray mixtures that include spray additives or liquid fertilizers may cause excessive corn leaf burn. Follow label directions.
Fluroxypyr + Clopyralid 0.125 + 0.125	1.33 pt WideMatch	WideMatch can be applied to field corn as a broadcast application by either ground or air. Apply to field corn up to and including the V5 stage of growth. Use of an adjuvant is not recommended when using WideMatch alone, as crop safety may be reduced. WideMatch can be tank mixed with other herbicides registered for postemerge application to corn. Do not apply WideMatch in combination with crop oil concentrate or methylated seed oil unless risk of crop injury is acceptable. Follow label directions.
Fluthiacet-methyl 0.003 to 0.006	0.4 to 0.9 oz Cadet	Especially good for velvetleaf control and suppression of certain other small broadleaf weeds. The low rate is primarily to enhance velvetleaf control in tank mixes with other herbicides. Apply to field corn, seed corn, popcorn, or sweet corn from V2 to 48 inches tall. There is a 90 day preharvest interval. Always apply in combination with 0.25% v/v nonionic surfactant or 1 to 2 pt/acre crop oil. Cadet is a PPO inhibitor and can cause leaf burning or speckling. New growth is unaffected. Follow label directions.
Foramsulfuron 0.033	1.5 oz Option	Option is a sulfonylurea herbicide and will not control ALS-resistant weeds. Otherwise, it controls shattercane, rhizome johnsongrass, and certain annual grasses and broadleaf weeds in field corn. Apply postemerge to field corn up to the V7 stage or 16 inches in height. For corn 16 to 36 inches tall, apply with drop nozzles. Apply with methylated seed oil (MSO) at 1.5 pt/acre and 1.5 to 3 lb ammonium sulfate/acre. Can be tank mixed with dicamba, Distinct, Hornet, or atrazine (up to 12 inch height). Rainfast in 2 hours. Do not use in the same season as Counter 15G, Counter 20CR in-furrow, or Thimet insecticides. Replanting intervals are 7, 14, and 60 days for corn, soybean, and all other crops, respectively. Follow label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Foramsulfuron + Iodosulfuron 0.028 + 0.0018	1.5 oz Equip	Equip is a sulfonylurea herbicide and will not control ALS-resistant weeds. Controls shattercane, rhizome johnsongrass, and certain annual grasses and broadleaf weeds in field corn. Apply postemerge to field corn up to the V5 stage or 12 inches in height. Apply with methylated seed oil (MSO) at 1.5 pt/acre and 1.5 to 3 lb ammonium sulfate/acre. Can be tank mixed with dicamba, Distinct, Hornet, or atrazine. Rainfast in 2 hours. Do not use in the same season as Counter 15G, Counter 20CR in-furrow, or Thimet insecticides. Replant intervals are 9 months for soybean and cotton, 2 months for winter wheat, 15 days for corn, and 18 months for alfalfa. Follow label directions.
Glufosinate 0.37 to 0.44	28 to 34 oz Liberty or 22 oz Ignite 280	Liberty/Ignite is a nonselective herbicide for use over corn designated as Liberty Link or corn warranted by Bayer CropSciences as being resistant to Liberty/Ignite. Optimum weed control is achieved by applying with atrazine when weed height is 1 to 4 inches and corn height is less than 12 inches. May be applied without atrazine to corn up to the V7 stage (7 leaf collars visible) or until corn is 24 inches tall (freestanding), whichever comes first. Liberty/Ignite is primarily a contact herbicide, so thorough spray coverage is important. For best results on crabgrass, sandbur, and yellow foxtail, apply before tillering. Always condition water carrier with spray grade ammonium sulfate at 3 lb/acre before adding Liberty/Ignite to the spray tank. Do not add surfactants. Burndown activity occurs in 2 to 4 days. See label for rate guidelines, according to weed species and size. Liberty/Ignite is foliar active and has no soil activity. Unless weed pressure is light, apply over a soil-residual herbicide, or apply Liberty/Ignite twice in a season. Follow label directions.
Glyphosate	Glyphosate* (See glyphosate table)	Most glyphosate products may be applied postemerge to corn with the Roundup Ready/GT gene only. However, RT3 and Touchdown CT are not labeled for in-crop use. Apply from emergence through the V8 stage (8 leaf collars visible) or until corn height reaches 30 inches (freestanding), whichever comes first. For corn with the RR2 event, glyphosate may be applied with drop nozzles to corn 30 to 48 inches tall. Some tank mixtures limit application to corn 5 or 11 inches tall. Single in-crop applications of glyphosate must not exceed 1 qt/acre. Sequential in-crop applications must not exceed 2 qt/acre per growing season. Condition spray water with 1 to 2%, by weight, of spray-grade ammonium sulfate (8.5 to 17 lb/100 gal water) that is dissolved completely before adding glyphosate to the tank. Can be ground or aerially applied. Glyphosate has no soil residual activity. To reduce selection pressure for glyphosate resistance, a foundation treatment with a residual herbicide is recommended. Allow a minimum of 50 days between application and harvest of corn forage. There are no rotational crop restrictions. Follow label directions.
Glyphosate + Acetochlor + Atrazine	2 to 4 qt FieldMaster	FieldMaster is a restricted-use pesticide. Apply postemerge to corn with the Roundup Ready gene only from emergence up to 12 inches in height. Application rates depend on soil texture, amounts of previous crop residues, and density of emerged weeds. Additional glyphosate should be added when applying 2 to 3 qt FieldMaster. Controls a broad spectrum of annual weeds and suppresses emerged perennial weeds. Apply in water conditioned with 9 to 17 lb/100 gal of spray-grade ammonium sulfate that is dissolved completely before adding products to the tank. See atrazine for rotational crop restrictions. Follow label directions.
Glyphosate + S-metolachlor 0.7 + 0.94	2.5 pt Sequence	Sequence is a premix of glyphosate and Dual Magnum. Apply postemerge to corn with the Roundup Ready/GT gene only from emergence up to 30-inch corn. Apply in water preconditioned with ammonium sulfate. (It may also be applied preplant or preemerge, but it does not contain the benoxacor safener that is in Dual II Magnum.) Follow label directions.

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HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Glyphosate + S-metolachlor + Atrazine 0.47 to 0.70 + 1.1 to 1.6 + 1.3 to 2.0	2.5-3.75 qt Expert	Expert is a premix of the active ingredients in Bicep Magnum (a restricted-use pesticide) and glyphosate. Apply postemerge to corn with the Roundup Ready/GT gene only from emergence up to 12 inches in height. Do not tank mix with any other products. Apply in water preconditioned with ammonium sulfate. Follow label directions.
Halosulfuron + Dicamba 0.03 to 0.06 + 0.125 to 0.25	4 to 8 oz Yukon	4 oz of Yukon premix is equivalent to 2/3 oz Permit and 4 fl oz dicamba. May be broadcast applied over field corn from spike stage through 36 inches tall. Apply to small weeds for best performance. Must be applied with 0.25 to 0.5% nonionic surfactant or 1% (1 gal/100 gal spray mix) crop oil concentrate. Follow label directions.
Mesotrione 0.094	3 fl oz Callisto	Apply Callisto from emergence to 8-leaf stage of corn. Always add crop oil concentrate at 1% v/v (1 gal/100 gal spray). Note label for insecticide restrictions. Controls many annual broadleaf weeds. Callisto is rainfast after 1 hour. For corn up to 12 inches tall, Callisto may be used in combination with atrazine at 0.25 to 0.75 lb/acre or in combination with Bicep II Magnum or Lite Magnum. Can rotate to winter wheat 4.5 months after application; to cotton, soybean, or sorghum the following spring. See label for sprayer cleanup after application. Follow label directions.
Mesotrione + Atrazine + S-metolachlor 0.17 to 0.2 + 1.3 to 1.5 + 1.3 to 1.5	3 to 3.5 qt Lexar	Lexar, a premix of Callisto, Dual II Magnum, and atrazine (a restricted-use pesticide) may be applied postemerge to corn up to 12 inches tall. See Callisto entry for adjuvants and restrictions. Follow label directions.
Mesotrione + Atrazine + S-metolachlor 0.17 to 0.2 + 0.63 to 0.75 + 1.68 to 2	2.5 to 3 qt Lumax	Lumax, a premix of Callisto, Dual II Magnum, and atrazine (a restricted-use pesticide), may be applied postemerge to corn up to 12 inches tall. See Callisto entry for adjuvants and restrictions. Follow label directions.
Mesotrione + S-metolachlor + Glyphosate 0.094 + 0.94 + 0.94	3.6 pt Halex GT	Halex GT, a mixture of Callisto, Dual Magnum, and Touchdown, may be applied postemerge to glyphosate tolerant (GT or RR) corn from emergence to 30 inches in height. Condition water with 8.5 to 17 lb ammonium sulfate per 100 gal spray mix before adding Halex GT. Always add 0.25% v/v (1 qt/100 gal) nonionic surfactant. Best if applied to weeds before they become competitive. Follow label directions.
Metribuzin 0.094	2 oz Sencor DF	Sencor is a triazine herbicide used in field corn to replace or reduce the amount of atrazine required for postemerge broadleaf weed control. It can be tank mixed with atrazine, 2,4-D, dicamba, Basagran, Laddok S-12, dicamba plus atrazine premix, Tough, bromoxynil, bromoxynil plus atrazine premix, or Pursuit (Clearfield corn only). For application to small weeds, the Sencor rate can be reduced to 1.6 oz when tank mixed with bromoxynil. Follow crop size and adjuvant requirements on labels of the tank mix partners. Do not apply when crop is under weather stress. Do not use crop oil concentrate or any adjuvant containing vegetable or petroleum oils with any Sencor tank mixtures because severe leaf burn, crop stunting, and/or stand reduction can occur. Do not use on sand, loamy sand, or sandy loam having less than 0.5% organic matter. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Nicosulfuron 0.031	0.67 oz Accent SP	Controls 4- to 12-inch shattercane, 8- to 18-inch rhizome johnsongrass, and certain annual grasses and broadleaf weeds in field corn. Can be broadcast applied over corn up to 20 inches tall (freestanding). For corn 20 to 36 inches tall, apply with drop nozzles. Accent application to corn having 7 to 10 leaf collars increases the potential for ear malformation (pinching). This risk may be reduced greatly, but not eliminated, by using drop nozzles adjusted so as to not apply Accent into the corn whorl. Do not apply to field corn taller than 36 inches or with more than 10 leaf collars visible, whichever is more restrictive. Do not apply to seed corn or popcorn taller than 20 inches. Apply with nonionic surfactant or crop oil concentrate. In addition, UAN or spray-grade ammonium sulfate can be added to enhance performance on certain weed species. Sequential treatments can improve rhizome johnsongrass control. Do not apply to corn that was treated with Counter 15G or Counter 20CR in-furrow. Can be applied following T-band applications of Counter 20CR, but injury potential still exists. Do not apply in irrigation water. Often tank mixed with dicamba or emulsified bromoxynil formulations to enhance broadleaf weed control. Use nonionic surfactant rather than crop oil concentrate for these mixtures. Can be tank mixed with pendimethalin to provide late-season, residual grass control. A timely cultivation may be necessary to control suppressed weeds, weeds beyond maximum size at application, or weeds that emerge after Accent application. Optimum timing for cultivation is 7 to 14 days after application. See label for insecticide compatibility, sprayer cleanup, subsequent cropping, feeding restrictions, and other guidelines.
Nicosulfuron + Rimsulfuron 0.023 + 0.012	0.75 oz Steadfast	Steadfast contains 50% nicosulfuron and 25% rimsulfuron. Note grass and broadleaf size restrictions on label. It can be applied to field corn up to 12 inches tall or up to V5 stage (5 leaf collars), whichever comes first. Must be applied with either crop oil concentrate or nonionic surfactant and ammonium nitrogen fertilizer. Follow label directions.
Nicosulfuron + Thifensulfuron 0.02-0.031 + 0.0015-0.002	0.5-0.75 oz Stout	Stout contains 67.5% nicosulfuron and 5% thifensulfuron. Note grass and broadleaf size restrictions on label. It can be applied to field corn up to 12 inches tall or up to V5 stage (5 leaf collars), but no taller. Must be applied with either crop oil concentrate or nonionic surfactant and ammonium nitrogen fertilizer. Follow label directions.
Primisulfuron 0.036	0.76 oz Beacon or split application of 0.38 oz + 0.38 oz Beacon	Controls 4- to 12-inch shattercane, 8- to 16-inch rhizome johnsongrass, and many annual broadleaf weeds 1 to 4 inches tall. Apply to approved field corn hybrids at 4- to 20-inch height or postdirected between the rows for corn from 20-inch height to tasseling. Apply with nonionic surfactant or crop oil concentrate. Up to 1 gal/acre of UAN can be added to improve control of velvetleaf and rhizome johnsongrass. Do not apply to corn treated with Counter 15G insecticide. Do not apply in irrigation water. Half rates of Beacon and Accent can be applied together as a sequential treatment to a preemerge grass-control herbicide. Can be tank mixed with dicamba, dicamba plus atrazine premix, bromoxynil plus atrazine premix, or 2,4-D for enhanced broadleaf weed control, but then do not use crop oil concentrate adjuvant. Can be tank mixed with pendimethalin for enhanced residual grass control. See label for insecticide compatibility, sprayer cleanup, subsequent cropping, feeding restrictions, and other guidelines. Follow label directions.
Primisulfuron + Dicamba 0.023 + 0.137	5 oz NorthStar	NorthStar is a formulated premix of primisulfuron (Beacon) and the sodium salt of dicamba (Banvel SGF) for postemerge control of many broadleaf weeds, shattercane, and johnsongrass. Apply broadcast over-the-top when field corn is between 4 and 20 inches tall (V2 to V6), and apply postdirected to corn up to 36 inches tall. See label for possible tank mix partners and for instructions on use of spray adjuvants. Follow label directions.
Primisulfuron + Prosulfuron 0.027 + 0.009	1 oz Spirit	Spirit is a formulated 3:1 premix of primisulfuron (Beacon) and prosulfuron (Peak). Compared with Exceed, Spirit has somewhat more grass activity and somewhat less broadleaf weed activity. Rotate to any soybean within 10 months after application where soil pH is below 7.8. Where soil pH is 7.8 or above, do not rotate to soybean the next year. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Rimsulfuron 0.012 to 0.016	0.75 to 1 oz Resolve DF	Apply postemerge to field corn up to 12 inches tall or up to 6 leaf collars, whichever is more restrictive. May be tank mixed with glyphosate products for application over glyphosate-tolerant corn. May be tank mixed with Starane and dicamba for kochia control. Precipitation is required for optimum activity. See label for tank mix precautions. Apply with 0.25% v/v of a good nonionic surfactant plus either 2 qt/acre UAN or 2 lb/acre spray-grade AMS. Do not apply with liquid nitrogen fertilizer as the total carrier. May be applied aerially. Do not chemigate. Rotate to wheat after 4 months and to soybean, sorghum, or sunflower after 10 months. Follow label directions.
Rimsulfuron + Dicamba 0.016 + 0.13	4 oz Require Q	Require Q is a premix of Resolve and dicamba for postemerge control of broadleaf and grass weeds. Apply to corn after it is 4 inches tall (V2) but before corn is 20 inches tall and exhibiting 7 or more collars, whichever is more restrictive. Apply Require Q with a nonionic surfactant and an ammonium nitrogen fertilizer. STS soybeans may be planted 1 month and wheat 3 months after an application of Require Q at 4 oz. See label for other crops. Follow label directions.
Rimsulfuron + Thifensulfuron 0.0104 + 0.0052	0.33 oz Basis	Controls emerged foxtail, fall panicum, and barnyardgrass that is less than 2 inches tall and provides short-term residual control if activated by rainfall or sprinkler irrigation. Apply to field corn that will have a lay-by cultivation 10 or more days after Basis application. Apply when corn is in the spike to 4-leaf (2 leaf collars visible) stage (approximately 0.5 to 6 inches tall). Grass weeds must be less than 2 inches tall at treatment. Apply with nonionic surfactant or crop oil concentrate and with UAN or spray-grade ammonium sulfate. If dicamba is added, do not use crop oil concentrate. Do not tank mix with Basagran, Laddok S-12, Accent, Beacon, or other ALS-inhibiting herbicides. Do not apply to corn that was treated with Counter 15G or 20CR in-furrow. See label for insecticide compatibility, sprayer cleanup, rotational cropping, and feeding restrictions. Rotate to wheat after 4 months and sorghum or sunflower after 10 months. Follow label directions.
S-metolachlor 0.95 to 1.9	1 to 2 pt Dual II Magnum or Charger Max	S-metolachlor alone or in premixes can be applied postemerge to corn up to 12 inches tall. Metolachlor has no postemerge activity. Its role is strictly to enhance residual weed control. Emerged weeds must be controlled with cultivation or the companion herbicide. Use only water as a carrier to avoid crop injury. Follow label directions.
Tembotrione 0.082	3 fl oz Laudis	Apply Laudis to all types of corn from emergence up to 8-leaf. Always apply with crop oil concentrate or methylated seed oil at 1% v/v and a nitrogen fertilizer source. Laudis controls many annual broadleaf and some grassy weeds. Atrazine is a recommended tank mix partner; however, corn must not exceed 12 inches tall. Laudis can be tank mixed with glyphosate or Ignite/Liberty. Laudis is rainfast in 1 hour. Can rotate to wheat in 4 months and to cotton, sorghum, and soybean the following spring. Do not graze or harvest forage within 45 days of application. Do not apply by air or chemigation. Follow label directions.
Thifensulfuron 0.004	0.125 oz Harmony SG or 0.083 oz Unity or Harass	Apply to 1- to 5-collar field corn not exceeding 16 inches tall for control of selected broadleaf weed species. Tank mix with other herbicides for broader spectrum weed control. ALS-resistant broadleaf weeds will not be controlled unless tank mixed with other broadleaf herbicides. Always apply with nonionic surfactant and nitrogen fertilizer additives. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Topramezone 0.016	0.75 fl oz Impact	Impact may be applied postemerge to all corn types and hybrids. Always apply with MSO (methylated seed oil) or COC (crop oil concentrate) adjuvant and a nitrogen fertilizer source such as 1.25 to 2.5 gal of 28 to 34% N/100 gal of spray. MSO at 1% v/v is recommended for best performance. On corn up to 12 inches, a tank mix with 0.25 to 1.0 lb atrazine is recommended. Other tank mixtures are approved, but some require substituting NIS (nonionic surfactant) for MSO or COC. Do not graze or feed treated corn for at least 45 days after application. Avoid cultivation for at least 7 days after application. Impact is rainfast after 1 hour. Can rotate to winter cereals after 3 months; can rotate to alfalfa, cotton, sorghum, or soybean the following spring. Follow label directions.
2,4-D 0.25 to 0.5 amine or mixed amine or 0.25 to 0.38 LVE	0.5 to 1 pt amine or mixed amine or 0.5 to 0.75 pt LVE of 4 lb/gal 2,4-D*	Controls or suppresses annual broadleaf weeds. Apply in at least 10 gal of water/acre from time corn emerges to tasseling. Do not apply from tasseling to dough stages. When corn is more than 8 inches tall, use drop nozzles to avoid application to corn leaves. Hybrids differ in response to 2,4-D; some are injured easily. Potential for injury is greater when corn is growing rapidly under high temperatures and high soil-moisture conditions. Low rates of 2,4-D in combination with other postemerge herbicides are safer to corn than higher rates of 2,4-D used alone. After application, delay cultivation for 8 to 10 days to allow corn to overcome temporary brittleness. Avoid spray or vapor drift to sensitive crops. Follow label directions.
2,4-D + Atrazine 0.25 to 0.38 +	0.56 to 0.84 2 to 3 pt Shotgun	Atrazine is a restricted-use pesticide. Shotgun is a premix containing 2,4-D iso-octyl ester and atrazine for postemerge control of annual broadleaf weeds. Apply over-the-top to corn from spike stage to 8 inches tall. For corn growing on coarse-textured soils, limit the rate to 2 pt. For corn 8 to 12 inches tall, apply with drop nozzles. A reduced rate of Shotgun can be tank mixed with bromoxynil or dicamba to enhance kochia control, including triazine-resistant kochia. Note weed size limitations. Do not apply aerially. Do not use with liquid fertilizer. Addition of adjuvants is not recommended because of enhanced potential for crop injury. Shotgun application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces the potential for runoff loss. Follow label directions.
DIRECTED POSTEMERGENCE		
Ametryn 1.6 to 2	2 to 2.5 lb Evik 80W	Apply as a postemerge directed spray in corn at least 12 inches tall (freestanding). Apply with nonionic surfactant at 0.5% v/v (2 qt/100 gal). Do not apply over-the-top to corn, because injury will occur. Do not apply within 3 weeks of tasseling. This is a nonselective contact herbicide. Follow label directions.
Paraquat 0.25 to 0.5	1 to 2 pt Gramoxone Inteon	Apply as a postemerge directed spray when corn is at least 10 inches tall (freestanding). Adjust nozzle to spray no higher than the lower 3 inches of corn stems. Always add nonionic surfactant. Do not tank mix with liquid fertilizer. Follow label directions.
PREHARVEST		
Carfentrazone + 2,4-D 0.016 to 0.3 + 0.5 to 1	1 to 2 pt Rage D-Tech	Apply after field corn reaches hard dough stage. A 3-day preharvest interval is required. See label for grazing restrictions. Always apply with nonionic surfactant, crop oil concentrate, or methylated seed oil. Best on morningglories, bindweed, and velvetleaf. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CORN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
PREHARVEST		
Glyphosate*		Several glyphosate formulations are approved for preharvest application to control annual and perennial weeds listed on the labels. Apply after corn is physiologically mature, as indicated by black layer formation, and grain moisture is below 35%. Allow a minimum of 7 days between application and harvest. Do not apply to corn grown for seed. Follow label directions.
2,4-D 0.5 to 1 Amine or LVE	1 to 2 pt of 4 lb/gal 2,4-D*	Apply after corn reaches hard dough or dent stage. Apply by air or ground equipment to suppress perennial weeds, decrease weed seed production, and control tall weeds and vines that interfere with harvesting. Do not allow grazing or feed forage from treated areas for 7 days after application. Follow label directions.
FOR SPOT TREATMENT ONLY		
Glyphosate*	1 to 2 gal /100 gal or 1.33 to 2.67 fl oz/ gal spray solution	Apply spot treatment to control annual and some perennial weeds. Apply at stage of weed growth recommended on glyphosate label but before corn silks. Corn that is not Roundup Ready will be killed. Avoid drift or spray outside target area.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR GRAIN SORGHUM

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED GRAIN SORGHUM HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds													Perennials Field Bindweed
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Longspine Sandbur	Shattercane	Witchgrass	Eastern Black Nighthshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed	Puncturevine	Common Ragweed	Sunflower	Velvetleaf	Venice Mallow	
Preplant Incorporated or Preemergence																						
Atrazine (E. KS only)	G	F	F	—	F	—	—	F	G-E	F	—	F	G ²	G	G	G-E ²	—	F	F	F	F	—
Bicep II Magnum ³ , Cinch ATZ ³	G	G-E	E	G-E	E	F-G	P	G-E	G-E	F	F	F	F	G	F	G-E	—	F	F	F	F	—
Bicep Lite II Magnum ³ , Cinch ATZ Lite ³	G	G-E	E	G-E	E	F-G	P	G-E	G-E	F	F	F	F	G	F	G	—	F	F	P	F	—
Dual II Magnum ³ , Cinch ³ , Frontier ³ , Charger Max ³	G	G-E	G-E	G-E	G-E	F-G	P	G	G	—	—	—	—	—	F	—	G	—	—	—	—	—
Guardman Max ³ , Propel ATZ ³	G	G-E	E	G-E	E	F-G	P	G-E	G-E	F	—	F	F	G	F	G-E	—	F	—	F	F	—
G-Max Lite ³ , Propel ATZ Lite ³	G	G-E	E	G-E	E	F-G	P	G-E	G-E	F	—	F	F	G	F	G	—	F	F	P	F	—
Lariat ³ , Bullet ³	G	G-E	E	G-E	E	F-G	P	G-E	G-E	F	—	F	F	G	F	G-E	—	F	—	F	—	—
Lumax ³	E	E	E	E	E	F-G	P	E	E	G	E	E	E	G-E	F-G	E	G	G	G	E	E	—
Milo-Pro	—	—	—	—	—	—	—	—	—	F	F	—	F ²	G	—	G-E ²	—	F	—	—	—	—
Partner ³	G	G-E	G-E	G-E	G-E	F	P	G	G	—	—	—	—	F-G	—	G	—	F	—	—	—	—
Outlook ³ , Propel ³	G	G-E	G-E	G-E	G-E	F-G	P	G	E	—	—	—	—	F	—	G	—	—	—	—	—	—
Postplant Incorporated																						
Prowl, Pendimax, Pendant	F-G	G-E	G	G	G	E	—	G	—	—	—	—	F-G	G	—	F	—	—	—	F	—	—
Prowl + Atrazine, Pendimax + Atrazine	F-G	G-E	G	G	G	E	—	G	G	F	—	F-G	G	G	F	G	—	G	G	G	G	—
Trifluralin	F	G-E	E	G-E	E	E	G-E	G-E	—	—	—	—	F-G	F-G	—	F-G	F-G	—	—	—	—	—
Postemergence																						
Aim	G	—	—	—	—	—	—	—	E	F	F	F	F	E	F-G	G	F	F	F	G-E	G	F
Ally + 2,4-D	F	—	—	—	—	—	—	—	—	—	—	—	G ²	E	E	G ²	E	G-E	G-E	E	—	F
Atrazine	G	P	F	—	G	P	P	P	G-E	G	G	G	G-E ²	E	G	E ²	F-G	G	G	G	G	—
Banvel K + Atrazine	F-G	—	—	—	—	—	—	—	G-E	E	—	G-E	E	E	E	G	—	E	E	G-E	G-E	F
Broclean, Buctril, Moxy, Bromox	G	—	—	—	—	—	—	—	E	G-E	—	G	F-G	G	F-G	F	G	G	G	G	G	—
Brozine, Buctril + Atrazine	G	—	—	—	—	—	—	—	E	E	—	E	G-E	E	G-E	G	G-E	G-E	E	G-E	E	—

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Apply only if field is planted with **Concept-treated sorghum seed**.

Caution: Disulfoton (Di-Syston) and phorate (Thimet), when applied separately on sandy and silt loam soils with preemergent herbicides commonly used on sorghum, may reduce crop stands. We do not know what causes the adverse interaction.

HERBICIDES FOR GRAIN SORGHUM

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED GRAIN SORGHUM HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds													Perennials Field Bindweed				
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Longspine Sandbur	Shattercane	Witchgrass	Eastern Black Nighthshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed	Puncturevine	Common Ragweed	Sunflower	Velvetleaf	Vernice Mallow					
Postemergence																										
Clarity, Banvel, Sterling Blue	F	—	—	—	—	—	—	—	G	G-E	—	F	G-E	G	G-E	G	—	G	G	F-G	F				F	
Laddok S-12	G-E	—	—	—	—	—	—	—	G	E	G-E	E	—	E	G	G	F	G-E	E	E	E				—	
Paramount	G	F	F	F	G	—	—	F	—	—	—	—	F	F	G	—	—	F	F	F	—				G-E	
Peak	E	—	—	—	—	—	—	—	F	E	E	G	G ²	G	F	G ²	G-E	E	E	E	E				F	
Permit	G	—	—	—	—	—	—	—	—	E	—	—	G ²	F	P	F ²	G	E	E	G-E	G			—		
Priority	G	—	—	—	—	—	—	—	E	E	F	F	G ²	E	E	G	G	G	E	G-E	G			F		
RangeStar, Brash, WeedMaster	P-F	—	—	—	—	—	—	—	G	G-E	E	F-G	G-E	E	E	G	G	G-E	G-E	G	G				F	
Shotgun	P-F	—	—	—	—	—	—	—	G	E	E	E	G	E	E	G	G	E	E	G-E	G-E				—	
Starane	F	—	—	—	—	—	—	—	F	G	—	—	E	P	E	P	G	E	G	G	G				F-G	
2,4-D	P	—	—	—	—	—	—	—	G	E	E	G	G	E	E	G	G	G-E	E	G	G				F	

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Apply only if field is planted with **Concep-treated sorghum seed**.

Caution: Disulfoton (Di-Syston) and phorate (Thimet), when applied separately on sandy and silt loam soils with preemergent herbicides commonly used on sorghum, may reduce crop stands. We do not know what causes the adverse interaction.

HERBICIDES FOR GRAIN SORGHUM

Before using products containing atrazine, you must consult the Atrazine Watershed Information Center (AWIC) to determine whether the use of atrazine is prohibited in your watershed. The AWIC can be accessed through www.atrazine-watershed.info or call 1-866-365-3014.

Atrazine Rate Limitations

All atrazine uses on cropland must conform to the maximum rate limits shown below. The “Precautionary Statements” on atrazine labels indicate required set-backs from all wells, streams, ponds, or other water sources.

For Wheat Stubble Applications In Wheat-sorghum-fallow Rotations

Apply a maximum of 3 lb active ingredient/acre to stubble ground following wheat harvest. Treat only once during same fallow period. See Chemical Fallow section of atrazine label for additional instructions.

For Soil Applications In Spring, Before Crop Emergence

On Highly Erodible Soils (as defined by the Natural Resources Conservation Service)

If plant residue cover at planting is 30% or more, then apply a maximum of 2 lb ai/acre as a broadcast spray.

If soil coverage is less than 30% at planting, apply a maximum of 1.6 lb ai/acre.

On Soils Not Highly Erodible

Apply a maximum of 2 lb ai/acre as a broadcast spray.

For Postemergence Applications

If no atrazine was applied before sorghum emergence, apply a maximum of 2 lb ai/acre broadcast. If a postemergence treatment is required following an earlier herbicide application, the total atrazine applied may not exceed 2.5 lb ai/acre per calendar year. Postemergence applications over 1 lb ai/acre are not considered Best Management Practices. Runoff loss potential is very high from mid-April through July.

Practices To Reduce Atrazine Losses In Surface Water Runoff In Central And Eastern Kansas

Sorghum producers who no-till plant should consider split applications of herbicides, applying about two-thirds of the rate either the previous fall or early-preplant in spring, and about one-third at planting time. The highest atrazine losses occur when intense rain storms follow atrazine application to high-residue, wet soils. Long-term weather records show that Kansas tends to have little winter precipitation, and that the probability of high-intensity storms occurring in March to mid-April is about half the probability of them occurring from mid-April through June. Therefore, fall and early-spring applications have less potential for loss in surface water runoff. In addition, such applications have the advantage of controlling winter annual weeds and tend to keep fields in “plantable” condition during wet spring weather, reducing the need for preplant burndown treatments.

Sorghum producers who till before planting should consider preplant incorporation of atrazine and companion herbicides such as Dual II Magnum, Outlook, and alachlor. Mechanically incorporating these herbicides in the top 2 inches of soil reduces atrazine losses in runoff by about two-thirds. Soil incorporation can be done with field cultivators, finishing disks, or spring tooth harrows at any time within 14 days before planting. Harrow attachments are recommended for the incorporation implement to avoid streaking. At planting, avoid furrowing that could move herbicide-treated soil out of the crop row.

Reduced-rate atrazine approaches for sorghum. Some soil-applied formulations, such as Bicep Lite II Magnum and G-Max Lite, contain a lower proportion of atrazine than other formulations, such as Bicep II Magnum and Guardsman Max. Also, banding preemergence herbicides reduces the amount applied per acre by one-half to two-thirds. Postemergence herbicides like Buctril/Atrazine, dicamba + atrazine, and Shotgun and many postemergence tank mixtures contain only about 0.5 lb ai/acre atrazine but still provide good control of tough broadleaf weeds such as velvetleaf, cocklebur, pigweeds, morningglory, and sunflowers.

Nonatrazine alternatives for sorghum. Peak, Permit, and Ally XP are sulfonyleurea herbicides for weed control in sorghum. They often are tank mixed with dicamba or 2,4-D.

HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Alachlor 2 to 4	2 to 4 qt Intrro	A restricted-use pesticide. Controls most annual grasses and pigweeds. Apply and incorporate (not on coarse-textured soils) into the top 2 inches of soil within 7 days before planting, or surface apply after planting but before grain sorghum emerges. Use 4 lb/acre as a preplant incorporated treatment to reduce competition from shattercane. For hard-to-kill weeds listed on label, or for land under irrigation, apply the upper end of rate range. Apply only to fields planted with Concep-treated sorghum seed. No-Till: Higher rates may be applied as a single application within 30 days before planting or as split applications within 45 days before planting. Do not exceed 4.25 qt on highly erodible soils with less than 30% plant residue cover. Follow label directions.
Alachlor + Atrazine 1.6 to 2.5 + 0.94 to 1.5	2.5 to 4 qt Bullet or Lariat	Alachlor and atrazine are restricted-use pesticides. Can be applied and incorporated into the top 2 inches of soil (not on coarse-textured soils) within 7 days before planting. In sensitive watersheds, atrazine Best Management Practices suggest that soil surface applications at sorghum planting time should not exceed 1 lb/acre because of high potential for runoff losses. Plant only Concep-treated sorghum seed. Follow atrazine rate limits and label directions.
Atrazine 1.6 or 2	1.6 or 2 qt Atrazine 4L or 1.8 or 2.2 lb Atrazine 90DF*	A restricted-use pesticide. It can injure sorghum on calcareous soils. Controls small-seeded broadleaf weeds best and suppresses annual grasses and large-seeded broadleaf weeds. Preplant incorporate or apply after planting but before sorghum emerges. In sensitive watersheds, atrazine Best Management Practices suggest that soil surface applications at sorghum planting time should not exceed 1 lb/acre because of high potential for runoff losses. Do not use on coarse-textured soils or other soils with less than 1% organic matter. Choice of rotational crops depends on atrazine rate, soil pH, and time of application. Follow atrazine rate limits and label directions. No-Till: Atrazine can be applied to Kansas row-crop stubble from fall harvest to December 31 to control winter annual weeds and reduce the need for burndown herbicide application or preplant tillage in spring on fields to be planted to sorghum. Apply with crop oil concentrate to enhance foliar activity. Tank mixing with 2,4-D LVE and/or dicamba enhances control of dandelion and other broadleaf winter annual weeds. Can be tank mixed with Gramoxone Inteon to enhance control of cheat, downy brome, and Japanese brome. For highly erodible soils with less than 30% plant residue cover, limit fall application to a maximum of 1.6 lb. Total atrazine applications must not exceed 2.5 lb/acre per calendar year. Do not apply to frozen ground or where soil surface conditions favor wind erosion. Do not plant any crops except corn, grain sorghum, or forage sorghum in the following spring. Follow directions on 24(c) Special Local Need label for Kansas.
Carfentrazone 0.0074	0.5 fl oz Aim EC	No-Till: Can be applied alone or with other herbicides in fallow and preplant burndown applications to control or suppress annual broadleaf weeds. Combine with glyphosate, paraquat, or atrazine to broaden the burndown spectrum. Apply with nonionic surfactant or crop oil concentrate. Aim is a contact herbicide requiring thorough spray coverage of the foliage. Do not exceed 1 fl oz/acre per season for all fallow, preplant, or in-crop applications to sorghum. Follow label directions.
Carfentrazone + 2,4-D 0.008 to 0.016 + 0.25 to 0.5	0.5 to 1 pt Rage D-Tech	No-Till: Can be applied alone or with other herbicides in fallow and preplant burndown applications. Can be tank mixed with glyphosate, paraquat, and other herbicides to broaden the weed control spectrum and to accelerate burndown. A 10-day interval is required between application and sorghum planting. Always apply with nonionic surfactant, crop oil concentrate, or methylated seed oil. Follow label directions.
Dicamba up to 0.5	up to 1 pt Clarity, Banvel, or Sterling Blue	No-Till: Apply up to 16 fl oz/acre in fall for control of winter annual weeds. In spring, may apply up to 8 fl oz if applied at least 10 days before sorghum planting. Especially helpful to control certain weeds not very susceptible to 2,4-D and glyphosate, such as chickweed, smartweed, wild buckwheat, kochia, and Russian thistle. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Dicamba + 2,4-D* 0.25 + 1 amine or LVE	0.5 pt Clarity or Sterling Blue + 1 qt of 4 lb/gal 2,4-D* or 1 qt Range Star, Brash, or WeedMaster	No-Till: For control of established alfalfa and annual weeds, apply when alfalfa regrowth is 6 to 8 inches tall and growing actively. Most effective if applied to alfalfa regrowth in fall. If alfalfa escapes occur, apply only dicamba at rate recommended on label after sorghum emerges. Do not apply less than 15 days before planting sorghum. Follow label directions.
Dimethenamid-P 0.6 to 1.0	12 to 21 oz Outlook or Propel	Controls most annual grasses and small-seeded broadleaf weeds. For best weed control with Outlook, use 14 oz/acre in coarse-textured soil, and use a minimum of 18 oz/acre for medium soils with less than 3% organic matter. Apply within 2 weeks before planting and shallowly incorporate, or apply after planting up to grain sorghum emergence. Use only Concep-safened grain sorghum seed. Not registered for use on forage sorghum. Fall cereals can be planted after 4 months. Follow label directions.
Dimethenamid-P + Atrazine 0.53 to 1.0 + 1.0 to 1.9	2.5 to 4.6 pt Guardzman Max or Propel ATZ	Guardzman Max is a premix of dimethenamid-P (Outlook) and atrazine (a restricted-use pesticide). Apply before, during, or after planting. Can be shallowly incorporated. Rates depend on soil texture. In sensitive watersheds, atrazine Best Management Practices suggest that soil surface applications at sorghum planting time should not exceed 1 lb/acre of atrazine because of high potential for runoff losses. Use only Concep-safened grain sorghum seed. Follow atrazine rate limits and label directions. No-Till: Apply within 30 days before planting. Increase rates by 0.5 pt/acre for heavy residues. Tank mix with crop oil concentrate and other herbicides as appropriate for control of emerged weeds.
Dimethenamid-P+ Atrazine 0.63 to 1.1 + 0.69 to 1.2	2 to 3.5 pt G-Max Lite or Propel ATZ Lite	G-Max Lite is a premix of 2.5 lb dimethenamid-P (Outlook) and 2.75 lb atrazine (a restricted-use pesticide) for use by growers wanting to reduce rates of soil-applied atrazine. See preceding entry for comments on safened seed. Follow label directions.
Glyphosate	Glyphosate* (See glyphosate table)	No-Till: Use to control annual weeds up to 6 inches tall and some perennial weeds in fallow fields or before sorghum emergence. Application in 3 to 10 gal/acre spray is more effective than in higher gallonage. Condition spray water with 1 to 2%, by weight, of spray-grade ammonium sulfate (9 to 17 lb/100 gal water) before adding glyphosate products to the tank. Some glyphosate products contain little or no adjuvant, so check label requirements carefully. Dust on plants can decrease performance. Usually applied with 2,4-D or dicamba to enhance control of broadleaf species. Follow label directions.
Paraquat 0.5 to 1.0	2 to 4 pt Gramoxone Inteon	No-Till: Gramoxone Inteon is a formulation designed to reduce the amount of paraquat absorbed after accidental ingestion. Paraquat is a restricted-use, nonselective, nonresidual, contact herbicide often used for preplant burndown. Apply in clean water or clear fertilizer solutions to thoroughly cover actively growing annual weeds 1 to 6 inches tall. Rate depends on weed size. Dust on plants reduces paraquat activity, but application with atrazine and/or nitrogen carrier enhances activity. Adjuvants are required for good performance. Use nonionic surfactant at 0.25% v/v (1 qt/100 gal) when applying with atrazine in nitrogen fertilizer carrier. For all other applications, use either crop oil concentrate at 1% v/v or nonionic surfactant. Follow label directions.
Propazine 0.75 to 1.2	0.75 to 1.2 qt Milo-Pro	Milo-Pro controls mainly small-seeded broadleaf weeds. It resembles atrazine in weed control performance but is safer than soil-applied atrazine, especially on lighter soils in central and western Kansas. Do not apply on sand or loamy sand soils. Milo-Pro may be applied to the soil surface 4 weeks before planting to after planting but prior to sorghum emergence. Do not apply more than 1.2 qt per growing season. The preharvest interval (PHI) is 70 days for forage sorghum and 90 days for grain sorghum. Do not use on sweet sorghum. Crop rotation restrictions are: small grains 4 months, corn 12 months, all other crops 18 months. Follow label directions.

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HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Prosulfuron 0.018 to 0.036	0.5 to 1 oz Peak	In Kansas and Nebraska only, Peak can be applied after planting but before weed or sorghum emergence. See label for precautions. If applying with Dual II Magnum or Bicep Lite II Magnum, plant only Concep-treated seed. Preemerge application gives less control of velvetleaf, common cocklebur, and morningglory than postemerge application. No restrictions for rotation to wheat. Refer to most recent label before rotating Peak-treated fields to soybean in the next year. Do not rotate to sunflower for 24 months. Follow label directions.
S-metolachlor 1 to 1.6	1 to 1.66 pt Dual II Magnum, Charger Max, or Cinch	Controls most annual grasses and small-seeded broadleaf weeds. Apply preplant and incorporate into the top 2 inches of soil, or apply after planting but before sorghum or weeds emerge. The benoxacor safener in these products is specific to corn and does not safen these herbicides for use on sorghum. Plant only Concep-safened forage or grain sorghum seed. Small grains can be planted 4.5 months after treatment. Follow label directions.
S-metolachlor + Atrazine 0.96 to 1.26 + 1.24 to 1.6	1.6 to 2.1 qt Bicep II Magnum, Charger Max ATZ, or Cinch ATZ	These are formulated mixtures of 3.1 lb atrazine (a restricted-use herbicide) and 2.4 lb S-metolachlor/gal. Apply preplant and incorporate into the top 2 inches of soil before planting, or apply after planting but before sorghum or weeds emerge. In sensitive watersheds, atrazine Best Management Practices suggest that soil surface applications at sorghum planting time should not exceed 1.0 lb/acre because of high potential for runoff losses. For a tank mix of Dual II Magnum and atrazine, follow directions on the Dual II Magnum label. Can injure sorghum on calcareous soils and should not be used on coarse-textured soils or other soils with less than 1% organic matter. The benoxacor safener in these products is specific to corn and does not safen these herbicides for use on sorghum. Use only Concep-safened forage or grain sorghum seed. No-Till: Apply two-thirds of the recommended rate as a split treatment 30 to 45 days before planting and the remainder at planting. From 15 to 30 days preplant, a split application is preferred because it increases the chances of satisfactory activation by rainfall, but a single application is permissible. Can be tank mixed with paraquat or glyphosate. Follow label directions.
S-metolachlor + Atrazine 0.92 to 1.25 + 0.73 to 1	1.1 to 1.5 qt Bicep Lite II Magnum, Charger Max ATZ Lite, or Cinch ATZ Lite	These are mixtures of 2.67 lb atrazine (a restricted-use herbicide) and 3.33 lb S-metolachlor for use by growers wanting to reduce rates of soil-applied atrazine. This premix is recommended for sensitive watersheds where atrazine Best Management Practices suggest using no more than 1.0 lb atrazine/acre for soil surface applications at planting time. Use only on sorghum with Concep seed treatment. Follow atrazine set-back guidelines and label directions.
S-metolachlor + Atrazine + Glyphosate 1.1 to 1.6 + 1.3 to 2.0 + 0.47 to 0.70	2.5-3.75 qt Expert	No-Till: This premix contains the active ingredients of Bicep Magnum (a restricted-use pesticide) and glyphosate. Use before crop emergence, as a burndown when weeds are present. Use only on sorghum with Concep seed treatment. Follow label directions.
S-metolachlor + Atrazine + Mesotrione 1.68 + 0.168 + 0.63	2.5 qt Lumax	Lumax is a premix of 2.68 lb S-metolachlor (Dual II Magnum), 0.268 lb mesotrione (Callisto), and 1 lb atrazine (a restricted-use pesticide). Lumax can be applied preplant non-incorporated (up to 21 days before planting) up through planting but prior to sorghum emergence. Plant Concep-treated seed only. Applying Lumax less than 7 days before planting will increase the risk of crop injury. Lumax also may be applied as a split application to grain sorghum. Apply Lumax at 1.25 to 1.5 qt/acre as a non-incorporated early preplant application (7 to 21 days before planting) followed by a second application of 1 to 1.25 qt/acre preemerge prior to sorghum emergence. The total amount of Lumax cannot exceed 2.5 qt/acre. Do not apply to sandy soils (sand, sandy loam, or loamy sand). Do not apply to emerged grain sorghum. Do not use on forage sorghum, sweet sorghum, sudangrass, or any dual-purpose sorghum. Follow label directions.

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HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
S-metolachlor + Glyphosate 0.9 to 1.1 + 0.70 to 0.84	2.5 to 3 pt Sequence	No-Till: Formulation of 2.25 lb ae glyphosate and 3 lb S-metolachlor/gal. Apply preplant to preemerge as burndown before crop emergence. Use only on sorghum with Concep seed treatment. Follow label directions.
2,4-D LVE 0.25 to 1	0.5 to 2 pt of 4 lb/gal 2,4-D* LVE	No-Till: Low volatile esters are preferred over amine formulations as components of preplant burndown applications. They are more effective in controlling weeds and are less water soluble than amine salts. These factors help reduce potential for crop injury. Sorghum can be injured by carryover from preplant 2,4-D. Observe the rate guidelines and preplant waiting periods on product labels. Including 2,4-D in the burndown mixture helps control winter annual weeds such as dandelion, prickly lettuce, horseweed, and evening primrose, and early spring-germinating weeds, such as ragweed and lambsquarters. Follow label directions.
LAY-BY AND POSTEMERGENCE INCORPORATED (PREEMERGENCE TO WEEDS)		
Pendimethalin 0.75 to 1.5	1.5 to 3.6 pt Pendimax 3.3, Pendant, Prowl 3.3EC, Acumen or 1.5 to 3 pt Prowl H₂O*	Apply to cultivated or otherwise weed-free soil after grain sorghum is 4 inches tall until last cultivation (lay-by). Use drop nozzles if foliage interferes with spray coverage of soil. After treatment and within 7 days, pendimethalin should be incorporated thoroughly into the top 1 inch of soil by cultivation or with adequate irrigation or rainfall. Will not control emerged weeds. Can be tank mixed with atrazine, except on sands and loamy sands, until sorghum is 12 inches tall. Follow atrazine rate limitations and label directions. Do not allow grazing or feed forage from treated areas to livestock for 21 days after treatment. Follow label directions.
Trifluralin 0.3 to 0.8	0.6 to 1.6 pt of 4 lb/gal trifluralin	Apply to cultivated or otherwise weed-free soil after grain sorghum is 8 inches tall. Use drop nozzles if foliage interferes with spray coverage of soil. After applying, incorporate by rolling or sweep cultivator and move soil over base of sorghum plants. Trifluralin will not control emerged weeds. Can be tank mixed with atrazine, except on sands and loamy sands, until sorghum is 12 inches tall. Follow label directions.
POSTEMERGENCE		
Atrazine 2	2 qt Atrazine 4L or 2.2 lb Atrazine 90DF*	A restricted-use pesticide. It can injure sorghum on calcareous soils. Controls broadleaf weeds more effectively than grasses. The 2 lb/acre rate is permissible only when no atrazine was applied before sorghum emergence. Postemerge atrazine rates over 1 lb/acre are not considered Best Management Practices because of high potential for movement in surface water runoff. Apply before weeds are 1.5 inches tall and before sorghum exceeds 12 inches. Do not plant treated fields to any crop other than sorghum or corn for 18 months after application. Apply with 1% v/v crop oil concentrate, or 0.25% v/v nonionic surfactant, to enhance foliar uptake. Follow atrazine rate limits and cropping, feeding, and grazing instructions on label.
Atrazine 1.2	1.2 qt Atrazine 4L or 1.3 lb Atrazine 90DF*	A restricted-use pesticide. It can injure sorghum on calcareous soils. Do not use on sands and loamy sands or injury can occur. Controls broadleaf weeds in western Kansas. Apply when sorghum is 6 to 12 inches high. Add crop oil concentrate or nonionic surfactant according to label. Follow atrazine rate limits and precautions on label.

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HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Bentazon + Atrazine 0.43 to 0.75 + 0.43 to 0.75	1.33 to 2.33 pt Laddok S-12	Laddok S-12 is a premix of 2.5 lb bentazon (Basagran) and 2.5 lb atrazine/gal (a restricted-use pesticide). Controls many broadleaf weeds. Apply when weeds are small and growing actively but before they reach size limits on label. Both ingredients are contact herbicides, so thorough coverage is needed. Always add crop oil concentrate, Dash HC, UAN, or spray-grade ammonium sulfate solution as adjuvant. Do not apply to sorghum taller than 12 inches. Do not cultivate within 5 days of application. Laddok S-12 application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces potential for runoff loss. Do not allow grazing or feed treated forage for 21 days. Follow atrazine rate limits and label directions.
Bromoxynil 0.25	1 to 1.5 pt Buctril*	Apply bromoxynil when broadleaf weeds are small and growing actively but before they reach size limits listed on label. Apply at 3- to 4-leaf stage up to boot stage of sorghum. Use a maximum of two applications per season. This is a contact herbicide, so thorough coverage is required. Bromoxynil is safer for sorghum than 2,4-D or dicamba. Pigweeds are somewhat tolerant and should be no larger than the 4-leaf stage. Can be tank mixed with low rates of 2,4-D or dicamba. Do not cut forage for feed or allow grazing within 30 days of treatment. Follow label directions.
Bromoxynil + Atrazine 0.19 to 0.38 + 0.38 to 0.75	1.5 to 3 pt Buctril + Atrazine	Atrazine is a restricted-use pesticide. These premixes of 1 lb bromoxynil and 2 lb atrazine/gal control many broadleaf weeds. Use up to two applications per season when weeds are small and growing actively but before they reach size limits listed on the label. Apply after 2- to 4-leaf stage but before grain sorghum is 10 inches tall. Can be tank mixed with dicamba to increase control of pigweeds, kochia, and field bindweed. Tank mixing with up to 8 oz/acre 2,4-D increases control of devilsclaw and field bindweed but also increases potential for sorghum injury. Bromoxynil plus atrazine application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces runoff loss potential. Do not cut forage for feed or allow grazing within 30 days of treatment. Follow atrazine rate limits and label directions.
Carfentrazone-ethyl 0.0074	0.5 fl oz Aim EC	Helps control black nightshade, lambsquarter, pigweed, and morningglory when applied to actively growing plants 1 to 4 inches tall and velvetleaf up to 18 inches tall. Can be applied to grain sorghum up to the 6-leaf stage. Always apply with nonionic surfactant at 0.25% v/v. Application with crop oil concentrate may cause excessive sorghum leaf burn and is not recommended. Avoid spraying under high-moisture conditions (heavy dew, rain). Can be tank mixed with other postemerge sorghum herbicides to broaden the weed spectrum and increase the level of control. For tank mixes, follow application and rotation guidelines of the more restrictive partner. Aim is a contact herbicide requiring thorough and uniform spray coverage. Any crop can be planted after 30 days following application. Follow label directions.
Carfentrazone-ethyl + Halosulfuron 0.0074 + 0.031	1 oz Priority	1 oz Priority premix is equivalent to 0.5 fl oz Aim plus 2/3 oz Permit. Apply to sorghum from the 2- to 6-leaf stage with 0.25% v/v nonionic surfactant. Applications with crop oil concentrates or methylated seed oils are not recommended. Follow label directions.
Carfentrazone + 2,4-D 0.008 + 0.25	0.5 pt Rage D-Tech	May be broadcast applied over grain sorghum from 5 inches tall to the V6 (6 leaf collars) stage. Apply with a nonionic surfactant at 0.25% v/v (1 qt/100 gal spray solution). May be tank mixed with atrazine on sorghum up to 12 inches tall. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Dicamba 0.25	0.5 pt Clarity, Banvel, or Sterling Blue	Controls annual broadleaf weeds. Broadcast apply when weeds are small and growing actively and sorghum is in the 2- to 5-leaf stage but before it is 8 inches tall. On sorghum from 8 to 15 inches tall, apply with drop nozzles to keep dicamba off leaves and out of whorls. Failure to observe these height guidelines can result in damaged seed heads. Do not apply to sorghum grown for seed. Do not allow grazing of treated areas or feed treated forage or silage before mature grain stage. Do not apply when the temperature on the day of application is expected to exceed 85°F. Expect some crop response in the form of rolled-up leaves and leaning stems. Follow label directions and precautions.
Dicamba + Atrazine 0.28 + 0.53	2 pt Banvel K + Atrazine	This is a premix of dicamba and atrazine (a restricted-use pesticide) for control of many broadleaf weeds, including triazine-resistant species. For best performance and least crop injury, apply when sorghum has 2 to 5 leaves and weeds are less than 6 inches tall. Banvel-K + atrazine application is considered an atrazine Best Management Practice for use in sensitive watersheds because the low rate of atrazine reduces potential for runoff loss. Follow atrazine rate limits and label directions.
Dicamba + 2,4-D 0.125 + 0.36	1 pt Brash, Range Star, or WeedMaster	Apply to sorghum in the 3- to 5-leaf stage (4 to 8 in tall). Performs best on weeds less than 3 inches tall. Expect injury symptoms on sorghum, such as leaning and brittle stems and rolled leaves. These symptoms may be outgrown within 2 weeks. Do not apply if potential for injury is not acceptable. Do not apply with surfactants and oils. Follow label directions.
Dimethenamid-P + Atrazine 0.53 to 1.0 + 1.0 to 1.9	2.5 to 4.6 pt Guardsman Max or Propel ATZ	These are a premix of dimethenamid-P and atrazine (a restricted-use pesticide). Guardsman Max may be applied postemerge over grain sorghum from Concep-safened seed, but expect some sorghum stunting. Apply to sorghum from the 2-leaf stage up to 12 inches tall. Apply with crop oil concentrate to enhance foliar uptake of atrazine. Only the atrazine with crop oil concentrate has foliar activity, so expect best activity when weeds are small. Follow atrazine rate limits and label directions.
Fluroxypyr 0.125	0.67 pt Starane	Starane can be applied to grain sorghum from the 3- to 7-leaf stage of growth as a broadcast application by either ground or air. Use drop nozzles and directed spray from the 8-leaf stage to boot stage. Use of a high quality nonionic surfactant is recommended for improved weed control, especially in hot, dry conditions. Starane can be tank mixed with other herbicides registered for postemerge application to grain sorghum. Do not apply with Ally XP herbicide. Follow label directions.
Halosulfuron 0.031	0.67 oz Permit	Controls several broadleaf weed species and suppresses yellow nutsedge. Apply to grain sorghum from the 2-leaf through lay-by stages (before grain head emergence). Usually used following a foundation application of Intrro or Lariat-type herbicide. To improve control of pigweed and morningglory species, tank mix with dicamba or 2,4-D. Always apply with a quality nonionic surfactant at 0.25 to 0.5% v/v (1 to 2 qt/100 gal). To control velvetleaf up to 12 inches tall, add 4% (4 gal/100 gal) liquid nitrogen fertilizer. Follow label directions.
Halosulfuron + Dicamba 0.03 to 0.05 + 0.125 to 0.19	4 to 6 oz Yukon	4 oz of Yukon premix is equivalent to 2/3 oz Permit and 4 fl oz dicamba. May be broadcast applied over grain sorghum from the 2-leaf stage up to 8 inches tall, and with drop nozzles up to 15-inch tall sorghum. May be applied with atrazine and crop oil concentrate. Follow label directions.
Metsulfuron methyl + 2,4-D amine 0.002 + 0.25	0.05 oz Ally XP + 1/2 pt 2,4-D amine	Broadcast apply to grain sorghum 3 to 10 inches in height. May be applied with drop nozzles to sorghum up to 15 inches tall, but only before the boot stage. Controls pigweeds, puncturevine, and velvetleaf less than 6 inches tall. Do not use surfactant or crop oil. May be ground or aerial applied. Prior cultivation to cover sorghum brace roots is recommended to minimize injury from 2,4-D. Follow label directions.

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HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Prosulfuron 0.013 to 0.027	0.375 to 0.75 oz Peak	Controls or suppresses many broadleaf weed species. Usually used following a foundation application of Dual- or Bicep-type herbicide. Apply over-the-top to sorghum at least 5 inches tall. Refer to label for weed size limitations. If applied alone or tank mixed with atrazine, add crop oil concentrate at 1 qt/acre. Also add 2 to 4 qt/acre UAN if velvetleaf is targeted. If tank mixed with 2,4-D, dicamba, or liquid formulations of bromoxynil, add nonionic surfactant instead of crop oil concentrate. There are no restrictions for rotation to wheat. Sunflower and soybean are very sensitive to Peak carryover. See label for rotation restrictions that differ by field location, rate of Peak applied, and soil pH. Follow label directions.
Quinclorac 0.25 to 0.38	5.3 to 8 oz Paramount	Paramount can be applied to grain sorghum from emergence to 12 inches for control of field bindweed, foxtail, barnyardgrass, and morningglory. Best annual grass control occurs when grass density is moderate to low and plants are less than 2 inches tall. Field bindweed should be growing actively with runners at least 4 inches long. Always apply with methylated seed oil adjuvants. UAN or AMS can be added. Addition of 0.5 to 1 lb atrazine is recommended, particularly for control of pigweed, velvetleaf, and sunflower. Follow label directions.
2,4-D 0.33 to 0.5 amine or mixed amine, or 0.25 to 0.5 LVE	0.67 to 1 pt amine or mixed amine or 0.5 to 1 pt LVE 4 lb/gal 2,4-D*	Numerous formulations of 2,4-D are available. Weedar 64 contains 3.8 lb/gal dimethylamine salt. Savage is a dry soluble formulation containing 95% dimethylamine salt. Weedone 638, Weedone LV4, and Weedone LV6 contain 2.8 lb, 3.8 lb, and 5.7 lb/gal, respectively, of the butoxyethyl ester. Hi-Dep contains 3.8 lb/gal of the dimethylamine and diethanolamine (mixed amine) salts. Salvo and SEE 2,4-D LV4 contain 5 lb and 3.8 lb/gal, respectively, of iso-octyl ester. Application rates, spray volumes, and timings differ with company and formulation. 2,4-D controls or suppresses annual and perennial broadleaf weeds. Most sorghum hybrids are injured by 2,4-D. High relative humidity and air temperature increase potential for sorghum injury. Sorghum is most tolerant to 2,4-D when 5 to 10 inches tall. Even then, expect crop response in the form of rolled leaves, and brittle, spreading stems and tillers. When crop is more than 8 inches tall, use drop nozzles to reduce spray deposition on sorghum leaves. Do not apply during boot, flowering, or early dough stages. Very low rates of 2,4-D in combination with other postemerge herbicides are much safer to sorghum than higher rates of 2,4-D used alone. Yield-reducing sorghum injury can occur from over-the-top application rates as low as 0.125 lb and is common for rates of 0.25 lb and up. Producers should weigh potential sorghum injury from 2,4-D against potential loss of sorghum yield from weed competition.
2,4-D + Atrazine 0.25 + 0.56	2 pt Shotgun	Shotgun is a premix of 2,4-D iso-octyl ester and atrazine (a restricted-use pesticide) for postemerge control of annual broadleaf weeds. Apply over-the-top to sorghum from the spike to 4-leaf stage or up to 8 inches tall. Apply with drop nozzles to 5-leaf or 8- to 12-inch tall sorghum. A reduced rate of Shotgun can be tank mixed with bromoxynil or dicamba for kochia control, including triazine-resistant kochia. Note weed size limitations. Do not use with liquid fertilizer. Addition of adjuvants is not recommended because of enhanced potential for crop injury. Has more potential for sorghum injury than dicamba + atrazine, Laddok S-12, or bromoxynil plus atrazine. Do not apply aerially. Shotgun application is considered an atrazine Best Management Practice for use in sensitive watersheds, because the low rate of atrazine reduces potential for runoff loss. Follow label directions.
DIRECTED POSTEMERGENCE		
Paraquat 0.25 to 0.5	1 to 2 pt Gramoxone Inteon	Apply when freestanding sorghum is at least 12 inches tall. Use precision directed-spray equipment adjusted so that no more than the lower 3 inches of sorghum stem is contacted by paraquat. Always add nonionic surfactant, but do not tank mix with liquid fertilizer. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR GRAIN SORGHUM

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
HOODED APPLICATIONS		
Glyphosate	Glyphosate* (See glyphosate table)	Some glyphosate products are labeled for application under hooded sprayers between grain sorghum rows. Equipment must be operated in a manner that avoids bouncing or raising the hoods off the ground, or sorghum injury may occur. Use low-pressure/low-drift nozzles. Maximum sprayer speed is 5 mph, and maximum wind speed is 10 mph. See "Selective Equipment" section of label for further details.
FOR SPOT TREATMENT ONLY		
Glyphosate	1 to 2 gal Glyphosate per 100 gal + surfactant or 1.28 to 2.56 fl oz/gal spray mix	Apply as spot treatment to control annual and some perennial weeds. Apply at stage of weed growth recommended on glyphosate label but before heading of sorghum. Sorghum in treated area will be killed. Avoid spray drift outside target areas.
ROLLER OR WICK-TYPE APPLICATORS		
Note: Expect best results when target weeds are 8 to 12 inches taller than grain sorghum. Two applications made in opposite directions give better coverage. Operate at ground speeds of less than 5 mph. See glyphosate label for application directions and precautions.		
Herbicide/method	<u>Mixing Ratio</u> herbicide: water	Comments and limitations
Glyphosate/Roller	1:19	A 5% solution for control of volunteer corn and shattercane.
	1:9	A 10% solution to control volunteer corn and shattercane and suppress johnsongrass, redroot pigweed, giant ragweed, sunflower, velvetleaf, common milkweed, and hemp dogbane. Roller speed should be maintained at 40 to 60 rpm.
Glyphosate/Wick	1:2	This 33% solution in a rope wick should perform like the 10% solution in the roller.
HARVEST AIDS		
Diquat 0.38 to 0.5	1.5 to 2 pt Reglone/Diquat	Use for seed production only. For preharvest desiccation of foliage, apply 1 to 2 weeks before harvest and when seed moisture is 30% or less. This coincides with black layer on kernels in the lower part of the heads. Do not allow grazing of treated areas or feed treated forage. Do not use seed from treated plants for food or feed purposes. Follow label directions.
Carfentrazone 0.015	Up to 1 fl oz Aim EC	May be applied, alone or tank mixed with other desiccants, to physiologically mature sorghum. Apply with 1% v/v crop oil concentrate. Good spray coverage is essential. Allow at least three days between application and harvest. Follow label directions.
Glyphosate	Glyphosate* (See "Glyphosate Product Comparisons" table)	Use for feed grain production only. For preharvest desiccation of sorghum foliage and grain, apply when grain moisture is 30% or less. This coincides with black layer on kernels in the lower part of the heads. After application, a 7-day harvest delay is required, and a 2-week delay is recommended, to give glyphosate time to work. Apply aerially or by ground. Follow label directions.
Sodium chlorate 4 to 6	0.75 to 1 gal Defol 6 or 4 to 6 qt Sodium Chlorate 5	Can be used to reduce moisture content in sorghum grain. Apply at physiological maturity, when kernels at the base of the sorghum head show black-layer formation. Most effective when application is followed by dry, sunny weather. Apply by aircraft or ground equipment 7 to 10 days before harvest. Use spray adjuvants as recommended on the label. Can be applied in 28% UAN carrier to enhance foliar desiccation and to apply nitrogen for the succeeding crop. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SOYBEAN

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED SOYBEAN HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds													Perennials		
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Field Sandbur	Shattercane	Witchgrass	Eastern Black Nightshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed ²	Prickly Sida	Common Ragweed	Pennsylvania Smartweed	Sunflower	Velvetleaf	Venice Mallow	Rhizome Johnsongrass	Yellow Nutsedge
Preplant Incorporated																								
Pursuit + Trifluralin	G-E	G-E	E	G-E	E	E	G-E	G-E	E	F ³	—	G	G	G	F-G	E	G	F	G	G	F	F	—	—
Scepter + Trifluralin	G-E	G-E	E	G-E	E	E	G-E	G-E	E	E ³	—	G	G	G	F-G	E	G	G	G	E	G	G	—	—
Trifluralin, Sonalan	G-E	G-E	E	G-E	E	E	G-E	G-E	F	—	—	—	F-G	F-G	—	G	—	P	P	—	—	—	F	—
Preplant Incorporated or Preemergence																								
Authority First/Sonic	G-E	F	F	F	F	—	—	—	E	G-E	—	G	E	E	E	E	G	E ³	G	G-E ³	E	E	—	G
Boundary	G	G	G	G	G	—	—	G	G	—	—	F	—	G	—	G	G	G	F	G	—	—	—	F
Command	E	E	G-E	E	E	F	F-G	—	P	F	—	G	G	E	P	P	E	G	G	P	E	E	—	—
Canopy	G-E	F	F	F	F	—	—	—	—	G-E	—	G-E ³	—	G	E	E	G	G	G	E	G-E	—	—	F
Define	E	G	G	G	G-E	F	F	G	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Domain	G	G	G	G	G	—	—	—	—	—	—	G	G	E	—	G	G	G	G	G	G	G	—	—
Dual II Magnum	E	G	G-E	G-E	G-E	F-G	—	G-E	G	—	—	—	F-G	—	G	F	F-G	—	—	—	—	—	—	F
Envive	G	F	F	F	F	—	—	—	E	G-E	—	G-E	G	E	E	E	G	G	G	E	G-E	G-E	—	—
FirstRate	E	—	—	—	—	—	—	—	—	E	—	E ³	—	E	G	E ³	G	G	G	E ³	G-E	E	—	—
Gangster	G-E	F	F	F	F	—	—	—	E	E	—	E	E	E	E	E	G	E	G	E ³	E	E	—	G
Lasso, Micro Tech, Intro	E	G	G-E	G-E	G-E	F	—	G-E	G	—	—	—	F-G	—	G	F	F-G	F	—	—	—	—	—	F
Outlook	E	G	G-E	G-E	G-E	—	P-F	G-E	G	—	—	—	—	G	—	G	—	—	—	—	—	—	—	F
Pendimethalin	G	G-E	G-E	G-E	G-E	G	G	G	—	—	—	—	F-G	F-G	—	F-G	—	—	F	—	F	—	—	—
Prowl + Pursuit (Pursuit Plus)	G	G-E	G-E	G-E	E	G	G	G	E	—	—	—	G	G	F	E	G	F	G	—	G	—	—	—
Pursuit	E	F	F	F	G	—	F	—	E	F ³	—	G	G ³	G	F	E ³	G	F	G	G	G	F	—	—
Python	E	—	—	—	—	—	—	—	G	F-G ³	—	G	G ³	G	F	G ³	G	G	G	G	G-E	E	—	—
Scepter	G-E	F	—	—	G	—	F	—	E	E ³	—	G-E	—	G	F	E ³	G	G	G	E	G	G	—	—
Sencor	F	P-F	P-F	P-F	—	—	—	—	P-F	G	—	G	G	E	—	G	G-E	G	G	G	G	G	—	—
Spartan	G-E	—	—	—	—	—	—	—	E	—	—	—	G	G	E	E	G	—	F	—	F	F	—	G
Valor, Encompass	G	F	F	F	F	—	—	—	E	—	F	G-E	G	E	G	E	G	G	F	—	F-G	G-E	—	—
Valor XLT	G	F	F	F	F	—	—	—	E	G	—	E	G	E	E	E	G-E	G-E	G	E	G-E	E	—	—
Postemergence																								
Assure II	E	G-E	G-E	E	E	G-E	E	G-E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G-E	—
Basagran	G-E	—	—	—	—	—	—	—	—	E	G-E	E	—	G	P	—	F-G	G	G-E	G	G	G	—	G
Basagran + Blazer(Storm)	G	—	—	—	—	—	—	—	G-E	G-E	G-E	E	—	F-G	G	G-E	G	G-E	G-E	G	G-E	G	—	F
Classic	G-E	—	—	—	—	—	—	—	—	E	—	E	—	—	G	G ³	—	G	G	E	F	—	—	G
Cobra, Phoenix	G	—	—	—	—	—	—	—	E	F-G	G-E	G-E	F-P	F-P	G	E	G	E	F	F	F	F	F-G	—
Cobra + Pursuit	G	G	F	—	G	—	E	—	E	E	—	E	G	F	G-E	E	G-E	E	G	G-E	G	E	F	—
Extreme (resistant soybeans only)	E	E	E	E	E	E	E	E	E	E	G	E	G	E	E	E	G-E	G	E	E ³	E	E	E	F
FirstRate	E	—	—	—	—	—	—	—	—	E ³	—	E	—	—	G	—	—	G	G	E	E	E	—	—
Fusilade DX	E	G-E	G-E	G-E	G	G-E	E	G-E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G-E	—

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Pigweed species may vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible than other pigweeds to postemergence herbicides.

³Except where resistant weed populations have developed.

HERBICIDES FOR SOYBEAN

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED SOYBEAN HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS¹

Herbicide(s)	Crop Tolerance	Annual Grasses							Annual Broadleaf Weeds													Perennials				
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Field Sandbur	Shattercane	Witchgrass	Eastern Black Nightshade	Cocklebur	Devilsclaw	Jimsonweed	Kochia	Lambsquarters	Morningglory	Pigweed ²	Prickly Sida	Common Ragweed	Pennsylvania Smartweed	Sunflower	Velvetleaf	Venice Mallow	Rhizome Johnsongrass	Yellow Nutsedge		
Postemergence																										
Fusion	E	G-E	G-E	E	E	G-E	E	G-E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G	—
Glyphosate (resistant soybeans only)	E	E	E	E	E	E	E	E	G	E	G	E	G	E	G	E	E	G	E	E	G	E	—	E	F	
Harmony SG	G	—	—	—	—	—	—	—	—	F	—	F	—	G	—	E ³	—	—	E	F	G	—	—	—	—	
Poast Plus	E	G-E	G-E	G-E	E	G-E	E	G-E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G-E	—	
Pursuit	E	G	F	—	G	—	E	—	E	E ³	—	E	G ³	F	G	E ³	—	F	G	G ³	G	—	F	—		
Raptor	G-E	G	G	—	G	—	E	—	E	E ³	—	E	G ³	G	G	E ³	—	G	E	E ³	G-E	—	F	—		
Reflex, Flexstar	G	—	—	—	—	—	—	—	G-E	F	F-G	E	—	F	G	G-E	—	F	G-E	—	—	—	—	—		
Resource	G	—	—	—	—	—	—	—	—	F	—	F	—	F-G	—	F	G	—	—	—	E	—	—	—		
Scepter	E	—	—	—	—	—	—	—	—	E ³	—	—	—	—	—	G ³	—	—	—	G ³	—	—	—	—		
Select	E	G-E	G-E	G-E	E	G-E	E	G-E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G-E	—		
Synchrony	E	—	—	—	—	—	—	—	—	E ³	—	E	—	G-E	G-E	E ³	—	G	E	E ³	E	—	—	G		
Ultra Blazer	G	—	—	F	F	—	F	—	G-E	F	F-G	E	—	F-G	G	G-E	—	F	G-E	—	—	—	—	—		

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Pigweed species may vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible than other pigweeds to postemergence herbicides.

³Except where resistant weed populations have developed.

HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Alachlor 2 to 4	2 to 4 qt Intrro or Micro-Tech , or 16 to 26 lb Lasso II	A restricted-use pesticide. Controls grasses more effectively than broadleaf weeds. Apply and incorporate into the top 1 to 2 inches of soil within 7 days before planting or surface apply after planting but before crop or weeds emerge and within 5 days of last tillage operation. Can be tank mixed with Command, Scepter, Pursuit, or Sencor. Follow directions and precautions on labels.
Carfentrazone 0.0074 TO 0.015	0.5 to 1 oz Aim EC	Provides burndown control of velvetleaf and suppression of certain other broadleaf weeds. Apply with nonionic surfactant. Generally applied in combination with other herbicides for broader spectrum weed control.
Carfentrazone + 2,4-D 0.008 to 0.024 + 0.25 to 0.74 lb ae	8 to 24 oz Rage D-Tech	Provides burndown control of broadleaf weeds as a fall or spring treatment. A waiting interval of at least 7 days is required between application and planting soybeans for application rates up to 16 oz/acre. A waiting interval of 30 days is required between application and planting soybeans for application rates up to 24 oz/acre. Apply with oil concentrate at 1% v/v or nonionic surfactant an 0.25% v/v. Can be applied using liquid fertilizer as the spray carrier.
Chlorimuron + Tribenuron 0.0156 to 0.046 + 0.0046 to 0.014	1.1 to 3.3 oz Canopy EX	Canopy EX is a premix of 22.7% chlorimuron (Classic) and 6.8% tribenuron (Express) for fall and early preplant application up to 45 days before planting soybeans. Provides foliar and residual control of certain broadleaf weeds including chickweed, field pansy, henbit, and most winter annual mustard species. Apply with crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v. Only use the 1.1 oz rate on soils with pH greater than 7. The addition of 2,4-D at 1 pt/acre is required at the 1.1 oz rate and is recommended for all Canopy EX applications. Can be tank mixed with various herbicides for enhanced burndown and residual weed control. Do not allow grazing in treated fields or harvest for forage or hay. Wheat can be planted after 4 months, alfalfa or field corn after 10 months, sorghum after 12 months, and sunflowers after 12 months.
Chlorimuron + Metribuzin 0.027 to 0.047 + 0.161 to 0.28	4 to 7 oz Canopy	Canopy is a premix of 10.7% chlorimuron (Classic) and 64.3% metribuzin (Sencor) recommended mainly for eastern Kansas. Provides residual and burndown control of many broadleaf weeds. If emerged weeds are present at treatment time, add crop oil concentrate to enhance foliar activity. Can be tank mixed with various herbicides for enhanced burndown and residual weed control. Can be applied early preplant. Do not apply to soils with a composite pH above 7. Do not allow grazing in treated fields or harvest for forage or hay. Wheat can be planted after 4 months; alfalfa, field corn, or cotton after 10 months; sorghum after 12 months, and sunflower or canola after 18 months.
Chlorimuron + Flumioxazin 0.0194 to 0.033 + 0.0561 to 0.0935	3 to 5 oz Valor XLT	Valor XLT is a premix of 10.3% chlorimuron (Classic) and 30% flumioxazin (Valor). Recommended mainly for eastern Kansas. Provides residual and burndown control of many broadleaf weeds. Can be applied preplant in the fall or spring, or preemergence until 3 days after planting. If emerged weeds are present at the time of treatment, add crop oil concentrate to enhance foliar activity. The addition of glyphosate and/or 2,4-D is recommended for more broad-spectrum burndown weed control. If the soil pH is greater than 6.8, do not use greater than 2.5 oz/acre of Valor XLT. Do not apply Valor XLT in fields treated with products containing flufenacet, alachlor, metolachlor, or dimethenamid. Do not allow grazing in treated fields or harvest for hay or forage. Do not rotate to wheat for 4 months; field corn, cotton, or sorghum for 10 months; alfalfa for 12 months; sunflower for 18 months; or canola for 30 months after application.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Chlorimuron + Flumioxazin + Thifensulfuron 0.014 to 0.03 + 0.046 to 0.097 + 0.0045 to 0.0094	2.5 to 5.3 oz Envive	Envive is a premix of 9.2% chlorimuron (Classic), 29.2% flumioxazin (Valor), and 2.9% thifensulfuron (Harmony SG) for residual and burndown control of many broadleaf weeds. Can be applied preplant in the fall or spring or preemergence until 3 days after planting. If emerged weeds are present at the time of treatment, add crop oil concentrate or nonionic surfactant to enhance foliar activity. The addition of glyphosate, 2,4-D, and/or dicamba is recommended for more broad-spectrum burndown weed control. If the soil pH is greater than 7.0, do not use greater than 2.5 oz/acre of Envive. Do not apply Envive in fields treated with products containing flufenacet, alachlor, metolachlor, or dimethenamid. Do not allow grazing in treated fields or harvest for hay or forage. Do not rotate to wheat for 4 months; field corn, cotton, or sorghum for 10 months; alfalfa for 12 months; sunflower for 18 months; or canola for 30 months after application.
Clomazone 0.5 to 0.75	1.33 to 2 pt Command	Controls velvetleaf, many annual grasses, and some broadleaf weeds. Can be applied preemergence or incorporated with one or two passes to a maximum depth of 3 inches. Can be tank mixed with trifluralin, Scepter, Sencor, pendimethalin, Intro, or Dual II MAGNUM. Susceptible nearby plants can show symptoms of foliar whitening or yellowing from spray or vapor drift of Command. Rotation to soybean, corn, and sorghum can be done after 9 months, to wheat after 12 months, and to other crops after 16 months. Do not allow grazing or feed soybean plants from treated fields. See label restrictions for preemergence use.
Cloransulam 0.032 to 0.04	0.6 to 0.75 oz FirstRate	Controls many broadleaf weeds as a preplant incorporated, preplant, or preemergence treatment. Can be applied up to 30 days before planting. Apply with nonionic surfactant, MSO, or crop oil concentrate plus UAN fertilizer solution for control of emerged weeds in no-till. Wheat can be planted after 4 months, and alfalfa, corn, sorghum, or cotton can be planted 9 months after application. Do not plant any other crop until 30 months after application and completion of a field bioassay. Do not apply through a chemigation system. Refer to supplemental label for aerial application.
Cloransulam + Flumioxazin 0.016 to 0.032 + 0.05 to 0.1	0.3 to 0.6 oz First Rate or Gangster FR + 1.5 to 3 oz Valor or Gangster V	Gangster is a co-pack of cloransulam (FirstRate) and flumioxazin (Valor). Can be applied from 14 days before to 3 days after soybean planting. Apply with oil concentrate for enhanced burndown control of emerged weeds in no-till. Tank mixes of Gangster with Domain, Dual II MAGNUM, Boundary, Outlook, Define or alachlor products may result in severe soybean injury. Do not rotate to alfalfa or oats for 12 months, or to sunflower or canola until 30 months after treatment.
Cloransulam + Sulfentrazone 0.015 to 0.04 + 0.12 to 0.31	3 to 8 oz Authority First or Sonic	Authority First and Sonic are premixes of 7.9% cloransulam and 62.1% sulfentrazone. Can be applied preplant or preemergence until 3 days after planting. Primarily controls yellow nutsedge and broadleaf weeds, including waterhemp, Palmer amaranth, morningglory, velvetleaf, and black nightshade. The low rates are recommended primarily as a foundation treatment ahead of glyphosate in glyphosate-resistant soybeans. Higher rates are recommended for use on conventional soybean varieties. Do not use on sandy soils with less than 1% organic matter. Do not rotate to wheat for 4 months, corn for 10 months, alfalfa or sorghum for 12 months, cotton for 18 months, canola for 24 months, or sunflower for 30 months after application.
Dimethenamid-P 0.5 to 0.98	12 to 21 oz Outlook or Propel	For preemergence control of weeds, apply to soybean preplant, preplant incorporated into the surface 2 inches, or preemergence to early postemergence. Can be applied up to 45 days before planting. Controls grasses more effectively than broadleaf weeds. Rate depends on soil texture and organic matter. Can be tank mixed with Command, pendimethalin, Pursuit, Scepter, Sencor, or trifluralin. Fall cereals can be planted 4 months after application, and any crop can be planted in the following season. Follow directions and precautions on the label.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Ethalfuralin 0.56 to 1.125	1.5 to 3 pt Sonalan	Apply up to 3 weeks before planting and incorporate uniformly into the top 2 to 3 inches of soil for partial control of black nightshade. Can be tank mixed with Command, Dual, Intrro, Sencor, Pursuit, or Scepter. Do not allow grazing or cut hay.
Flufenacet 0.25 to 0.45	7 to 12 oz Define DF or 8 to 14 oz Define SC	Provides early-season control of certain annual grasses. Can be applied preplant, preplant incorporated up to 14 days before planting soybean, or preemergence. Can be tank mixed with FirstRate, Scepter, Sencor, glyphosate, or 2,4-D.
Flumetsulam 0.04 to 0.07	0.8 to 1.33 oz Python	Controls annual broadleaf weeds as a preplant incorporated or preemergence application. Preemergence treatments can be tank mixed with glyphosate, Gramoxone Inteon, or 2,4-D to help control emerged weeds in no-till. Do not apply if soil pH is greater than 7.8. Corn and soybean can be planted anytime after application. Do not rotate to alfalfa for 4 months, wheat and oats for 4.5 months, grain sorghum for 12 months, sunflower for 18 months, or any other crop until a field bioassay has been completed. Do not apply aerially or through a chemigation system.
Flumioxazin 0.064 to 0.096	2 to 3 oz Valor or Encompass	Apply in the fall, preplant, or preemergence to soybean. Add oil concentrate to enhance burndown activity on emerged weeds in no-till. Controls several broadleaf weeds, including pigweeds and black nightshade. Can be tank mixed with Python, FirstRate, pendimethalin, Pursuit Plus, or Command. Tank mixes of Valor with flufenacet, metolachlor, dimethenamid, or alachlor products may result in severe soybean injury. Do not rotate to wheat for 1 month, or to alfalfa or oats for 8 months after application.
Glyphosate 0.38 to 1.12 lb ae	1 to 3 pt of 3 lb ae/ gal Glyphosate* (See glyphosate table)	Apply to control emerged weeds before or after soybean planting but before crop emergence. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank. Can be tank mixed with pendimethalin, Dual II MAGNUM, Intrro, Sencor, or Scepter for residual activity. Follow label directions. Fall treatments can be especially effective for control of emerged winter annual weeds and reduce the need for intensive spring burndown treatments.
Glyphosate + S-Metolachlor 0.68 to 0.87 lb ae + 1 to 1.2	2.5 to 3 pt Sequence	Sequence is a premix of 2.25 lb glyphosate and 3.0 lb S-metolachlor (Dual Magnum)/gal. Apply preplant up to 14 days before planting or preemergence. Provides burndown control of most existing weeds and early-season residual control of small-seeded grasses and some small-seeded broadleaf weeds. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal water can improve control of emerged weeds.
Imazaquin 0.125	2.8 oz Scepter DG	Controls many annual weeds in soybean in and east of Jewell, Mitchell, Lincoln, Ellsworth, McPherson, Harvey, Sedgwick, and Sumner counties. Apply preplant (up to 45 days before planting) and incorporate with two passes in top 2 inches of soil. Preemergence application can be effective if enough rainfall to wet the soil to a depth of 2 inches is received within 7 days of planting. Wheat can be planted after 4 months. Field corn can be planted after 9.5 months if 15 inches of rainfall were received from 2 weeks before application through November 15. Can be tank mixed with pendimethalin, trifluralin, Outlook, or Dual II MAGNUM. Do not allow grazing and do not feed treated soybean forage. Follow label directions, precautions, and cropping limitations.

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Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Imazaquin + Pendimethalin 0.125 + 0.83	2.8 oz Scepter DG + 2 pt Pendimethalin 3.3* or 1.75 pt Prowl H₂O	Controls many annual weeds in soybean in and east of Jewell, Mitchell, Lincoln, Ellsworth, McPherson, Harvey, Sedgwick, and Sumner counties. Apply preplant (up to 45 days before planting) and incorporate with two passes in top 2 inches of soil. Preemergence application can be effective if enough rainfall to wet the soil to a depth of 2 inches is received within 7 days of planting. Do not apply after soybean emergence. Wheat can be planted after 4 months. Oats can be planted after 11 months. Field corn can be planted after 9.5 months if 15 inches of rainfall were received from 2 weeks before application through November 15. Do not allow grazing or feed treated soybean forage. Follow label directions, precautions, and cropping limitations.
Imazethapyr 0.063	4 oz Pursuit	Controls many annual weeds. Apply up to 45 days before planting and incorporate with two passes into the top 1 to 2 inches of soil. Preemergence application can be effective if enough rainfall to wet the soil to a depth of 2 inches is received within 7 days of planting. Wheat can be planted after 4 months, and field corn after 8.5 months. Do not rotate to grain sorghum. Can be tank mixed with pendimethalin, trifluralin, Intro, Outlook, or Dual II MAGNUM. Do not allow grazing or feed treated soybean forage, hay, or straw. Follow label directions, precautions, and cropping instructions.
Imazethapyr + Pendimethalin 0.063 + 0.84	2.5 pt Pursuit Plus	Pursuit Plus is a premix of 2.7 lb pendimethalin (Prowl) and 0.2 lb imazethapyr (Pursuit)/gal. For a tank mix, use rates shown on Pursuit label. Controls many annual weeds. Apply up to 45 days before planting and incorporate with two passes into the top 1 to 2 inches of soil. Preemergence application can be effective if enough rainfall to wet the soil to a depth of 2 inches is received within 7 days of planting. Wheat can be planted after 4 months, and field corn after 8.5 months. Do not rotate to grain sorghum. Do not allow grazing or feed treated soybean forage, hay, or straw. Follow label directions, precautions, and cropping limitations.
Iodosulfuron 0.0019	0.3 oz Autumn	Apply after fall harvest and at least 90 days prior to soybean planting for burndown control of broadleaf weeds. Generally tank mixed with 2,4-D for improved weed control. Apply to actively growing weeds. Apply with 1% v/v crop oil concentrate plus 28% nitrogen fertilizer at 1 to 2 qt/acre or 1.5 to 3 lb/acre ammonium sulfate. Do not apply to frozen ground.
S-Metolachlor 0.95 to 1.91	1 to 2 pt Dual II MAGNUM, Cinch, or Charger Max	Controls grasses more effectively than broadleaf weeds. Apply preplant up to 30 days before planting or preemergence. Can be tank mixed with Command, Pursuit, Scepter, or Sencor. Small grains can be planted 4.5 months after treatment. Follow label directions and precautions.
S-Metolachlor + Fomesafen 0.98 + 0.25	2 pt Prefix	Prefix is a premix of S-metolachlor (Dual Magnum) and fomesafen (Reflex). Apply preplant up to 14 days before planting through preemergence. Follow label directions and precautions.
S-Metolachlor + Metribuzin 0.98 to 1.94 + 0.24 to 0.48	1.5 to 2.75 pt Boundary 6.5E	Boundary 6.5E is a premix of 5.25 lb S-metolachlor (Dual II Magnum) and 1.25 lb metribuzin (Sencor)/gal. Apply preplant within 14 days ahead of planting or preemergence. Lower use rates are effective in a two-pass planned program ahead of a postemergence treatment. May be tank mixed with glyphosate, paraquat, or 2,4-D for enhanced burndown control in no-till. Do not use on soils with pH above 7.5 or less than 0.5% organic matter. Follow directions regarding rates, cropping limitations, and precautions on product labels.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Metribuzin 0.38 to 0.75	0.5 to 1 lb Dimetric or Tricor	Apply preplant up to 30 days before planting or preemergence to soybeans. A sequential or "split-shot" treatment with one application up to 30 days preplant followed by a preemergence application often provides the best results. Add crop oil concentrate to enhance burndown of emerged weeds in no-till. Controls broadleaf weeds more effectively than grasses. Metribuzin (Sencor) has a narrow margin of safety. Plant seed at least 1.5 inches deep. Do not use on loamy sand or sandy loam with less than 2% organic matter. Do not allow grazing or feed forage from treated fields within 40 days. Can be tank mixed with other burndown or residual herbicides for broader spectrum weed control.
Metribuzin + Sulfentrazone 0.135 to 0.34 + 0.09 to 0.225	8 to 20 oz Authority MTZ	Authority MTZ is a premix of 27% metribuzin and 18% sulfentrazone. Can be applied preplant in the fall or spring, or preemergence until 3 days after planting. Primarily controls yellow nutsedge and broadleaf weeds including waterhemp, Palmer amaranth, morningglory, velvetleaf, and black nightshade. The low rates are recommended primarily as a foundation treatment ahead of glyphosate in glyphosate-resistant soybeans. Higher rates are recommended for use on conventional soybean varieties. Do not use more than 12 oz/acre on soil with pH 7.5 and higher. Do not rotate to wheat for 4 months; corn for 10 months; alfalfa, sorghum, or sunflower for 12 months; cotton for 18 months; or canola for 24 months after application.
Paraquat 0.5 to 1	2 to 4 pt Gramoxone Inteon	A restricted-use pesticide. Apply to control emerged weeds before or after soybean planting but before crop emergence. Always apply with a nonionic surfactant. Dust on plants can inactivate Gramoxone Inteon. Can be tank mixed with 2,4-D or various residual herbicides. Tank mixes with Sencor will increase burndown by Gramoxone Inteon.
Pendimethalin 0.5 to 1.5	1.2 to 3.6 pt Pendimethalin 3.3* or 1.5 to 3 pt Prowl H₂O	Controls grasses more effectively than broadleaf weeds. Apply preplant up to 60 days before planting or preemergence. Can be surface applied or incorporated. Can be tank mixed with Scepter, Pursuit, Sencor, and Command. Follow label directions and precautions.
Pyraflufen 0.0008 to 0.0012	0.5 to 0.75 oz ET	Contact herbicide that provides burndown control of small broadleaf weeds less than 4 inches tall or 3 inches in diameter. Generally applied as a tank mixture with 2,4-D or glyphosate for control of larger weeds and broader spectrum weed control.
Sulfentrazone 0.14 to 0.375	4.5 to 12 oz Spartan	Apply preplant or preplant incorporated up to 60 days before planting or preemergence to soybean. Add oil concentrate for enhanced burndown of existing weeds in no-till. Controls yellow nutsedge and several broadleaf weeds including pigweeds, morningglory, and black nightshade. Do not rotate to wheat for 4 months, field corn for 10 months, sorghum for 10 to 18 months, or alfalfa for 12 to 18 months after application.
Sulfentrazone + Carfentrazone 0.14 to 0.21 + 0.016 to 0.023	5.75 to 8.5 oz Spartan Charge	Apply in the fall, preplant, or preemergence to soybean for burndown and residual control of pigweeds, kochia, and other broadleaf weeds. The lower rates are for low organic matter, coarse-textured soils, and the higher rates are needed on fine-textured soils with higher organic matter content. May be tank mixed with glyphosate for improved grass burndown activity.
Sulfentrazone + Glyphosate 0.1 to 0.31 + 0.54 to 1.64	23 to 70 oz Spartan Advance	Apply in the fall, preplant, or preemergence to soybean for burndown and residual control of pigweeds, kochia, and other weeds. The low rates are recommended primarily as a foundation treatment ahead of glyphosate in glyphosate-resistant soybeans. Higher rates are recommended for use on conventional soybean varieties. Supplemental glyphosate is recommended for adequate weed control with the lower Spartan Advance application rates.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Sulfentrazone + Imazethapyr 0.10 to 0.31 + 0.02 to 0.063	4 to 12 oz Authority Assist	Authority Assist is a premix containing 3.33 lb sulfentrazone and 0.67 lb imazethapyr/gal. Can be applied preplant in the fall or spring, or preemergence until 3 days after planting. Provides more grass control or suppression than Authority First or Authority MTZ. The low rates are recommended primarily as a foundation treatment ahead of glyphosate in glyphosate-resistant soybeans. Higher rates are recommended for use on conventional soybean varieties. Do not rotate to wheat for 4 months; corn for 10 months; alfalfa for 12 months; oats, cotton, sorghum, or sunflower for 18 months; or canola for 40 months after application. Do not feed soybean forage, hay, or straw to livestock.
Thifensulfuron 0.014 to 0.028	0.45 to 0.9 oz Harmony SG , or 0.3 to 0.6 oz Unity or Harass	Apply preplant until prior to soybean emergence for burndown of certain broadleaf weeds. Generally applied as a tank mix with other burndown herbicides such as 2,4-D or glyphosate for broader spectrum weed control. Apply with nonionic surfactant or crop oil concentrate plus ammonium nitrogen fertilizer additives.
Thifensulfuron + Chlorimuron 0.0016 to 0.013 0.005 to 0.04	0.375 to 3 oz Synchrony XP	Provides preplant burndown and/or residual control of small broadleaf weeds depending on the rate of application. Rates less than 1 oz/acre are generally recommended only for tank mixes with glyphosate and will provide minimal residual weed control. Do not use rates higher than 1 oz/acre on soils with a pH greater than 7.0. Generally tank mixed with 2,4-D for enhanced broadleaf weed control and/or with glyphosate for enhanced grass and broadleaf weed control. Apply with crop oil concentrate plus nitrogen fertilizer solution additives when applied alone or with 2,4-D. Apply with nonionic surfactant plus ammonium sulfate when tank mixed with glyphosate. Do not rotate to wheat for 4 months, corn for 9 to 12 months, or sunflower for 18 months after treatment. Consult the herbicide label for more specific crop rotation and use guidelines.
Trifluralin 0.5 to 1	1 to 2 pt Trifluralin 4E*	Controls grasses more effectively than broadleaf weeds. Apply before planting and incorporate into the top 2 to 3 inches of soil within 24 hours. Usually controls shattercane. Can be tank mixed with Sencor, Command, Pursuit, or Scepter. Can be applied through chemigation system when followed by 0.5 to 1 inch of irrigation to incorporate. Follow label directions.
2,4-D 0.38 to 1	0.75 to 2 pt of 4 lb/gal 2,4-D*	Apply 0.75 to 1 pt/acre ester formulations 7 or more days before planting, 0.75 to 1 pt/acre amine formulations 15 days or more before planting, or 1 to 2 pt/acre ester or amine formulations 30 days or more before planting for control of emerged broadleaf weeds. Ester formulations generally provide better weed control with less risk of carryover injury to soybean than amine formulations. Can be tank mixed with other herbicides such as glyphosate, Gramoxone Inteon, Sencor, pendimethalin, and Pursuit Plus for broad-spectrum and/or residual weed control. May be especially cost effective as a fall treatment for control of winter annual broadleaf weeds ahead of no-till soybeans planted the following spring.
POSTEMERGENCE		
Acifluorfen 0.25 to 0.38	1 to 1.5 pt Ultra Blazer	A contact herbicide that controls many broadleaf weeds. Apply when seedling weeds are in the 4- to 6-leaf stage and growing actively. Apply with nonionic surfactant. Ultra Blazer can burn, bronze, or crinkle some soybean leaves. Soybeans outgrow this condition, and new growth develops normally. Can be tank mixed with Basagran, 2,4-DB, Classic, Poast Plus, Scepter, or Fusilade DX. Do not apply within 50 days of harvest. Do not use treated plants for feed or forage. Follow label directions.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Acifluorfen + Bentazon 0.25 + 0.5 to 1.0	1 pt Ultra Blazer + 1 to 2 pt Basagran , or 1.5 pt Storm	A combination of Ultra Blazer and Basagran can be used for control of annual broadleaf weeds. Storm is a premix of 2.67 lb bentazon and 1.33 lb acifluorfen/gal. Apply before seedling weeds reach size limits listed on label. Apply with nonionic surfactant. For improved velvetleaf control, apply with crop oil concentrate or with 1 gal 28% nitrogen solution/acre. Can be tank mixed with Classic, Harmony SG, Poast Plus, Pursuit, or 2,4-DB. Follow directions on product labels.
Bentazon 0.5 to 1.5	1 to 3 pt Basagran	Controls many broadleaf weeds. Apply when weeds are small and actively growing but before they reach size limits listed on label. Apply with crop oil concentrate or 1 gal 28% nitrogen solution/acre for improved control of velvetleaf. Can be tank mixed with Ultra Blazer, Classic, Pursuit, Scepter, 2,4-DB, or Poast Plus. Follow label directions and precautions.
Carfentrazone 0.004	0.25 oz Aim EC	Primarily for velvetleaf control and suppression of certain other broadleaf weeds. Apply from the V3 through the V10 stage of soybean in combination with nonionic surfactant. Often causes burn on existing soybean foliage, but new growth should be unaffected. Often applied in combination with other herbicides for broader spectrum weed control.
Chlorimuron 0.008	0.5 oz Classic	Controls annual broadleaf weeds. Apply to small, actively growing weeds through the 3 trifoliolate-leaf stage of soybean. Apply with surfactant. Wheat or barley can be planted after 3 months and corn or sorghum after 9 months, except where Classic is applied after Canopy (15 months). Can be tank mixed with 2,4-DB to increase morningglory control, or with glyphosate (Roundup Ready soybean only) for broad-spectrum weed control. Some pigweed species, such as waterhemp and Palmer amaranth, have developed resistance to Classic and other herbicides having the same mode of action. Management strategies such as alternative control methods, crop rotation, and using herbicides with a different mode of action to replace or supplement Classic in a tank mix need to be considered in areas that may have resistant weed biotypes. Do not allow grazing or harvest for forage. Follow label directions and cropping limitations.
Clethodim 0.05 to 0.25	4 to 16 oz Select, Arrow, Section, or Volunteer , or 6 to 16 oz Select Max	Controls many annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on the label. The lowest application rates are primarily for control of volunteer Roundup Ready corn less than 12 inches tall. Apply Select and comparable products with crop oil concentrate at 1% v/v. Apply Select Max with crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v plus ammonium sulfate at 2.5 to 4 lb/acre. Can be tank mixed with Pursuit, Cobra, Basagran, Classic, Reflex, Flexstar, FirstRate, Synchrony STS, Storm, Ultra Blazer, or glyphosate (Roundup Ready soybean only). Tank mixing with broadleaf herbicides can reduce grass control. Do not apply within 60 days of harvest. Do not allow grazing or use treated plants for feed or forage.
Cloransulam 0.016	0.3 oz FirstRate	Controls certain broadleaf weeds. Apply with nonionic surfactant, crop oil concentrate, or methylated seed oil plus UAN fertilizer solution when weeds are at the 2- to 4-leaf stage and actively growing. Can be tank mixed with Basagran, Ultra Blazer, Cobra, Reflex, Pursuit, Assure II, Fusion, Poast Plus, Select, or glyphosate (Roundup Ready soybean only). Wheat can be planted after 4 months, and alfalfa, corn, sorghum, or cotton can be planted 9 months after application. Do not plant any other crop until 30 months after application and completion of a field bioassay. Do not apply through a chemigation system. Refer to supplemental label for aerial application.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Fluazifop-P 0.06 to 0.19	4 to 12 oz Fusilade DX	Controls many annual and perennial grasses including shattercane, volunteer corn, and rhizome johnsongrass. Apply with crop oil concentrate or nonionic surfactant. Repeat treatment for regrowth of rhizome johnsongrass. Apply when grasses are small and growing actively but before they reach size limits listed on label. Make last application before soybean bloom. Do not harvest plants for forage or hay. Can be tank mixed with Basagran, Ultra Blazer, Flexstar, Classic, or Pursuit for broadleaf control. Tank mixing with broadleaf herbicides can reduce grass control. Follow label directions and precautions.
Fluazifop-P + Fenoxaprop 0.06 to 0.22 + 0.02 to 0.07	4 to 14 oz Fusion	Controls many annual grasses including foxtails, shattercane, and volunteer corn. Apply with crop oil concentrate or nonionic surfactant. Apply when grasses are small and growing actively but before they reach size limits listed on label. Make last application before soybeans begin to bloom. Can be tank mixed with Basagran, Ultra Blazer, Flexstar, Classic, or Pursuit for broadleaf control. Tank mixing with broadleaf herbicides can reduce grass control. Do not harvest plants for forage or hay. Follow label directions and precautions.
Flumiclorac 0.013 to 0.081	2 to 12 oz Resource	Controls velvetleaf and certain other broadleaf weeds. Apply to small, actively growing weeds before they reach the size limits listed on the label. The 2 oz rate is primarily to enhance velvetleaf control in tank mixes with other broadleaf herbicides. Large velvetleaf can be controlled with the higher use rates. Always apply with crop oil concentrate. Resource is a contact herbicide and can cause temporary leaf burning or speckling, but new soybean growth is unaffected. Can be tank mixed with Assure II, Fusilade DX, Fusion, Poast Plus, Basagran, Storm, Classic, Cobra, Harmony SG, Pursuit, Scepter, Select, FirstRate, Flexstar, Reflex, Raptor, or glyphosate (Roundup Ready soybean only). Do not allow grazing or use treated soybean plants for feed or animal bedding. Follow label directions, precautions, and cropping limitations.
Fluthiacet 0.003 to 0.006	0.4 to 0.9 oz Cadet	Primarily for velvetleaf control and suppression of certain other small broadleaf weeds. The low rate is primarily to enhance velvetleaf control in tank mixes with other herbicides. Apply to soybeans from the first trifoliolate through the full flower stage of growth to control or suppress labeled weeds less than 2 inches tall. Large velvetleaf can be controlled with the higher use rates. Always use in combination with 0.25% v/v nonionic surfactant or 1 to 2 pt/acre crop oil concentrate. Cadet is a contact herbicide and can cause temporary leaf burning or speckling, but new soybean growth is unaffected.
Fomesafen 0.19 to 0.25	0.75 to 1 pt Reflex or Flexstar	A contact herbicide that controls many broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on the labels (normally 2 to 3 weeks after planting). Apply with crop oil concentrate or nonionic surfactant. UAN or ammonium sulfate also can be added for improved weed control. Reflex and Flexstar can cause temporary leaf speckling and burning, but new soybean growth is unaffected. Can be tank mixed with Fusilade DX, Fusion, Select, Assure II, Poast Plus, Basagran, Classic, Harmony GT, Synchrony STS, Scepter, or 2,4-DB. Do not use west of Highway 75. Do not rotate to sorghum or sunflowers within 18 months of application. Do not allow grazing or harvest treated soybean for forage or hay. Follow label directions, precautions, and cropping limitations.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Fomesafen + S-metolachlor 0.24 + 1	1 qt Prefix	Prefix is a premix containing 4.34 lb S-metolachlor (Dual magnum) and 0.95 lb fomesafen (Reflex)/gal that provides residual grass control and foliar and residual control of certain broadleaf weeds such as waterhemp. May be applied postemergence in soybeans up to the third trifoliolate stage. Premix may be tank mixed with glyphosate to provide residual weed control along with enhanced control of waterhemp. Add NIS at 0.25% v/v if the glyphosate brand does not contain a built-in adjuvant. Always add AMS at 8.5 to 17 lb/100 gal to the Prefix + glyphosate tank mix in glyphosate-resistant soybeans. Necrotic spotting, leaf bronzing, leaf crinkling, or curling of soybean leaves may occur after a postemergence application. Do not use COC with the Prefix + glyphosate tank mix or increased soybean injury may occur. Do not apply west of U.S. Highway 281 in Kansas. Do not rotate back to wheat before 4.5 months, corn before 10 months, and grain sorghum before 18 months.
Glufosinate 0.40	22 oz Ignite 280	Ignite 280 is a nonselective herbicide for use only on soybeans designated as Liberty Link. Application to other soybeans will result in severe injury or death of the crop. Apply to soybeans from emergence until the bloom stage of growth for control of small, actively growing weeds less than 4 inches tall. Always condition spray water with spray-grade ammonium sulfate at 3 lb/acre before adding Ignite 280 to the spray solution. Ignite is most effective with warm temperatures, high relative humidity, and bright sunlight. Application to stressed plants or late in the day may result in reduced weed control. Ignite 280 has no residual activity, so two-pass weed control programs including a preemergence herbicide or sequential postemergence treatments generally are required to achieve good weed control and minimize weed competition. Do not apply more than two applications of Ignite 280 to Liberty Link soybeans, and allow at least 10 days between applications. Do not graze or harvest the treated crop for hay.
Glyphosate 0.63 to 1.5 lb ae	1.5 to 4 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply only to Roundup Ready soybean. Application to other soybeans will result in severe injury or death of the crop. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Controls most annual and perennial weeds at the rates suggested on the label. Glyphosate has no residual activity, so sequential applications or cultivation may be required for season-long control, especially in wide-row soybeans. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank.
Glyphosate + S-Metolachlor 0.68 to 0.95 lb ae + 1 to 1.4	2.5 to 3.5 pt Sequence	Apply only to Roundup Ready soybean. Application to other soybeans will result in severe injury or death of the crop. Sequence is a premix of 2.25 lb glyphosate and 3.0 lb S-metolachlor (Dual Magnum)/gal. Can be applied to soybean from emergence through the 3 trifoliolate-leaf stage. Provides control of most emerged weeds and residual control of small-seeded grasses and some small-seeded broadleaf weeds. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal water can improve control of emerged weeds.
Imazamox 0.031 to 0.039	4 to 5 oz Raptor	Controls many annual grasses and broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on the label. Apply with nonionic surfactant, crop oil concentrate, or methylated seed oil plus fertilizer solutions. Some weed species, such as Palmer amaranth, have developed resistance to Raptor and other herbicides having the same mode of action. Management strategies such as alternative control methods, crop rotation, and using herbicides with a different mode of action to replace or supplement Raptor in a tank mix need to be considered in areas that may have resistant weed biotypes. Do not rotate to wheat for 3 months, or to corn, grain sorghum, and sunflower for 9 months after application. Do not allow grazing or feed treated soybean forage, hay, or straw to livestock.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Imazaquin 0.063 to 0.125	1.4 to 2.8 oz Scepter DG	Controls cocklebur, pigweed, sunflower, and volunteer corn (except imidazolinone-tolerant corn). Apply when weeds are growing actively but before they reach size limits listed on label. Apply with nonionic surfactant or crop oil concentrate. Some pigweed species, such as Palmer amaranth, have developed resistance to Scepter and other herbicides having the same mode of action. Management strategies such as alternative control methods, crop rotation, and using herbicides with a different mode of action to replace or supplement Scepter in a tank mix need to be considered in areas that may have resistant weed biotypes. Do not allow grazing or feed treated soybean forage, hay, or straw. Follow label directions, precautions, and cropping limitations.
Imazethapyr 0.063	4 oz Pursuit	Controls annual broadleaf weeds and grasses. Apply to small, actively growing weeds before they reach size limits listed on label. Apply with nonionic surfactant, crop oil concentrate, or methylated seed oil, plus fertilizer solutions. Weed control with Pursuit has been enhanced more by methylated seed oil than by nonionic surfactant or crop oil concentrate in research conducted at K-State. Some pigweed species, such as Palmer amaranth, developed resistance to Pursuit and other herbicides having the same mode of action. Management strategies such as alternative control methods, crop rotation, and using herbicides with a different mode of action to replace or supplement Pursuit in a tank mix need to be considered in areas that may have resistant weed biotypes. Can be tank mixed with Basagran, Ultra Blazer, Cobra, and Storm. A tank mix with Cobra or Ultra Blazer improves control of pigweeds, ragweed, prickly sida, venice mallow, and copperleaf. Do not rotate to grain sorghum. Wheat can be planted after 4 months and field corn after 8.5 months. Do not allow grazing or feed treated soybean forage, hay, or straw. Follow label directions, precautions, and cropping limitations.
Imazethapyr + Glyphosate 0.063 + 0.75	3 pt Extreme	Apply only to Roundup Ready soybeans. Extreme is a premix of 0.17 lb imazethapyr (Pursuit) and 2 lb glyphosate/gal. Provides foliar and residual control of many grass and broadleaf weeds. Apply with nonionic surfactant plus ammonium sulfate. Do not rotate to grain sorghum. Wheat can be planted after 4 months and field corn after 8.5 months. Do not allow grazing or feed treated soybean forage, hay, or straw. Follow label directions, precautions, and cropping limitations.
Lactofen 0.09 to 0.2	6 to 12.5 oz Cobra or 8 to 12.5 oz Phoenix	A contact herbicide that controls many broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on labels (normally 2 to 3 weeks after planting). Apply with 1 to 2 pt/acre crop oil concentrate when soybeans are at first or second trifoliolate leaf stage. Cobra can cause speckling, discoloration, cupping, or crinkling of leaves. Phoenix generally causes less soybean response than Cobra but also may be slightly less effective on certain weeds. Soybeans outgrow these conditions, and new growth develops normally. Cobra can be especially helpful in controlling pigweed species. Palmer amaranth is more difficult to control and may require the high use rate and perhaps sequential applications, especially for larger plants. Can be tank mixed with FirstRate, Classic, Resource, Synchrony STS, Raptor, Pursuit, Select, or glyphosate (Roundup Ready soybean only). Do not use treated plants for feed or forage. Follow label directions.
Quizalofop 0.03 to 0.075	5 to 12 oz Assure II	Controls many annual and perennial grasses including shattercane, volunteer corn and wheat, and rhizome johnsongrass. Apply with 1% v/v crop oil concentrate or 0.25% v/v nonionic surfactant. Slightly higher rates are recommended west of I-135. When higher rates are used, Assure II can be tank mixed with Basagran, Harmony SG, Synchrony STS, or Classic. Tank mixing with broadleaf herbicides can reduce grass control. Follow label directions.

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HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Sethoxydim 0.1 to 0.28	0.75 to 2.25 pt Poast Plus	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Apply to annual grasses up to 8 inches, volunteer corn up to 20 inches, shattercane 6 to 18 inches, and rhizome johnsongrass 15 to 25 inches tall. Apply with crop oil concentrate. For improved control of volunteer corn, crabgrass, and rhizome johnsongrass, also apply with ammonium sulfate at 2.5 lb/acre or 28% UAN at 2 to 4 qt/acre. Do not apply within 90 days of harvest. Do not use treated plants for feed or forage. Can be tank mixed with Basagran or Storm. Tank mixing with broadleaf herbicides can reduce grass control. Follow label directions and precautions.
Thifensulfuron 0.004	0.125 oz Harmony SG or 0.083 oz Unity or Harass	Primarily for control of lambsquarters, annual smartweeds, and velvetleaf at 3 to 4 leaf stage. Harmony SG generally is used in a tank mix with Assure II, Classic, Scepter, 2,4-DB, or Basagran for a wider spectrum of weed control. May be tank mixed with glyphosate in Roundup Ready soybeans. Always apply with nonionic surfactant and nitrogen fertilizer additives. Do not apply by chemigation. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock. Follow label directions.
Thifensulfuron + Chlorimuron 0.0016 to 0.0049 + 0.005 to 0.015	0.375 to 1.125 oz Synchrony XP	Use only the 0.375 oz rate on non-STS soybeans. Rates above 0.375 should be used only on STS soybeans. Controls several broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on the label. Apply with crop oil concentrate plus nitrogen fertilizer solution. Some pigweed species, such as waterhemp and Palmer amaranth, have developed resistance to Synchrony and other herbicides with the same mode of action. Management strategies such as alternative control methods, crop rotation, and using herbicides with a different mode of action to replace or supplement Synchrony in a tank mix need to be considered in areas that may have resistant weed biotypes. Can be tank mixed with Assure II, Cobra, Ultra Blazer, Flexstar, 2,4-DB, or glyphosate (resistant soybeans only). Do not plant wheat for 3 months; corn, sorghum, or cotton for 9 months; alfalfa for 12 months; or sunflower or canola for 18 months after treatment. Follow directions and precautions on the label.
2,4-DB + tank mix partner 0.03	2 oz Butyrac 200 or 2,4-DB 200	Applied as a tank mix partner with other broadleaf herbicides to enhance control of morningglory, cocklebur, and other broadleaf weeds, particularly with late applications.
DIRECTED POSTEMERGENCE		
Paraquat 0.07 to 0.12	4.5 to 8 oz Gramoxone Inteon	A restricted-use pesticide. Apply after soybeans are more than 8 inches tall and weeds have emerged. Use postemergence directed precision equipment adjusted so that no more than the lower 3 inches of the soybean plant is contacted by the spray, or crop injury can result. Apply with nonionic surfactant. Do not exceed 30 psi spray pressure. Do not feed forage or hay to livestock. Follow label directions and precautions.
FOR SPOT TREATMENT ONLY		
Clethodim	2 qt Select or Section /100 gal	For control of annual and perennial grasses, apply as a spot treatment until vegetation is uniformly wet but not to the point of spray runoff. Always apply with crop oil concentrate.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
FOR SPOT TREATMENT ONLY		
Fluazifop-P	2 qt Fusilade DX /100 gal	Apply as spot treatment before bloom for control of annual and perennial grasses, including shattercane and rhizome johnsongrass. Treat again if necessary. Always apply with crop oil concentrate or nonionic surfactant. Do not allow grazing of treated area or harvest for hay. Do not plant crops such as corn, sorghum, or cereals within 60 days after last application. Follow label directions and precautions.
Glyphosate	1 to 2 gal Glyphosate* /100 gal or 1.33 to 2.67 oz Glyphosate*/gal spray solution	Apply as spot treatment to control annual and perennial grasses, including shattercane and rhizome johnsongrass. Non-Roundup Ready soybeans treated with glyphosate will be severely injured. Use the lower rates for control of small annual weeds and the higher rates for control of perennial weeds. Do not allow grazing of treated area or harvest for hay. Do not plant crops such as corn, sorghum, or cereals within 60 days after last application. Follow label directions and precautions.
Quizalofop	3 pt Assure II /100 gal water	Use as a spot treatment to control annual species like volunteer corn and perennials like rhizome johnsongrass. Always apply with crop oil concentrate or nonionic surfactant. Apply on a "spray to wet" basis.
Sethoxydim	1 gal Poast Plus /100 gal water	Apply 1% solution as a spot treatment to control annual and perennial grasses. Always apply with crop oil concentrate. Apply spray for complete and uniform coverage but not to the point of runoff. Do not make more than one spot treatment in a given area per season. Do not apply broadcast and spot treatments in the same area in the same season. Follow label directions and precautions.

RECIRCULATING, ROLLER, AND ROPE-WICK APPLICATIONS

Apply glyphosate in an applicator to actively growing, susceptible weeds after they are a minimum of 6 inches above soybeans. Better results may be obtained if two applications are made in opposite directions. Operate equipment at ground speeds of less than 5 mph. Follow all label directions, warnings, and precautions.

Applicator	Gallons Glyphosate*:Water	Comments
Recirculating sprayer	0.5:20	Controls volunteer corn and shattercane.
Recirculating sprayer	0.75:20	Controls volunteer corn, shattercane, cocklebur, pigweed, sunflower, and johnsongrass.
Recirculating sprayer	1:20	Controls weeds listed above and suppresses milkweed and hemp dogbane.
Roller	1:19	A 5% solution for control of volunteer corn and shattercane.
Roller	1:9	A 10% solution for control of volunteer corn and shattercane. Suppresses johnsongrass, pigweed, giant ragweed, sunflower, velvetleaf, milkweed, and hemp dogbane.
Rope wick	1:2	This 33% solution in a rope wick should provide similar weed control to a 10% solution in the roller.

APPLICATION THROUGH SPOT SPRAYERS

Apply glyphosate with a directed stream to actively growing weeds. Applications in soybean must be made before pod set. Best results are obtained when at least three leaves of the weeds are contacted with the directed spray. Apply glyphosate:water at 1:20 gal. Controls cocklebur, velvetleaf, sunflower, shattercane, and other weeds. Non-Roundup Ready soybeans treated with glyphosate will be severely injured. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SOYBEAN

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
HARVEST AIDS		
Carfentrazone 0.016 to 0.023	1 to 1.5 oz Aim EC	For desiccation of susceptible broadleaf weeds. Apply after soybeans reach maturity but at least 3 days before harvest. Always apply with 1% v/v crop oil concentrate in a minimum spray volume of 5 gal/acre for aerial application or 10 gal/acre for ground application. Do not exceed a total of 1.5 oz/acre during the growing season.
Diquat 0.38 to 0.5	1.5 to 2 pt Reglone/Diquat	Use on seed crop only. For preharvest desiccation of foliage, apply 1 week before harvest. Do not allow grazing of treated areas or feed treated forage. Do not use seed from treated plants for food, feed, or oil.
Glyphosate 0.75 to 1.5 lb ae	1 to 2 qt of 3 lb ae/ gal Glyphosate* (See glyphosate table)	For control of broadleaf and grass weeds that can interfere with harvest, apply with ground or aerial equipment after soybean pods have lost all green color and at least 7 days before harvest. Glyphosate products vary in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Do not allow grazing or feed treated crop to livestock within 25 days of treatment. Do not apply to soybean being harvested for use as seed.
Paraquat 0.125 to 0.25	8 to 16 oz Gramoxone Inteon	For desiccation of crop and weed foliage to help facilitate harvest. Apply after soybeans reach physiological maturity and seed moisture is 30% or less and at least 15 days prior to harvest. Always apply with 0.25% v/v nonionic surfactant or a 1% v/v crop oil concentrate. Do not graze or harvest treated fields for forage or hay.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SUNFLOWER

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
EPTC 2 to 3	2.5 to 3.5 pt Eptam 7E or 10 to 15 lb Eptam 20G	Controls many grasses and certain broadleaf weeds. Apply just before planting and incorporate immediately. Use the low rate on light-textured soils.
Ethalfuralin 0.56 to 1.125	1.5 to 3 pt Sonalan	Controls grasses more effectively than broadleaf weeds. Apply before planting and incorporate within 48 hours. Can control shattercane. Follow label directions.
Glyphosate 0.38 to 0.75 lb ae	1 to 2 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply to control emerged weeds before or after sunflower planting but before crop emergence. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank. Follow label directions.
S-metolachlor 0.95 to 1.91	1 to 2 pt Dual Magnum or Charger Basic	Controls grasses and some small-seeded broadleaf weeds preemergence. Can be applied from 30 days before planting to crop emergence. Can be incorporated shallowly, but deep incorporation or excessive soil disturbance at planting may result in poor weed control. Use lower rates on coarse soils with low organic matter and the higher rates on fine textured soils with higher organic matter. Do not allow livestock to graze or feed in treated area.
Paraquat 0.63 to 1	2.5 to 4 pt Gramoxone Inteon	A restricted-use pesticide. Apply before crop emergence for control of emerged weeds. Paraquat is a contact herbicide and does not have soil activity. Always apply with a nonionic surfactant to 0.5% v/v.
Pendimethalin 0.5 to 1.5	1.2 to 3.6 pt Pendimethalin 3.3* or 1.5 to 3 pt Prowl H₂O	Controls grass weeds more effectively than broadleaf weeds. Refer to soybean weed-response table for weeds controlled with Prowl. Pendimethalin can be applied from 60 days before planting until crop emergence. Incorporation generally improves weed control in conventional tillage systems. Extremely cool, wet weather following application and sunflower planting can result in problems with sunflower emergence and injury. Do not feed forage or allow livestock to graze in treated fields. Follow label directions.
Sulfentrazone 0.094 to 0.25	3 to 8 oz Spartan 4F	Apply in the fall, preplant, or preemergence to sunflowers for control of pigweeds, kochia, Russian thistle, and certain other broadleaf weeds. The lower rates are for low organic matter, coarse-textured soils, and the higher rates are needed on fine-textured soils with higher organic matter content. Preplant treatments 14 days or more before planting have generally provided better weed control and crop tolerance than preemergence applications at planting time. Follow label directions.
Sulfentrazone + Cargentrazone 0.07 to 0.21 + 0.008 to 0.023	3 to 8.5 oz Spartan Charge	Apply in the fall, preplant, or preemergence to sunflowers for burndown and residual control of pigweeds, kochia, and other broadleaf weeds. The lower rates are for low organic matter, coarse-textured soils, and the higher rates are needed on fine-textured soils with higher organic matter content. May be tank mixed with glyphosate for improved grass burndown activity.
Sulfentrazone + Glyphosate 0.09 to 0.16 + 0.49 to 0.84	21 to 36 oz Spartan Advance	Apply in the fall, preplant, or preemergence to sunflowers for burndown and residual control of pigweeds, kochia, and other weeds. The lower rates are for low organic matter, coarse-textured soils, and the higher rates are needed on fine-textured soils with higher organic matter content. Supplemental glyphosate is recommended for adequate weed control with the lower Spartan Advance application rates.
Trifluralin 0.5 to 1	1 to 2 pt Trifluralin 4E*	Controls grasses more effectively than broadleaf weeds. Apply before planting and incorporate within 24 hours. Can control shattercane. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SUNFLOWER

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Clethodim 0.07 to 0.25	6 to 16 oz Select, Arrow, or Volunteer, or 9 to 16 oz Select Max	Controls annual and perennial grasses. Apply when grasses are actively growing but before they exceed size limits listed on the label. Apply Select and comparable products with oil concentrate at 1% v/v. Apply Select Max with nonionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v, plus ammonium sulfate at 2.5 to 4 lb/acre. Weed control is reduced if applied when grasses are under drought stress. Do not apply within 70 days of harvest. Do not allow grazing or use treated plants for feed or forage.
Imazamox 0.031	4 oz Beyond	Apply to Clearfield sunflowers only. Beyond will severely injure or kill non-Clearfield sunflower. Can be applied from the V2 through the V8 stage of sunflower for control of susceptible broadleaf weeds before they exceed 3 inches and susceptible grasses before they exceed the 4- to 5-leaf stage. Apply with nonionic surfactant and nitrogen fertilizer additives. May not control ALS-resistant kochia, pigweed, or shattercane biotypes. Temporary yellowing of sunflower plants may occur shortly after application of Beyond, especially when applied to crops growing under environmental stress. Do not plant corn, sorghum, cotton, or sunflower within 9 months of Beyond application.
Quizalofop 0.03 to 0.075	5 to 12 oz Assure II	Controls many annual and perennial grasses including shattercane, volunteer corn, and volunteer wheat. Apply with 1% v/v crop oil concentrate or 0.25% v/v nonionic surfactant. Weed control is reduced if applied when weeds are under drought stress. Do not graze or feed forage, hay, or straw from treated areas to livestock. Do not apply within 60 days of sunflower harvest.
Sethoxydim 0.1 to 0.28	1 to 2 pt Poast	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Apply to annual grasses up to 8 inches, volunteer corn up to 20 inches, shattercane 6 to 18 inches, volunteer wheat before tillering, and rhizome johnsongrass 15 to 25 inches tall. Higher rates are recommended in the western third of Kansas than in the eastern part of the state. Always apply with crop oil concentrate or Dash. Weed control is reduced if applied when grasses are under drought stress. Do not apply within 70 days of harvest. Do not use treated plants for feed or forage. Follow label directions and precautions.
Tribenuron 0.0078 to 0.0156	0.25 to 0.5 oz Express TS	Apply to ExpressSun sunflowers only. Express will severely injure or kill non-ExpressSun sunflower. Can be applied between the 1-leaf and the beginning of bud stage of sunflower growth for control of small, actively growing broadleaf weeds. Apply with methylated seed oil at 1% v/v. May not control ALS-resistant biotypes of kochia or pigweed. Temporary yellowing of sunflower plants may occur shortly after application of Express, especially when applied to crops growing under environmental stress. Do not apply within 70 days of sunflower harvest. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
HARVEST AIDS		
Glyphosate 0.75 lb ae	22 oz Roundup Weather Max, Roundup Original Max, or Roundup Power Max	Apply by ground or aerial equipment to control annual and perennial weeds and help facilitate harvest. Apply when sunflower seeds reach physiological maturity (when seed moisture is 35% or less). For many sunflower varieties, this stage is when the backs of heads are yellow and bracts are turning brown. Allow a minimum of 7 days between treatment and harvest for livestock feeding.
Paraquat 0.3 to 0.5	1.2 to 2 pt Gramoxone Inteon	A restricted-use pesticide. Always apply with nonionic surfactant. Apply with ground or aerial equipment 7 to 21 days before harvest to desiccate sunflower plants, broadleaf weeds, and grasses. Apply when sunflower seeds reach physiological maturity (when seed moisture is 35% or less). For many varieties, this stage is when backs of heads are yellow and bracts are turning brown. Do not allow grazing of treated areas or feed treated forage.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SUNFLOWER

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
HARVEST AIDS		
Sodium chlorate 6	1 gal Defol 6	Apply by ground or aerial equipment to facilitate harvest and reduce moisture in mature seed heads. Apply 7 or more days before harvest when seed heads are fully mature. Do not allow grazing of treated fields or feed treated forage.

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HERBICIDES FOR WINTER WHEAT

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED WHEAT HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS^{1,2}

	Crop Tolerance	Winter Annuals										Summer Annuals, Broadleaf							Perennials			
		Grasses					Broadleaf					Wild Buckwheat	Kochia	Lambsquarters	Prickly Lettuce	Pigweed	Pennsylvania Smartweed	Sunflower		Russian Thistle	Field Bindweed	
Herbicide(s)		Downy Brome	Japanese Brome	Cheat	Italian Ryegrass	Jointed Goatgrass	Blue Mustard	Treacle Mustard	Tumble Mustard	Field Pennycress	Shepherds-purse	Flixweed/Tansy Mustard	Henbit	Wild Buckwheat	Kochia	Lambsquarters	Prickly Lettuce	Pigweed	Pennsylvania Smartweed	Sunflower	Russian Thistle	Field Bindweed
Postemergence																						
WideMatch	G	—	—	—	—	—	F	F	F	F	F	F	—	E	E	P	E	—	F	E	F	F
2,4-D	G	—	—	—	—	—	E	E	E	E	E	E	P	F	F-G	E	E	E	F	G	E	F-G

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except where resistant weed populations have developed.

HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
HERBICIDES TO REDUCE TILLAGE IN FALLOW BEFORE PLANTING WINTER WHEAT		
Carfentrazone + 2,4-D 0.008 to 0.032 + 0.25 to 0.98 lb ae	8 to 32 oz Rage D-Tech	Provides burndown control of broadleaf weeds. A waiting interval of 30 days is required between application and planting wheat. Apply with oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v. Can be applied using liquid fertilizer as the spray carrier.
Chlorsulfuron + Metsulfuron 0.008 to 0.016 + 0.0016 to 0.0032	0.2 to 0.4 oz Finesse	Apply after wheat harvest in the fall or spring for broadleaf weed control. Always apply with a nonionic surfactant. Use in combination with tillage and a planned herbicide rotation program with other herbicides having different modes of action to minimize herbicide resistance problems. Do not use Finesse, Glean, Ally, or Amber on the same field within 24 months after application. Any remaining broadleaf weeds should be controlled before they produce seed to minimize the risk of resistant weed development. Do not rotate to oats for 10 months, to grain sorghum for 4 to 48 months, to non-STS soybeans for 14 months (east of Highway 183, west of Flint Hills), or to any other crop until a field bioassay has been completed. STS soybeans and IR corn hybrids can be planted 4 months after application if the soil pH is 7.5 or lower. Refer to the label for additional use and crop rotation guidelines.
Dicamba 0.13 to 2	0.25 to 4 pt Banvel, Clarity, Sterling Blue, Oracle, or Dicamba	Controls many annual and perennial broadleaf weeds. Apply to emerged and actively growing weeds after crop harvest and before a killing frost. Crop injury can occur if the interval between application and planting is less than 45 days/pt of product used/acre. Can be tank mixed with 2,4-D or glyphosate. Follow directions on product label(s).
Glyphosate 0.28 to 1.13 lb ae	12 to 48 oz of 3 lb/gal Glyphosate* (See glyphosate table)	For control of actively growing volunteer grains and some weeds such as downy brome and mustards up to 6 inches tall. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Can be used with dicamba or 2,4-D for enhanced control of certain broadleaf weeds. Apply in 3 to 10 gal spray/acre. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal water can increase performance of glyphosate. Dust on plants can reduce performance of glyphosate. Follow label directions.
Glyphosate + Dicamba 0.55 to 0.76 lb ae + 0.1 to 0.14	32 to 44 fl oz Fallow Master BS	Fallow Master BS is a premix of 2.2 lb glyphosate and 0.4 lb dicamba (Banvel)/gal. Can control volunteer grains and certain annual weeds. Apply this product at least 15 days before planting wheat. Addition of 2% ammonium sulfate by weight can increase performance. Follow label directions and precautions
Glyphosate + 2,4-D 0.28 to 0.75 lb ae + 0.5 to 1	12 to 32 oz of 3 lb ae /gal Glyphosate* (See glyphosate table) + 1 to 2 pt of 4 lb/gal 2,4-D*	For control of volunteer grains, downy brome, tansy mustard, and other weeds, apply to actively growing plants. The addition of 2% ammonium sulfate by weight (17 lb/100 gal water) can increase performance of glyphosate. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Follow directions, precautions, and cropping limitations on product label(s).
Metribuzin 0.38 to 0.75	0.5 to 1 lb Dimetric or Tricor	Apply after wheat harvest in fall or in early spring. Can be tank mixed with paraquat, glyphosate, or other burndown herbicides. Wheat can be seeded 120 days after application. Do not allow grazing of treated fields. Follow label directions.
Metsulfuron methyl + tank mix partner 0.0038	0.1 oz Ally or Metsulfuron* + appropriate rate of tank mix herbicide	For control of certain broadleaf weeds, apply as a postemergence treatment in fallow in combination with glyphosate, 2,4-D, dicamba, or residual fallow herbicides. Always apply with a nonionic surfactant. Do not apply Ally alone to fallow, and always till at least once before planting wheat. Ally should be used no more than once in a 22-month period, and any remaining broadleaf weeds should be controlled before they produce seed to minimize the risk of resistant-weed development.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
HERBICIDES TO REDUCE TILLAGE IN FALLOW BEFORE PLANTING WINTER WHEAT		
Paraquat 0.5 to 1.0	2 to 4 pt Gramoxone Inteon	A restricted-use pesticide. This contact herbicide is applied in clean water or nitrogen solutions to annual weeds 1 to 6 inches tall to control existing vegetation. Always apply with nonionic surfactant. Can be tank mixed with 2,4-D, or Banvel. Dust on plants can inactivate paraquat. Follow label directions.
Picloram + 2,4-D amine or LVE 0.13 to 0.25 + 0.5 to 1	0.5 to 1 pt Tordon 22K + 1 to 2 pt of 4 lb/gal 2,4-D*	Picloram is a restricted-use pesticide. For reduction of field bindweed and for control of many annual broadleaf weeds after wheat harvest and before planting winter wheat, barley, or oats in continuous small grain or small grain/fallow systems. Allow a minimum of 45 (0.5 pt Tordon) to 60 days (0.5 to 1 pt Tordon) between application and planting wheat. Do not treat with Tordon more than once each calendar year. Some injury to wheat can occur even when applied as directed, especially if dry conditions prevail. Consider the risk of crop injury, and apply as a spot treatment where feasible. Broadleaf crops are extremely susceptible to Tordon. Avoid spray drift, and do not rotate to susceptible broadleaf crops until 36 months after treatment. Follow label directions.
Triasulfuron + tank mix partner 0.013 to 0.022	0.28 to 0.47 oz Amber + appropriate rate	Apply after wheat harvest in the fall or spring. Must be tank mixed with a herbicide having a different mode of action. Always apply with a nonionic surfactant. Do not apply any herbicide with the same mode of action within 12 (pH < 7.5) to 15 (pH > 7.5) months after Amber application. Do not rotate to oats, barley, or rye for 6 to 18 months, grain sorghum for 14 to 24 months, soybeans or corn for 14 to 36 months, or any other crop until a field bioassay has been completed. Refer to the label for additional use and crop rotation guidelines.
2,4-D LVE 0.5 to 1.5	1 to 3 pt of 4 lb/gal 2,4-D*	Apply after wheat harvest and during fallow periods to control susceptible broadleaf weeds. Allow 2 weeks after a 0.5-inch rainfall for 2,4-D to degrade before planting wheat. Follow label directions.
PREPLANT AND/OR PREEMERGENCE		
Chlorsulfuron + Metsulfuron 0.0195 + 0.0039	0.5 oz Finesse or Report Extra	Provides suppression of light to moderate populations of cheat, Japanese brome, and downy brome and control of many broadleaf weeds. Apply preplant or preemergence to wheat seeding but before wheat and grass emergence. Cheatgrass suppression depends on precipitation before emergence. Do not use west of Highway 183. Do not apply to soils with a pH less than 5.0 or greater than 7.9. Any broadleaf weeds that escape Finesse control should be controlled with a sequential application of a herbicide having a different mode of action. Do not rotate to oats for 10 months, grain sorghum for 4 to 48 months, soybeans for 14 months (east of Highway 183, west of Flint Hills), or any other crop until a field bioassay has been completed. STS soybeans or IR corn hybrids can be planted 4 months after application if the soil pH is 7.5 or lower. Refer to the label for additional use and crop rotation guidelines.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
PREPLANT AND/OR PREEMERGENCE		
Sulfosulfuron 0.031	0.67 oz Maverick	Controls cheatgrass and certain broadleaf weeds. Apply after planting wheat but before wheat and weeds emerge. Preemergence Maverick treatments have been less consistent than fall postemergence applications. If wheat is planted into dry soils and continued dry weather is forecasted, delay Maverick treatment until wheat and weeds have emerged and are growing actively. Wheat can be grazed anytime after Maverick treatment. STS and IR corn can be planted 3 months after Maverick treatment if soil pH is less than 7.5 and cumulative precipitation exceeds 18 inches. Cotton and non-STS soybeans can be planted 12 months after Maverick treatment if soil pH is less than 7.5 and cumulative precipitation exceeds 30 inches. Planting sorghum, non-IR corn, or sunflower is not recommended until at least 22 months after Maverick treatment. Rotation to other crops or with shorter interval requires successful completion of a field bioassay, and no sooner than 3 months after Maverick application. The risk of Maverick carryover is greatest on high pH soils and with sorghum, sunflowers, alfalfa, or canola.
Triasulfuron 0.016 to 0.026	0.35 to 0.56 oz Amber	Provides suppression of light to moderate populations of cheat, Japanese brome, and downy brome and control of many broadleaf weeds. Apply preplant, preplant shallowly incorporated, or preemergence after wheat seeding but before wheat and grass emergence. Cheatgrass suppression depends on precipitation before emergence. Do not apply the 0.56 oz/acre rate on soils with a pH > 7.5. Do not apply any herbicide with the same mode of action within 12 (pH < 7.5) to 15 (pH > 7.5) months after Amber application. Any broadleaf weeds that escape Amber control should be controlled in the spring with a herbicide having a different mode of action. Do not rotate to oats, barley, or rye for 6 to 18 months, grain sorghum for 14 to 24 months, soybeans or corn for 14 to 36 months, or any other crop until a field bioassay has been performed. Refer to the label for additional use and crop rotation guidelines.
POSTEMERGENCE		
Bromoxynil 0.25 to 0.5	1 to 2 pt Buctril, Bromox, Brox, or Moxy	This is a contact herbicide for control of several broadleaf weeds. Apply in fall or in spring to seedling weeds until wheat reaches boot stage. Fall applications provide the best control of weeds that emerge in the fall. Can control wild buckwheat in spring. Can be tank mixed with MCPA, Banvel, Clarity, Glean, Ally, Harmony Extra, Amber, Finesse, 2,4-D, or Sencor. Do not allow grazing on fields for 45 days after application. Follow label directions.
Bromoxynil + MCPA 0.25 to 0.5 + 0.25 to 0.5	1 to 2 pt Bison, Bromox MCPA, or Brox M	Controls many broadleaf weeds. Apply to wheat after 3-leaf stage but before boot stage. Apply to seedling weeds before they reach size limits listed on labels. Can be tank mixed with Glean, Ally, Harmony Extra, Amber, Finesse, Sencor, or MCPA ester. Do not allow grazing on fields for 45 days after application. Follow label directions and precautions.
Bromoxynil + 2,4-D 0.25 to 0.5 + 0.25 to 0.5	1 to 2 pt Buctril, Bromox, Brox, or Moxy + 0.5 to 1 pt of 4 lb/gal 2,4-D*	This is a tank mix of bromoxynil and 2,4-D. Can control wild buckwheat and other broadleaf weeds. Apply after tillering but before jointing stage. Apply before weeds are past 3- to 4-leaf stage or more than 2 to 6 inches tall. Do not allow grazing on fields for 45 days after application. Follow directions and precautions on the bromoxynil label.
Carfentrazone 0.08 to 0.017	0.5 to 1 oz Aim EC	A contact herbicide for control of certain broadleaf weeds. Apply in the fall or spring to seedling weeds before jointing of wheat. Apply with nonionic surfactant at 0.25% v/v. May cause leaf burn on wheat leaves, especially with warm conditions at and following application. Can be tank mixed with Ally, Amber, Banvel, Clarity, Express, Finesse, Harmony Extra, Peak, 2,4-D, or MCPA.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Carfentrazone + 2,4-D 0.008 to 0.016 + 0.25 to 0.49 lb ae	8 to 16 oz Rage D-Tech	Provides control of broadleaf weeds. Apply in the fall or spring to wheat in the 3-leaf to jointing stage of growth for control of small, actively growing weeds. Apply with nonionic surfactant at 0.25% v/v. Do not graze dairy or meat animals for 14 days after application. Do not feed treated straw to livestock.
Chlorsulfuron 0.008 to 0.016	0.17 to 0.33 oz Glean or Report	Controls many broadleaf weeds. Apply after the 2-leaf but before the boot stage of wheat for control of weeds less than 2 inches tall or across. Apply with nonionic surfactant at 0.25% to 0.5% v/v. Can be applied with liquid N fertilizer, but do not use surfactant if liquid fertilizer is the carrier. Tank mixes can improve weed control and reduce the risk of herbicide-resistance problems. Glean can be tank mixed with MCPA, 2,4-D, Buctril, Clarity, or Banvel. The maximum Glean use rate is 0.33 oz/acre, which can be applied once per crop period east of Highway 183 and once every 36 months west of Highway 183. Do not rotate to oats or barley for 10 months, grain sorghum for 4 to 48 months, non-STS soybeans for 14 months (east of Highway 183, west of Flint Hills), or any other crop until a field bioassay has been performed. STS soybeans and IR corn hybrids can be planted 4 months after application if the soil pH is 7.5 or lower. Do not apply to soils with a pH above 7.9. Refer to the label for additional use and crop rotation guidelines.
Chlorsulfuron + Metsulfuron methyl 0.008 to 0.016 + 0.0016 to 0.0031	0.2 to 0.4 oz Finesse or Report Extra	Controls many broadleaf weeds. Apply after 2-leaf stage but before boot stage of wheat. Always apply with a nonionic surfactant at 0.25 to 0.5% v/v. Can be applied with liquid nitrogen fertilizer, but do not add surfactant if liquid fertilizer is the carrier. Use higher rate for wild buckwheat control and extended residual control. Tank mixes can improve weed control and reduce the risk of herbicide-resistance problems. Finesse can be tank mixed with Banvel, Clarity, Buctril, MCPA, Sencor, or 2,4-D. Do not apply to soils with a pH below 5.0 or above 7.9. In western tier of Kansas counties, the maximum use rate is 0.3 oz/acre applied not more than once every 24 months. Do not rotate to oats for 10 months, grain sorghum for 4 to 48 months, non-STS soybeans for 14 months (east of Highway 183, west of Flint Hills), or any other crop until a field bioassay has been performed. STS soybeans and IR corn hybrids can be planted 4 months after application if soil pH is 7.5 or lower. Refer to label for additional use and crop rotation guidelines.
Dicamba 0.06 to 0.125	2 to 4 fl oz Banvel, Sterling Blue, Clarity, Oracle or Dicamba	Controls certain broadleaf weeds. Apply after the 2-leaf stage but before the wheat joints in the spring. Application after jointing increases the risk of crop injury. Generally applied as a tank mix with another broadleaf herbicide for broad-spectrum broadleaf weed control. Can be tank mixed with Glean, Amber, Finesse, Ally, Express, Harmony Extra, Buctril, MCPA, or 2,4-D. Do not apply with surfactant unless tank mixing with a sulfonyleurea herbicide. Refer to the label for grazing and hay restrictions.
Dicamba + 2,4-D 0.06 to 0.13 +0.25 to 0.38	2 to 4 fl oz Banvel, Clarity, or Sterling Blue + 0.5 to 0.75 pt of 4 lb/gal 2,4- D* , or 0.5 to 1 pt WeedMaster, Brash, or RangeStar	Apply to small, actively growing weeds after winter dormancy but before joint stage of wheat. Controls wild buckwheat and other broadleaf weeds. Follow label restrictions for pasture and hay for lactating dairy animals.
Diclofop 0.5 to 1	1.33 to 2.67 pt Hoelon	A restricted-use pesticide. Primarily used for Italian ryegrass control. Apply postemergence in the fall or spring before wheat jointing for control of Italian ryegrass with up to 2 tillers. Do not apply 2,4-D, MCPA, or dicamba within 5 days of Hoelon application, or grass weed control may be reduced. Do not apply when wheat and weeds are dormant and not actively growing. Do not allow livestock to graze treated fields for 28 days after treatment, or harvest forage, hay, or straw from treated fields before grain harvest.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Florasulam + MCPA 0.0044 + 0.31	17 oz Orion	Controls certain broadleaf weeds. Apply from the 3-leaf stage until jointing of wheat for control of small, actively growing weeds that have emerged at the time of application. Livestock can graze treated area 7 days after application. Do not apply within 60 days of harvest. Do not plant corn or sorghum within 3 months, or alfalfa, soybeans, and sunflowers within 9 months after application. For kochia or Russian thistle control, tank mix with Starane or Huskie. Tank mix with metsulfuron for improved henbit control.
Flucarbazone + Chlorsulfuron 0.018 to 0.026 + 0.009 to 0.014	0.6 to 0.9 oz Finesse Grass & Broadleaf	Finesse Grass & Broadleaf is a premix of chlorsulfuron (Glean) and flucarbazone (Everest) herbicides. Controls cheat, Japanese brome, Italian ryegrass, and many broadleaf weeds. Much less effective for downy brome control than for cheat or Japanese brome. Apply in the fall to small, actively growing weeds after wheat is in the 2-leaf stage of growth but before grasses exceed the 2-tiller growth stage. Can be applied in liquid nitrogen fertilizer carrier. Apply with 0.25 to 0.5% v/v nonionic surfactant plus 2 qt/acre liquid nitrogen fertilizer when applied in water carrier, 0.06 to 0.25% v/v nonionic surfactant with up to 50% liquid nitrogen carrier, and with no nonionic surfactant if applied in greater than 50% liquid nitrogen carrier. Application in liquid nitrogen carrier tends to increase cheatgrass control and the risk of crop injury. Do not use if soil pH is greater than 7.9. Do not replant wheat until 4 months after application. Do not rotate to soybeans for 14 to 48 months depending on geography, soil pH, and cumulative precipitation. Do not rotate to other crops until the completion of a successful field bioassay. Consult the label for additional use and crop rotation guidelines.
Fluroxypyr 0.105 to 0.14	0.3 to 0.4 pt Starane Ultra	Controls kochia, including ALS-resistant kochia, and certain other broadleaf weeds. Apply to small, actively growing weeds after winter dormancy but before the early boot stage of wheat. Often applied as a tank mix with other herbicides for broad-spectrum broadleaf weed control. Do not harvest treated forage or allow livestock to graze treated area within 7 days of application. Do not plant any crop except wheat, barley, oats, corn, or sorghum within 120 days after application.
Fluroxypyr + Clopyralid 0.125 + 0.125	1.33 pt WideMatch	Controls Canada thistle, musk thistle, bull thistle, kochia, and wild buckwheat. Does not control most winter annual mustard species very well. Apply to small, actively growing weeds when wheat is from the 3-leaf through the flag-leaf emergence stage of growth. Do not plant alfalfa or grain sorghum for 10.5 months; soybeans, dry beans, or sunflowers for 10.5 to 18 months; or cotton until at least 10.5 months, and conduct a field bioassay after WideMatch application.
Fluroxypyr + 2,4-D 0.25 + 0.5	1.33 pt Starane Plus Salvo	Controls kochia, including ALS-resistant kochia, and most broadleaf weeds. Apply to small, actively growing weeds after winter dormancy but before the early boot stage of wheat. Do not harvest treated forage or allow livestock to graze treated area within 7 days of application. Do not plant any crop except wheat, barley, oats, corn, or sorghum within 120 days after application.
Imazamox 0.031 to 0.047	4 to 6 oz Beyond	Apply to Clearfield wheat only. Beyond will severely injure or kill non-Clearfield wheat. Controls cheatgrass, jointed goatgrass, and many broadleaf weeds and suppresses feral rye. Can be applied to wheat between tiller initiation to jointing. Fall applications have generally provided better control of winter annual grasses than spring applications. Do not apply when wheat and weeds are dormant and not actively growing. Apply with nonionic surfactant and nitrogen fertilizer additives. Do not tank mix with sulfonylurea herbicides. Do not plant corn, sorghum, cotton, or sunflowers within 9 months of Beyond application.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Imazamox + MCPA 0.031 to 0.047 + 0.25 to 0.375	12 to 18 oz Clearmax	Clearmax is a co-pack of imazamox (Beyond) and MCPA herbicides. Apply to Clearfield wheat only. Clearmax will severely injure or kill non-Clearfield wheat. Controls cheatgrass, jointed goatgrass, and many broadleaf weeds and suppresses feral rye. Can be applied to wheat between tiller initiation and jointing. Fall applications have generally provided better control of winter annual grasses than spring applications. Clearmax can provide improved control of certain broadleaf weeds, including ALS-resistant biotypes, compared with Beyond. Do not apply when wheat and weeds are dormant and not actively growing. Apply with nonionic surfactant and nitrogen fertilizer additives. Do not tank mix with sulfonyleurea herbicides. Do not plant corn, sorghum, cotton, or sunflower within 9 months of Clearmax application.
Mesosulfuron 0.013	4.75 oz Osprey	Controls Italian (annual) ryegrass. Apply to actively growing weeds after wheat emergence but before the jointing stage of growth. Applications before wheat tiller initiation have a greater risk of stunting the crop. Must be applied with MSO or nonionic surfactant plus nitrogen fertilizer adjuvants. Topdress liquid nitrogen fertilizer applications are not recommended within 21 days of Osprey treatment because of the increased potential for crop injury. Can be tank mixed with Ally, Finesse, Harmony Extra, MCPA ester, or Starane. Do not plant barley, sunflowers, soybeans, or cotton until 90 days, corn until 12 months, or any other crop until 10 months after Osprey application.
Metribuzin 0.19 to 0.5	2 to 10 oz Dimetric or Tricor	Can control winter annual weeds such as cheat, downy brome, and mustards. Apply only on selected varieties of dryland winter wheat in fall or early spring. Wheat varieties differ in tolerance to metribuzin. Refer to the label for information on sensitive and tolerant varieties. Can be applied to wheat from the 2-leaf to jointing stage of growth, depending on application rate. Do not apply when wheat is in winter dormancy. Fall applications generally provide better cheatgrass control than spring applications. Can be tank mixed with 2,4-D, Banvel, Clarity, Buctril, Ally, Amber, Finesse, Glean, Harmony Extra, or MCPA. Crop injury can occur from application to wheat that was seeded less than 1 inch deep, on coarse-textured soils, soils low in organic matter, calcareous soils, or soils with a pH above 7.7. Do not allow grazing on treated fields for 14 days after application. Follow directions on all product labels.
Metsulfuron methyl + MCPA or 2,4-D 0.0038 + 0.25 to 0.50	0.1 oz Ally or Metsulfuron* + 0.5 to 1 pt of 4 lb/gal MCPA or 2,4-D*	Controls many broadleaf weeds. Apply with MCPA in the fall or spring after the 2-leaf stage but before the boot stage of wheat. Apply with 2,4-D in the spring after the wheat is fully tillered but before the early boot stage. Apply to small, actively growing weeds up to 2 inches tall or across. Surfactant should be used at 0.12 to 0.25% v/v. Do not rotate to sorghum, STS soybeans, IR corn, or proso millet for 4 months, barley or oats for 10 months, non-IR corn for 12 months, non-STS soybeans for 12 to 34 months, or sunflower for 22 months after Ally application. Do not use on soil with pH above 7.9.
Pinoxaden 0.054	16.4 oz Axial XL	Controls Italian ryegrass. Apply postemergence to actively growing plants when Italian ryegrass is in the 1- to 5-leaf stage and wheat is in the 2-leaf to pre-boot stage of growth. Do not graze livestock or harvest forage for hay from treated areas for a minimum of 50 days after application.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Propoxycarbazone 0.026 to 0.039	0.6 to 0.9 oz Olympus	Controls cheatgrass and certain broadleaf weeds. Apply to small, actively growing weeds after wheat emergence but before the jointing stage of growth. Applications before wheat tiller initiation have a greater risk of stunting the crop. Cheat and Japanese brome are more susceptible than downy brome and generally are controlled adequately in both fall and spring with the 0.6 oz rate. Fall applications at 0.9 oz are recommended for downy brome control. Apply with nonionic surfactant at 0.25 to 0.5% v/v. Liquid nitrogen fertilizer can be used as a spray carrier. Fall applications in liquid fertilizer solutions should not exceed 50% liquid nitrogen and no more than 30 pounds of actual nitrogen per acre. Only add 0.25% v/v surfactant when applied with fertilizer carrier. Can be tank mixed with 2,4-D, Ally, Amber, Finesse, Harmony Extra, MCPA, Banvel, Clarity, Starane, or Rave. STS soybeans can be planted 4 months after Olympus treatment. Cotton, grain sorghum, sunflowers, and non-STS soybeans can be planted 12 months after Olympus treatment if cumulative precipitation exceeds 24 inches. Corn can be planted 18 months after Olympus application if cumulative precipitation exceeds 30 inches. Rotation to other crops or with shorter interval requires successful completion of a field bioassay, and no sooner than 4 months after Olympus application.
Propoxycarbazone + Mesosulfuron 0.013 to 0.015 + 0.008 to 0.01	3 to 3.5 oz Olympus Flex	Olympus Flex is a premix of Olympus and Osprey. Controls cheatgrass, Italian ryegrass, and many winter annual broadleaf weeds. Apply to small, actively growing weeds after wheat emergence but before the jointing stage of growth. Applications before wheat tiller initiation have a greater risk of stunting the crop. Cheat and Japanese brome are more susceptible than downy brome. Apply with nonionic surfactant at 0.5 % v/v plus 28% UAN fertilizer at 1 to 2 qt/acre or ammonium sulfate at 1.5 to 3 lb/acre. Methylated seed oil or basic blend adjuvants may be used as alternatives to nonionic surfactant plus fertilizer adjuvants. Liquid nitrogen fertilizer can be used as part of the spray carrier, but only up to 50% of the total spray solution and not greater than 30 lb of actual nitrogen per acre. Application with fertilizer carrier should include 0.25% nonionic surfactant and may increase the risk of crop injury. The recommended intervals before planting rotational crops are 5 months for soybeans, 9 months for grain sorghum, 10 months for cotton, and 12 months for sunflower, canola, or corn. Rotation to other crops or with shorter intervals requires successful completion of a field bioassay, and no sooner than 4 months after Olympus Flex application.
Prosulfuron 0.15 to 0.29	0.25 to 0.5 oz Peak	Controls many broadleaf weeds. For control of small weeds, apply after wheat is in the 3-leaf stage but before the second node is detectable in stem elongation. For wild buckwheat control, apply after true leaves have developed on seedling plants. Apply with nonionic surfactant at 0.25 to 0.5% v/v. Apply as a tank mix with another broadleaf herbicide with a different mode of action in areas of known weed resistance. Can be tank mixed at the lower application rates with 2,4-D, MCPA, Banvel, Clarity, or Buctril. Do not rotate to soybeans or canola for 10 months, alfalfa for 15 months, or sunflowers for 24 months after Peak application. Do not allow grazing or feed forage from treated fields until 30 days after application.
Pyrasulfotole + Bromoxynil 0.021 to 0.028 + 0.16 to 0.22	11 to 15 oz Huskie	Controls many broadleaf weeds as a fall or spring application when weeds are small and actively growing. Apply when wheat is between the 1-leaf and flag leaf emergence stages of growth. Can be tank mixed with Ally, MCPA, 2,4-D, or dicamba. Apply with nonionic surfactant at 0.25 to 0.5% v/v plus ammonium sulfate at 0.5 to 1 lb/acre or ammonium nitrogen fertilizer at 1 to 2 qt/acre. Huskie may be applied with liquid nitrogen fertilizer as the spray carrier. Do not graze or harvest forage for 25 days after application.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Pyroxulam 0.0164	3.5 oz PowerFlex	Controls cheatgrass, Italian ryegrass, and many winter annual broadleaf weeds. Apply to small, actively growing weeds in wheat in the fall or spring from the 3-leaf stage up to jointing. Best control is obtained on grasses from 2-leaf to 2-tiller and before broadleaves are 2 inches tall or 2 inches in diameter. Cheat and Japanese brome are more susceptible than downy brome. Apply with a nonionic surfactant at 0.25 to 0.5% v/v. UAN fertilizer at 1 to 2 qt/acre or ammonium sulfate at 1.5 to 3 lb/acre can also be added for enhanced weed control. Liquid nitrogen can be used as a spray carrier. The spray solution should not be more than 50% liquid nitrogen and should not exceed 30 lb of actual nitrogen per acre. Only use nonionic surfactant at 0.25% v/v when applied in nitrogen carrier. May be tank mixed with labeled rates of other broadleaf herbicides as needed for optimal control. Do not mix with products containing dicamba or amine formulations of 2,4-D or MCPA as these products may antagonize grass control. Alfalfa, barley, canola, corn, cotton, sorghum, soybeans, or sunflowers can be planted 9 months after PowerFlex application. Wheat should not be grazed until 7 days after application or harvested for hay until 28 days after application.
Sulfosulfuron 0.031	0.67 oz Maverick	Controls cheatgrass and certain broadleaf weeds. Apply after wheat is in the 2-leaf stage but before jointing for control of small, actively growing weeds. Fall applications have provided better cheatgrass control than spring applications. Do not apply when wheat and weeds are dormant and not growing actively. Apply with nonionic surfactant at 0.5% v/v. Liquid nitrogen fertilizer can be used at a maximum of 50% of the spray carrier volume. Nonionic surfactant should be used at 0.25% v/v when fertilizer is part of the carrier. Can be tank mixed with 2,4-D, Ally, Glean, Finesse, Express, Harmony Extra, Bucril, or MCPA. Wheat can be grazed immediately after application but should not be harvested for hay until 30 days after application. STS and IR corn can be planted 3 months after Maverick treatment if soil pH is less than 7.5 and cumulative precipitation exceeds 18 inches. Cotton and non-STS soybeans can be planted 12 months after Maverick treatment if soil pH is less than 7.5 and cumulative precipitation is over 30 inches. Planting sorghum, non-IR corn, or sunflower is not recommended until at least 22 months after Maverick treatment. Rotation to other crops or with shorter interval requires successful completion of a field bioassay, and no sooner than 3 months after Maverick application. Risk of Maverick carryover is greatest on high pH soils.
Thifensulfuron + MCPA or 2,4-D 0.014 to 0.028 + 0.25 to 0.38	0.45 to 0.9 oz Harmony SG + 0.5 to 0.75 pt of 4 lb/gal MCPA or 2,4-D*	Controls many broadleaf weeds and wild garlic. Apply with MCPA in the fall or spring after the 2-leaf stage of wheat but before the flag leaf is visible. Apply with 2,4-D in the spring after wheat is fully tillered but before the flag leaf is visible. Apply with a nonionic surfactant at 0.12 to 0.25% v/v to small, actively growing weeds. Use 0.75 to 0.9 oz/acre for wild buckwheat or wild garlic control. Does not provide residual weed control, but any crop can be planted 45 days after treatment. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
Thifensulfuron + Tribenuron 0.009 to 0.019 + 0.005 to 0.009	0.45 to 0.9 oz Harmony Extra SG or 0.3 to 0.6 oz Nimble	Controls many broadleaf weeds and wild garlic. For control of weeds less than 4 inches tall or across, apply after wheat is at the 2-leaf stage but before the flag leaf is visible. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Apply as a tank mix with another broadleaf herbicide having a different mode of action in areas of known weed resistance. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Thifensulfuron + Tribenuron 0.003 to 0.0156 + 0.003 to 0.0156	0.4 to 1 oz Affinity BroadSpec	Controls many broadleaf weeds. For control of weeds less than 4 inches tall or across, apply after wheat is at the 2-leaf stage but before the flag leaf is visible. Apply with nonionic surfactant at 0.12 to 0.5% v/v or an oil concentrate at 1% v/v. Apply as a tank mix with another broadleaf herbicide having a different mode of action in areas of known weed resistance and at rates of 0.6 or less. Generally recommended for use in western Kansas. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
Thifensulfuron + Tribenuron 0.015 to 0.25 + 0.004 to 0.006	0.6 to 1 oz Affinity TankMix	Controls many broadleaf weeds. Apply after wheat is in the 2-leaf stage but before the flag leaf is visible for control of actively growing weeds less than 4 inches tall or across. Apply with a nonionic surfactant at 0.25 to 0.5% v/v or with an oil concentrate at 1% v/v. Recommended to be used in combination with other wheat herbicides having a different mode of action. Generally recommended for use in eastern and central Kansas. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
Thifensulfuron + Tribenuron + Metsulfuron 0.0047 to 0.009 + 0.0023 to 0.0047 + 0.0019 to 0.0038	0.3 to 0.5 oz Ally Extra SG or 0.2 to 0.4 oz Accurate Extra	Controls many broadleaf weeds and wild garlic. For control of weeds less than 4 inches tall or across, apply after wheat is at the 2-leaf stage but before the flag leaf is visible. Apply with a nonionic surfactant at 0.12 to 0.25% v/v. Apply as a tank mix with another broadleaf herbicide having a different mode of action in areas of known weed resistance. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock. Do not apply to soils with a pH greater than 7.9. Crop rotation restrictions differ with application rate, soil pH, and geography. Refer to the label for crop rotation guidelines.
Thifensulfuron + Tribenuron + Metsulfuron + dicamba 0.0047 to 0.0094 + 0.0024 to 0.0048 + 0.0019 to 0.0038 + 0.58 to 0.116	1.6 to 3.2 oz Agility SG	Agility SG is a premix of Ally Extra SG plus dicamba. Apply after wheat is in the 2-leaf stage but before jointing of wheat for control of most broadleaf weeds. Can be applied with water, liquid nitrogen fertilizer, or a mixture of both as a carrier. If 50% or more of the carrier is liquid nitrogen fertilizer, a surfactant is not recommended. Otherwise, apply with a nonionic surfactant at 0.125 to 0.25% v/v. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock. Crop rotation restrictions differ with application rate, soil pH, and geography. Do not rotate to sorghum, STS soybeans, or proso millet for 4 months, corn for 12 months, sunflowers for 10 to 22 months, non-STC soybeans for 12 to 34 months, or other crops for 34 months unless a successful field bioassay is completed prior to planting the rotational crop.
Triasulfuron 0.013 to 0.022	0.28 to 0.47 oz Amber	Controls many broadleaf weeds. Apply before boot stage of wheat. Use the higher rate for control of wild buckwheat and extended residual control. Can be applied with water, liquid nitrogen fertilizer, or mixture of both as a carrier. If 50% or more of the carrier is nitrogen fertilizer, no surfactant is needed. Otherwise, apply with a nonionic surfactant at 0.25 to 0.5% v/v. Tank mixes can improve weed control and reduce risk of herbicide resistance problems. Amber can be tank mixed with Banvel, Clarity, Buctril, MCPA, Sencor, or 2,4-D. Do not apply any herbicide with same mode of action within 12 (pH < 7.5) to 15 (pH > 7.5) months after Amber application. Do not rotate to oats, barley, or rye for 6 to 18 months, grain sorghum for 14 to 24 months, soybeans or corn for 14 to 36 months, or any other crop until a field bioassay is performed. Refer to label for additional use and crop rotation guidelines.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Triasulfuron + Dicamba 0.011 to 0.022 + 0.06 to 0.125	2 to 4 oz Rave	Rave is a premix of Amber and dicamba. Controls many broadleaf weeds. Apply after emergence but before jointing of wheat. Can be applied with water, liquid nitrogen fertilizer, or a mixture of both as a carrier. If 50% or more of the carrier is liquid nitrogen fertilizer, a surfactant is not recommended. Otherwise, apply with a nonionic surfactant at 0.25 to 0.5% v/v. Do not rotate to barley, oats, or rye for 6 to 18 months, corn for 14 to 36 months, sorghum for 14 to 24 months, STS soybeans for 11 months, non-STs soybeans for 14 to 26 months, or alfalfa for 24 months, and have a field bioassay performed, depending on soil pH and precipitation. In the event of catastrophic crop loss, grain sorghum and STS soybeans can be planted 4 months after application if the grower is willing to accept the risk of crop injury. Refer to the label for additional use and crop rotation guidelines.
Tribenuron 0.0078 to 0.015	0.25 to 0.5 oz Express TS or 0.17 to 0.33 oz Nuance	Controls many broadleaf weeds but is weak on wild buckwheat and pigweed species. For control of weeds less than 4 inches tall or across, apply after wheat is in the 2-leaf stage but before the flag leaf is visible. Apply with a nonionic surfactant at 0.25% to 0.5% v/v. Apply as a tank mix with another broadleaf herbicide in areas of known weed resistance. Can be tank mixed with MCPA, 2,4-D, Banvel, Clarity, or Buctril. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
2,4-D 0.25 to 0.5 LVE, or 0.25 to 0.75 amine	0.5 to 1 pt of 4 lb/gal 2,4-D* LVE or 0.5 to 1.5 pt of 4 lb/gal 2,4-D amine	Controls many broadleaf weeds but not wild buckwheat. The least injury to wheat can be expected if applied between full tiller (about 4 to 8 inches) and early boot stages. Likelihood of injury is increased if 2,4-D is applied to wheat in the fall when it is not tillered fully. Can be applied in nitrogen fertilizers. Do not apply when wheat is between early boot stage and milk stage. Do not allow grazing on treated fields within 2 weeks after treatment. Follow label directions.
2,4-D 0.75 to 1 LVE	1.5 to 2 pt of 4 lb/gal 2,4-D* LVE	Can be used to control wild garlic (wild onion). The least injury to wheat can be expected if 2,4-D is applied after full tiller stage (when wheat is 4 to 8 inches tall) but before wheat plants elongate rapidly or enter joint stage. This rate will not consistently kill wild garlic, but it reduces production of aerial bulblets and knocks down tops of plants.
PREHARVEST		
Carfentrazone 0.016 to 0.031	1 to 2 oz Aim EC	For dessication of susceptible broadleaf weeds. Apply after wheat is mature but at least 3 days before harvest. Always apply with 1% v/v crop oil concentrate in a minimum spray volume of 5 gal/acre for aerial application and 10 gal/acre for ground applications. Do not apply more than 2 oz of Aim during the growing season.
Carfentrazone + 2,4-D 0.016 to 0.032 + 0.49 to 0.8 lb ae	16 to 32 oz Rage D-Tech	Apply after wheat reaches the hard dough stage to control large, actively growing broadleaf weeds that can interfere with harvest. Apply with oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v. Do not harvest wheat until at least 7 days after application. Do not graze dairy or meat animals for 14 days after application. Do not feed treated straw to livestock.
Dicamba + 2,4-D 0.25 + 0.5 to 1 amine or LVE	0.5 pt Clarity or Sterling Blue + 0.5 to 1 qt of 4 lb/ gal 2,4-D*, or 1 to 2 pt WeedMaster , Brash , or RangeStar	This is a tank mix of Clarity and 2,4-D for control of susceptible broadleaf weeds that can interfere with harvest of fall-seeded wheat. Apply when wheat is in the hard dough stage and green color is gone from nodes of stem. A waiting period of 10 to 14 days is required before harvest. Do not allow grazing or use feed from treated area.

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HERBICIDES FOR WINTER WHEAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
PREHARVEST		
Glyphosate + 2,4-D 0.5 to 1 + 0.5 to 1	1 to 2 pt of 3 lb ae/gal Glyphosate* (See glyphosate table) + 1 to 2 pt 2,4-D*	For control of broadleaf and grass weeds that can interfere with harvest, apply when wheat is in the hard dough stage (30% or less grain moisture) and at least 7 days before harvest. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Do not feed treated straw or permit dairy animals or meat animals being finished for slaughter to graze treated grain fields within 2 weeks after treatment. Not recommended for wheat being harvested for use as seed.
Metsulfuron methyl + 2,4-D 0.0038 + 0.25 to 1	0.1 oz Ally or Metsulfuron* + 0.5 to 2 pt of 4 lb/gal 2,4-D*	For control of broadleaf weeds, apply when wheat is in the dough stage and at least 10 days before harvest. Always apply with a nonionic surfactant at 0.25 to 0.5% v/v. Do not use on soils with a pH greater than 7.9. Weeds growing under limited moisture may not be controlled. Do not use treated straw for livestock feed.
2,4-D LVE 0.67 to 1	0.67 to 1 qt of 4 lb/gal 2,4-D* LVE	Apply when wheat is in the hard dough stage to control large, actively growing broadleaf weeds that can interfere with harvest. Weeds growing under limited moisture may not be controlled. Do not use treated straw for livestock feed.
FOR SPOT TREATMENT ONLY		
Glyphosate	1.28 to 2.56 fl oz Glyphosate* /gal spray solution (See glyphosate table)	Apply as spot treatment to control annual and some perennial weeds. Apply at the recommended stage of weed growth before wheat begins heading. Crop in treated area will be killed. Avoid drift outside target area.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SPRING-SEEDED OAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Bromoxynil 0.25 to 0.38	1 to 1.5 pt Buctril, Bromox, or Moxy	Apply before seedling weeds are past 3- to 4-leaf stage or 1.5 inches in diameter. Apply to oats from 1-leaf to boot stage. Can be used to control wild buckwheat. Do not allow grazing on treated fields for 30 days after application.
Bromoxynil + 2,4-D 0.25 to 0.38 + 0.25	1 to 1.5 pt Buctril, Bromox, Brox, or Moxy + 0.5 pt of 4 lb/gal 2,4-D*	Can control wild buckwheat and other broadleaf weeds. Apply before weeds are past 3- to 4-leaf stage or more than 1.5 inches in diameter. Apply after tillering but before jointing stage of oats. Do not allow grazing on fields for 30 days after application.
Bromoxynil + MCPA 0.25 to 0.38 + 0.25 to 0.38	1 to 1.5 pt Bromox MCPA, Bison, or Brox M	Controls many broadleaf weeds. Apply to oats after the 3-leaf stage but before boot stage. Most effective on small, seedling weeds.
Carfentrazone 0.08 to 0.017	0.5 to 1 oz Aim EC	A contact herbicide for control of certain broadleaf weeds. Apply before jointing of oats for control of seedling weeds. Apply with nonionic surfactant at 0.25% v/v. May cause leaf burn on oat leaves, especially with warm conditions at and following application.
Carfentrazone + 2,4-D 0.008 to 0.016 + 0.25 to 0.49 lb ae	8 to 16 oz Rage D-Tech	Provides control of broadleaf weeds. Apply to oats in the 3-leaf to jointing stage of growth for control of small, actively growing weeds. Apply with nonionic surfactant at 0.25% v/v. Do not graze dairy or meat animals for 14 days after application. Do not feed treated straw to livestock.
Chlorsulfuron 0.008 to 0.015	0.17 to 0.33 oz Glean or Report	Controls many broadleaf weeds. For control of weeds less than 2 inches tall or across, apply after the 2-leaf but before the boot stage of spring oats. Apply with nonionic surfactant at 0.25% to 0.5% v/v. Tank mixes can improve weed control and reduce the risk of herbicide resistance problems. Glean can be tank mixed with MCPA, 2,4-D, Buctril, Clarity, or Banvel. Can be applied with liquid N fertilizer, if compatible, but then do not use surfactant. Glean can be applied once per crop period east of Highway 183 and once every 36 months west of Highway 183. STS soybeans, grain sorghum, and IR corn hybrids can be planted 4 months after Glean application if the soil pH is 7.5 or lower. Do not plant oat or barley for 10 months, non-STS soybean for 14 to 26 months, or any other crop until a field bioassay has been performed. Refer to label for additional crop rotation restrictions and sprayer tank cleaning procedures. Do not apply on soil with pH higher than 7.9.
Dicamba 0.13	0.25 pt Banvel, Clarity, Sterling Blue	Apply to small, actively growing weeds when oats are in the 2- to 3-leaf stage. Can control wild buckwheat. Do not allow grazing or harvest for dairy feed before milk stage of oats.
Florasulam + MCPA 0.0044 + .031	17 oz Orion	Controls certain broadleaf weeds. Apply from the 3-leaf stage until jointing of oats for control of small, actively growing weeds that have emerged at the time of application. Livestock can graze treated area 7 days after application. Do not apply within 60 days of harvest. Do not plant corn or sorghum within 3 months, or alfalfa, soybeans, and sunflowers within 9 months after application. For kochia or Russian thistle control, tank mix with Starane or Buctril. For henbit control, tank mix with metsulfuron.
Fluroxypyr + 2,4-D 0.25 + 0.5	1.33 pt Starane Plus Salvo	Controls kochia, including ALS-resistant kochia, and most broadleaf weeds. Apply to small, actively growing weeds after oats are fully tillered but before the early boot stage. Do not harvest treated forage or allow livestock to graze treated area within 7 days of application. Do not plant any crop except wheat, barley, oats, corn, or sorghum within 120 days after application.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR SPRING-SEEDED OAT

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Mesotrione 0.094	3 oz Callisto	Controls various grass and broadleaf weeds. Apply to emerged weeds less than 5 inches tall and at least 50 days prior to oat harvest. Apply with nonionic surfactant at 0.25% v/v. May result in temporary crop injury. Avoid tank mixing with EC formulation pesticides. Do not graze or feed forage within 30 days after application.
Prosulfuron 0.15 to 0.29	0.25 to 0.5 oz Peak	Controls many broadleaf weeds. For control of small broadleaf weeds, apply after oats are in the 3-leaf stage but before a second node is detectable as stem elongates. Apply with nonionic surfactant at 0.25 to 0.5% v/v. Apply as a tank mix with another broadleaf herbicide in areas of known weed resistance. Can be tank mixed at the lower application rates with 2,4-D, MCPA, Clarity, Banvel, or Buctril. Do not rotate to soybeans or canola for 10 months, alfalfa for 15 months, or sunflowers for 24 months following Peak application. Do not allow grazing or feed forage from treated fields until 30 days after treatment. Follow label directions and precautions.
Thifensulfuron 0.014 to 0.019	0.45 to 0.6 oz Harmony SG or 0.3 to 0.4 oz Unity or Harass	Controls many broadleaf weeds and wild garlic. For control of weeds less than 4 inches tall or across, apply after oats are in the 3-leaf stage but before jointing. Apply with a nonionic surfactant at 0.25% v/v. Do not apply to Ogle, Porter, or Premier oat varieties. Apply as a tank mix with another broadleaf herbicide having a different mode of action in areas of known weed resistance. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
Thifensulfuron + Tribenuron 0.009 to 0.012 + 0.005 to 0.007	0.45 to 0.6 oz Harmony Extra SG or 0.3 to 0.4 oz Nimble	Controls many broadleaf weeds and wild garlic. For control of weeds less than 4 inches tall or across, apply after oats are in the 3-leaf stage but before jointing. Apply with a nonionic surfactant at 0.25% v/v. Do not apply to Ogle, Porter, or Premier oat varieties. Apply as a tank mix with another broadleaf herbicide having a different mode of action in areas of known weed resistance. Do not feed forage from treated areas or allow livestock grazing within 7 days of application. Allow 30 days between application and feeding hay from treated areas to livestock.
2,4-D 0.25 to 0.5 amine, or 0.25 LVE	0.5 to 1 pt of 4 lb/gal 2,4-D* amine or 0.5 pt of 4 lb/gal 2,4-D* LVE	Controls most broadleaf weeds. Has least injury potential to oats if it is applied between full tiller (about 4 to 8 inches) and early boot stages. Do not apply before tiller stage or from early boot through milk stages. Do not allow grazing of fields within 2 weeks after treatment.
PREHARVEST		
2,4-D LVE 0.5 to 1	1 to 2 pt of 4 lb/gal 2,4-D* LVE	Apply when oats are in the hard dough stage to control actively growing, large, broadleaf weeds that can interfere with harvest. Weeds growing under limited moisture may not be controlled. Do not use treated straw for livestock feed.
Carfentrazone 0.016 to 0.031	1 to 2 oz Aim EC	For desiccation of susceptible broadleaf weeds. Apply after oats are mature but at least 3 days before harvest. Always apply with 1% v/v crop oil concentrate in a minimum spray volume of 5 gal/acre for aerial application and 10 gal/acre for ground applications. Do not apply more than 2 oz of Aim during the growing season.
Carfentrazone + 2,4-D 0.016 to 0.032 + 0.49 to 0.98 lb ae	16 to 32 oz Rage D-Tech	Apply after oats reach the hard dough stage to control large, actively growing broadleaf weeds that can interfere with harvest. Apply with oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v. Do not harvest oats until at least 7 days after application. Do not graze dairy or meat animals for 14 days after application. Do not feed treated straw to livestock.

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HERBICIDES FOR ALFALFA

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED ALFALFA HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS^{1,2}

Herbicide(s)	Crop Tolerance	Winter Annuals							Summer Annuals, Broadleaf							Perennials				
		Grasses			Broadleaf				Grasses				Broadleaf							
		Downy Brome	Japanese Brome	Cheat	Prickly Lettuce	Flixweed/Tansy Mustard	Treacle Mustard	Field Pennygrass	Shepherdspurse	Barnyardgrass	Crabgrass	Foxtail	Field Sandbur	Kochia	Lambsquarters	Morningglory	Pigweed	Common Ragweed	Pennsylvania Smartweed	Dandelion
Preplant																				
Balan	G	—	—	—	—	—	—	—	—	E	E	E	E	—	F-G	—	F-G	—	—	—
Eptam	F-G	—	—	—	—	—	—	—	F-G	E	E	E	E	—	F-G	F	F-G	—	—	—
Treflan	F-G	F-G	F-G	F-G	—	—	—	—	—	E	E	E	E	—	F-G	—	F-G	—	—	—
Postemergence to Alfalfa & Preemergence to Weeds																				
Chateau	G	G	E	E	E	E	E	E	E	F-G	F-G	G	F	E	E	G	E	E	E	G
Eptam	F-G	—	—	—	—	—	—	—	—	E	E	E	E	—	F-G	F	F-G	—	—	—
Prowl H ₂ O	G	—	—	—	—	—	—	—	—	E	E	E	G-E	F-G	G-E	—	G-E	—	—	—
Treflan HFP	F-E	G	G	G	—	—	—	—	—	E	E	E	G-E	F-G	G-E	—	G-E	—	—	—
Zorial	G	G	—	G	—	G	G	—	G	G	E	E	F-G	F	—	—	G	F	F	—
Postemergence																				
Arrow, Section, Select (Max), Volunteer	E	G-E	G-E	G-E	—	—	—	—	—	E	G	E	E	—	—	—	—	—	—	—
Buctril, Moxy (Seedling only)	G	—	—	—	—	—	—	G-E	G-E	—	—	—	—	G	G-E	G	F-G	G	G-E	—
Butyrac 200, 2,4-D B200	F-G	—	—	—	—	G	G	G	G	—	—	—	—	F-G	G-E	G-E	G-E	G-E	G-E	—
Glyphosate (Roundup Ready only)	E	E	E	E	G	E	E	E	E	G	E	E	E	G	G	G	E	G	E	F-G
Gramoxone Inteon	F	—	—	—	—	—	—	—	—	G	G	G	G	F-G	G	G	G	G	G	G
Pursuit	G-E	—	—	—	—	G-E	G-E ²	G-E	G-E	F-G	F	G	—	G	F	G	G ²	F	G	F
Poast, Poast Plus	E	G	G	G	—	—	—	—	—	E	G	E	E	—	—	—	—	—	—	—
Raptor	G-E	G-E	E	E	—	E	E ²	E	E	F-G	F-G	G-E	—	G ²	G	G	G ²	F	G	F
Dormant Treatments																				
Gramoxone Inteon	E	F	F	F	G	F	G	G	G	—	—	—	—	—	—	—	—	—	—	—
Karmex, Diuron	G	—	—	—	E	E	E	E	E	G-E	G-E	G-E	F	G	E	G	E	E	F-G	—
Pursuit	G-E	—	—	—	—	G-E	G-E ²	G-E	G-E	F-G	F-G	G-E	—	G	G	G	G ²	F	G	F
Sencor	G	G	G	G	—	E	E	E	E	F	F	F	—	E	E	—	G	E	E	F
Sinbar	G	G	G	G	E	E	E	E	E	G	G	G	G	G-E	E	E	G	E	E	G
Velpar	G	G	G	G	F	E	E	E	E	—	F	G	—	F	G	—	G	—	—	G
Velpar AlfaMax PM	G	G	G	G	E	E	E	E	E	G-E	G-E	G-E	—	G	E	G	E	E	F-G	G
Velpar AlfaMax Gold	G	G	G	G	E	E	E	E	E	E	G-E	G-E	—	G-E	E	G	E	E	F-G	G

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except where resistant weed populations have developed.

HERBICIDES FOR ALFALFA

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN OR PREPLANT		
Benefin 1.1 to 1.5	2 to 2.5 lb Balan DF	Controls grasses more effectively than broadleaf weeds. Apply before planting alfalfa and incorporate 2 to 3 inches deep within 4 hours.
EPTC 3 to 4	3.5 to 4.5 pt Eptam 7E	Controls grasses more effectively than broadleaf weeds. Apply preplant and immediately incorporate 2 to 3 inches deep.
Glyphosate 0.38 to 0.75 lb ae	1 to 2 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply before crop emergence for control of emerged weeds. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding herbicide to the spray tank.
Trifluralin 0.5 to 0.75	1 to 1.5 pt Treflan HFP	Supplemental label. Controls grasses more effectively than broadleaf weeds. Apply before planting alfalfa and incorporate 2 to 3 inches deep within 24 hours. Use the lower rate in coarsely textured soils and the higher rate on finely textured soils. Some crop stand reduction can occur, especially with cool, wet weather and deep seeding.
POSTEMERGENCE TO CROP AND PREEMERGENCE TO WEEDS		
EPTC 2.2 to 3	2.25 to 3.4 pt Eptam 7E	Controls grasses more effectively than broadleaf weeds. Meter into irrigation water applied to established stands before weed emergence. Use lower rate on coarsely textured soils. Do not apply to alfalfa within 14 days of harvest or grazing.
Flumioxazin 0.13	4 oz Chateau	For preemergence control of many annual grass and broadleaf weeds. Does not provide good control of emerged weeds. Can be applied between alfalfa cuttings before alfalfa exceeds 6 inches in height or as a fall or dormant season treatment. Works well when applied after the last alfalfa cutting in the fall. Can be chemigated. Tank mixing with EC formulated products will cause leaf burn. Provides excellent control of seedling dandelion but not established plants. Do not apply more than 8 oz/acre during one growing season. Do not harvest or graze alfalfa within 25 days after Chateau application.
Norflurazon 1 to 2	1.25 to 2.5 lb Zorial	Controls several grass and broadleaf weeds. Apply to established alfalfa between cuttings or as a dormant-season treatment. Do not apply to new alfalfa stands until 5 months after emergence of spring-seeded alfalfa or until after the first cutting of fall-seeded alfalfa. Approximately 1 inch of precipitation or irrigation is required for herbicide activation. Zorial has limited postemergence activity. Can be tank mixed with Butyrac, Pursuit, Velpar, Sinbar, Lexone, Sencor, Treflan, Eptam, Poast, or Karmex. Do not harvest alfalfa within 28 days of application. Soil disturbance such as rodent activity can result in temporary alfalfa bleaching. Do not exceed 2.5 lb product per year. Do not rotate to any crop other than cotton or soybeans within 16 months of application. Follow label directions and precautions.
Pendamethalin 0.47 to 3.8	1 to 8 pt Prowl H₂O	For preemergence control of certain annual grass and broadleaf weeds in seedling or established alfalfa for forage or hay. Apply at 1 to 2 pt/acre to seedling alfalfa between the 2 trifoliolate-leaf and 6-inch stages of growth. Apply at 2 pt/acre to established alfalfa from the last cutting in fall until alfalfa has 6 inches of regrowth in the spring. Some stunting and chlorosis of the alfalfa may occur. Do not apply less than 50 days before alfalfa harvest for forage or hay. Follow label directions and crop rotation guidelines.

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HERBICIDES FOR ALFALFA

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE TO CROP AND PREEMERGENCE TO WEEDS		
Trifluralin 0.75 to 2	1.5 to 4 pt Trifluralin 4E* or 20 lb Treflan TR 10	For preemergence control of barnyardgrass, crabgrass, foxtail, and other annual weeds. Apply to dormant or semidormant alfalfa or throughout the growing season immediately after cutting. Irrigation (0.5 inch) or rainfall is needed within 3 days after application, or the treatment must be incorporated to mix the herbicide into the soil but with minimal damage to the alfalfa. Apply chemigation treatments in 0.75 to 1 inch water through a center-pivot irrigation system to established alfalfa stands before weed emergence for all soil textures. If possible, inject only undiluted Treflan HFP into irrigation system. Use within 4 to 8 hours if mixed with water before application. Do not cut or allow grazing of plants within 21 days after application. Follow label and chemigation application directions.
POSTEMERGENCE		
Bromoxynil 0.25 to 0.38	1 to 1.5 pt Buctril, Bromox, Brox, or Moxy	Controls many broadleaf weeds. Apply in fall or spring to seedling alfalfa after 4 trifoliolate-leaf stage and when weed seedlings are less than 2 inches tall. Fall applications provide the best control of weeds that emerge in the fall. Leaf burn of alfalfa can occur after application, but new growth will not be affected. Can be tank mixed with Pursuit or 2,4-DB. Do not apply if temperature is expected to exceed 70°F (eastern Kansas) to 80°F (western Kansas) at or within 3 days after treatment. Do not harvest or allow grazing of spring-treated alfalfa within 30 days or fall- or winter-treated alfalfa within 60 days. Follow label directions and precautions.
Clethodim 0.07 to 0.156	6 to 10 oz Select, Arrow, Section, or Volunteer, or 9 to 16 oz Select Max	Controls annual and perennial grasses. Always apply Select and comparable products with crop oil concentrate at 1% v/v. Always apply Select Max with nonionic surfactants at 0.25 % v/v or crop oil concentrate at 1% v/v plus ammonium sulfate at 2.5 to 4 lb/acre. Can be applied to seedling or established alfalfa at least 15 days before grazing, feeding, or harvesting for hay. Apply to small, actively growing grasses before plants exceed the size limits on the label. Select is most effective on grasses before they have been mowed. Use the higher application rate and allow active regrowth before treating grasses that have been mowed. Follow label directions and precautions.
Glyphosate 0.38 to 1.55	1 to 4 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Broadcast apply only to Roundup Ready alfalfa. Application to conventional alfalfa varieties will result in severe injury or death of the crop. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Controls most annual and perennial weeds at the rates suggested on the label. Glyphosate has no residual activity, so multiple applications may be required through the season, particularly for control of both winter and summer annual weeds. The combined total per year for all in-crop applications should not exceed 6 qt of a 3 lb ae/gal glyphosate product*. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank. Remove domestic livestock before application, and wait a minimum of 5 days after the last application before grazing, or cutting and feeding of alfalfa forage or hay.
Imazamox 0.031 to 0.047	4 to 6 oz Raptor	Controls many annual weeds. Apply to established or seedling alfalfa after it has reached the 2 trifoliolate-leaf stage for control of small actively growing weeds less than 3 inches tall or across. Always apply with nonionic surfactant or oil concentrate plus fertilizer additives. Raptor will provide better control of volunteer wheat, cheatgrass, and other winter annual grasses than Pursuit. Weeds that are not actively growing because of environmental stress are less susceptible to control. Do not feed, harvest, or allow grazing of alfalfa for 20 days after an application. Refer to the label for crop rotation guidelines and other use directions and precautions.

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HERBICIDES FOR ALFALFA

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Imazethapyr 0.047 to 0.094	3 to 6 oz Pursuit	Controls many annual weeds. For control of small, actively growing weeds before they reach the size limits listed on the label, apply to established or seedling alfalfa after it has reached the 2 trifoliolate-leaf stage. Always apply with nonionic surfactant or oil concentrate plus fertilizer solutions. Weeds that are not actively growing because of environmental stress are less susceptible to control. Do not apply during the last year of the alfalfa stand. Do not feed, harvest, or allow grazing of alfalfa for 30 days after an application.
Paraquat 0.25	16 fl oz Gramoxone Inteon	A restricted-use pesticide. Always apply with nonionic surfactant. Apply for control of emerged annual grasses and broadleaf weeds in established stands (at least 1 year old) of alfalfa. Apply immediately after alfalfa has been removed but no more than 5 days after cutting. Alfalfa foliage present at time of application will be burned. Weeds that germinate after application will not be controlled. Do not cut, harvest, or allow grazing within 30 days of application. Follow label directions and precautions.
Sethoxydim 0.1 to 0.5	0.5 to 2.5 pt Poast or 0.75 to 2.25 pt Poast Plus	Controls annual and perennial grasses. Always apply with crop oil concentrate. Can be applied to seedling or established alfalfa at least 7 days before grazing, feeding, or cutting undried forage or 14 days before cutting for hay. Apply to annual grasses 3 to 8 inches tall and actively growing. Poast is most effective on grasses before they have been mowed. Use higher application rates and allow active regrowth before treating grasses that have been mowed. Higher application rates are recommended in western Kansas than in eastern Kansas. Follow label directions and precautions.
2,4-DB 0.5 to 1.5	1 to 3 qt Butyrac 200 or 2,4-DB 200	Controls seedlings of many broadleaf weeds. Apply to spring- or fall-seeded alfalfa at 2 to 4 trifoliolate-leaf stage and when weeds are less than 3 inches tall. Do not allow grazing or cut hay from treated fields of seedling alfalfa within 60 days and of established alfalfa within 30 days after treatment.
DORMANT SEASON		
Diuron 0.8 to 2.4	1 to 3 lb Karmex or 0.8 to 2.4 qt Diuron 4L	Apply to established alfalfa (1 year or older) after it is dormant in fall but before it begins to grow in spring. Do not use on loamy sand or sand. Do not replant treated areas to any crop within 2 years.
Hexazinone 0.25 to 1.5	0.5 to 3 qt Velpar L	Controls annual grasses and broadleaf weeds. Apply to dormant, established alfalfa in fall or late winter but before new growth begins in spring. Use 1 to 2 pt/acre to control tansy mustard and higher rates to control cheatgrass and other weeds. Do not allow grazing or feed treated forage for 30 days after treatment. Do not replant treated areas to corn for 12 months or any other crops within 2 years after treatment. Consult the label for soil texture guidelines and cropping limitations.
Hexazinone + Diuron 0.25 to 1.5 + 0.3 to 1.8	0.75 to 4.3 lb Velpar AlfaMax	Velpar AlfaMax is a unit pack that contains both hexazinone and diuron but is not a homogenous mix. One 14.2 lb unit pack treats between 3.3 and 10 acres, depending on soil texture, soil organic matter content, and weed species to be controlled. Controls annual grass and broadleaf weeds. Lower rates can be used specifically for tansy mustard control. Apply to dormant, established alfalfa in fall or late winter but before new growth begins in spring. Do not allow grazing or feed treated forage or hay for 30 days after treatment. Do not replant treated areas to corn for 12 months or any other crops within 2 years after treatment. Consult the label for soil texture guidelines and cropping limitations.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR ALFALFA

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
DORMANT SEASON		
Hexazinone + Diuron 0.23 to 1 + 0.55 to 2.4	1 to 4.3 lb Velpar AlfaMax Gold	Velpar AlfaMax Gold is a premix that contains hexazinone and diuron but has more diuron relative to hexazinone than Velpar AlfaMax. Use rates depend on soil texture, soil organic matter content, and weed species to be controlled. Controls annual grass and broadleaf weeds. Lower rates can be used specifically for tansy mustard control. Apply to dormant, established alfalfa in fall or late winter but before new growth begins in spring. Do not allow grazing or feed treated forage or hay for 30 days after treatment. Do not replant treated areas to corn for 12 months or to any other crops within 2 years after treatment. Consult the label for soil texture guidelines and cropping limitations.
Imazethapyr 0.047 to 0.094	3 to 6 oz Pursuit	Controls many annual weeds. Apply to established alfalfa in the fall or spring before plants have 3 inches of regrowth. Always apply with nonionic surfactant or oil concentrate plus fertilizer solutions. Weeds that are not actively growing because of environmental stress are less susceptible to control. Do not apply during the last year of the alfalfa stand. Do not feed, harvest, or allow grazing of alfalfa for 30 days after an application.
Metribuzin 0.4 to 1	0.5 to 1.33 lb Sencor DF	Controls winter annual and some summer annual weeds. Apply to dormant established alfalfa after first growing season. Do not apply after spring growth begins or before growth ceases in fall. Do not allow grazing or harvest within 28 days of treatment.
Norflurazon 1 to 2	1.25 to 2.5 lb Zorial	Controls several grass and broadleaf weeds. Apply to established alfalfa between cuttings or as a dormant-season treatment. Do not apply to new alfalfa stands until 5 months after emergence of spring-seeded alfalfa or until after the first cutting of fall-seeded alfalfa. Approximately 1 inch of precipitation or irrigation is required for herbicide activation. Zorial controls weeds preemergence and has limited postemergence activity. Can be tank mixed with Butyrac, Pursuit, Velpar, Sinbar, Sencor, Treflan, Eptam, Poast, or Karmex. Do not apply north of I-70. Do not harvest alfalfa within 28 days of application. Soil disturbance such as rodent activity may result in temporary alfalfa bleaching. Do not exceed 2.5 lb product per year. Do not rotate to any crop other than cotton or soybeans within 16 months of application. Follow label directions and precautions.
Paraquat 0.5 to 0.75	2 to 3 pt Gramoxone Inteon	A restricted-use pesticide. Paraquat is a contact herbicide. Apply to winter dormant alfalfa for control of winter annual weeds. Always apply with nonionic surfactant. Do not allow grazing and do not cut or harvest within 60 days of application. Can be tank mixed with Velpar. Follow label directions.
Terbacil 0.4 to 1.2	0.5 to 1.5 lb Sinbar 80W	Controls winter and summer annual weeds. Apply to established alfalfa (1 year or older) in fall or winter after alfalfa becomes dormant but before new growth starts in the spring. Do not use on sand, loamy sand, gravelly soils, or soils with less than 1% organic matter. Do not replant treated areas to other crops within 2 years.
HARVEST AIDS		
Diquat 0.38 to 0.5	1.5 to 2 pt Reglone/Diquat	Use on seed crop only. Desiccation is complete in 3 to 10 days. Do not allow grazing of treated areas or feed treated forage. Do not use seed from treated plants for food, feed, or oil.
Glyphosate 0.75 lb ae	1 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Apply to control weeds and assist in killing non-Roundup Ready alfalfa fields that are being terminated. Allow a minimum of 6 hours between application and alfalfa harvest. Subsequent tillage or herbicide treatment will be required for complete alfalfa kill. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COTTON

This publication primarily concerns chemical weed control. It is not intended to imply that cultivation, particularly in row crops, is undesirable. One or two cultivations can greatly improve weed control.

WEED RESPONSE TO SELECTED COTTON HERBICIDES WHEN APPLIED ACCORDING TO LABEL DIRECTIONS^{1,2}

Herbicide(s)	Crop Tolerance	Annual Grasses				Annual Broadleaf Weeds								Perennials	
		Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Cocklebur	Lambsquarters	Morningglory	Pigweed ³	Common Ragweed	Smartweed	Prickly Sida	Velvetleaf	Johnsongrass	Yellow Nutsedge
Preplant Incorporated															
Trifluralin	G	E	E	E	E	—	G	—	G	—	—	—	—	F	—
Preplant Incorporated or Preemergence															
Pendimethalin	G	E	E	E	E	—	G	—	G	—	—	—	—	F	—
Zorial	G	E	E	E	E	—	E	P	G	G	F	E	F	P	P
Preemergence															
Caparol	G	G	G	G	G	—	G	G	G-E	G	G	G-E	—	—	—
Cotoran	G	F	E	G	G	G	E	G	E	E	F	G	P	P	P
Karmex, Diuron	G	F	G	G	G	F	E	G	G	G	F	F	P	P	P
Dual Magnum, Cinch, Charger Max	G	E	G-E	G-E	E	—	F-G	—	G	—	—	—	—	—	F
Postemergence															
Assure II	E	E	E	E	E	—	—	—	—	—	—	—	—	G-E	—
Cotoran	F	—	—	—	—	G	G	F	F	F	F	P	P	—	P
Fusion	E	G	E	E	E	—	—	—	—	—	—	—	—	G-E	—
Ignite 280 (resistant cotton only)	E	G	G	G	G	G	G	G	G	G	G	G	G	F-G	F
Poast Plus	E	E	E	E	E	—	—	—	—	—	—	—	—	G	—
Select (MAX), Section, Volunteer, Arrow	E	G	E	E	E	—	—	—	—	—	—	—	—	G-E	—
Staple	E	—	—	—	—	G	—	G	G ²	F	F	F	G-E	—	F
Glyphosate (resistant cotton only)	E	E	E	E	E	E	G	G	E	G	G	F	G	E	P
Directed Postemergence															
Aim	F	—	—	—	—	G	E	G	G-E	F	G-E	G	E	—	—
Cobra	F	—	—	—	—	G	P	F	G-E	G	F	G	F	—	—
Karmex, Diuron	F	P	P	P	P	F	G	F	G	P	P	F	F	P	P
MSMA	G	G	G	G	G	E	P	P	P	P	P	—	—	F	P
Valor	G	—	—	—	—	G	E	G-E	G-E	G	G-E	G	E	—	—

¹Weed response ratings refer to application according to label directions and with favorable growing conditions:

E = Excellent; G = Good; F = Fair; P = Poor; and — = weed not listed on the herbicide label.

²Except for resistant weed populations.

³Pigweed species vary in response to herbicides. Common waterhemp and Palmer amaranth tend to be less susceptible to postemergence herbicides than other pigweed species.

HERBICIDES FOR COTTON

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Diuron 0.8 to 1.6	1 to 2 lb Karmex DF or 0.8 to 1.6 qt Diuron 4L	Controls certain grass and broadleaf weeds. Apply preemergence only. Do not use on sand or loamy sand soils or soils with less than 1% organic matter. Follow label directions for use guidelines and crop rotation restrictions.
Flumioxazin 0.03 to 0.06	1 to 2 oz Valor	Apply 1 oz/acre at least 14 days, or 2 oz/acre at least 21 days before planting no-till cotton. Applications at shorter intervals before planting or with tilled seedbeds may injure cotton. Controls pigweeds, lambsquarters, and certain other broadleaf weeds.
Fluometuron 1 to 2	2 to 4 pt Cotoran 4L or 1.2 to 2.4 lb Cotoran DF	Controls certain grass and broadleaf weeds. Apply preemergence only. Rates need to be adjusted for soil texture. Follow label directions.
Glufosinate 0.40 to 0.53	22 to 29 oz Ignite 280	Apply to control emerged weeds before or after cotton planting but before crop emergence. Weed control is often enhanced by the addition of ammonium sulfate at 3 lb/acre to the spray solution. Thorough spray coverage of small, actively growing weeds is essential for good weed control.
Glyphosate 0.28 to 1.125 lb ae	1 to 4 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply to control emerged weeds before or after cotton planting but before crop emergence. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal water can improve weed control. Follow label directions.
Norflorazon 1 to 2	1.25 to 2.5 lb Zorial	Controls grass and broadleaf weeds. Can be applied preplant incorporated or preemergence. A split application with a half rate applied preplant incorporated and the other half rate preemergence generally provides the best weed control. Only cotton or soybeans can be planted in the year following application.
S-metolachlor 0.48 to 1.27	0.5 to 1.33 pt Dual Magnum, Cinch, or Charger Basic	Apply preemergence to control annual grasses and certain small-seeded broadleaf weeds. Do not apply on sand or loamy sand soils. May be applied postemergence when cotton is 3 to 12 inches tall for residual weed control but will not control emerged weeds.
Paraquat 0.63 to 1	2.5 to 4 pt Gramoxone Inteon	A restricted-use pesticide. Apply before crop emergence for control of emerged weeds. Paraquat is a contact herbicide and does not have soil activity. Always apply with a nonionic surfactant to 0.5% v/v.
Prometryn 0.8 to 1.2	1.6 to 2.4 pt Caparol	Do not use on sand or sandy loam soils. Apply preemergence. Controls small-seeded broadleaves and some grasses.
Pendimethalin 0.5 to 1.5	1.2 to 3.6 pt Pendimethalin 3.3EC* or 1 to 3 pt Prowl H₂O	Controls grass weeds more effectively than broadleaf weeds. Can be applied preplant, preplant incorporated, or preemergence but generally provides the best weed control when incorporated. Follow label directions.
Pyrithiobac-sodium 0.031 to 0.047	0.6 to 1 oz Staple or 1.3 to 2.1 oz Staple LX	Controls certain broadleaf weeds. Do not rotate to grain sorghum in the year following Staple application.
Trifluralin 0.5 to 1	1 to 2 pt Trifluralin 4 EC*	Controls grasses more effectively than broadleaf weeds. Apply before planting and incorporate within 24 hours. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COTTON

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE		
Clethodim 0.07 to 0.156	6 to 10 oz Select, Arrow, Section, or Volunteer, or 9 to 16 oz Select Max	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Select can be tank mixed with Cobra or MSMA. Always apply Select and comparable products with crop oil concentrate at 1% v/v but not less than 1 pt/acre. Always apply Select Max with nonionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v, plus ammonium sulfate at 2.5 to 4 lb/acre. Follow label directions and precautions.
Fluazifop-P + Fenoxaprop 0.094 to 0.16 +0.03 to 0.05	6 to 10 oz Fusion	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Apply with crop oil concentrate or nonionic surfactant.
Fluometuron 1 to 2	2 to 4 pt Cotoran 4L or 1.2 to 2.4 lb Cotoran DF	Controls certain grass and broadleaf weeds. Apply postemergence or postemergence directed after cotton is 3 inches tall for control of weeds less than 2 inches tall. Apply with a nonionic surfactant. Follow label directions.
Glufosinate 0.40 to 0.53	22 to 29 oz Ignite 280	Broadcast apply to Liberty Link cotton only. Apply to small, actively growing weeds and before the early bloom stage of cotton. Thorough spray coverage of weed foliage is essential for effective weed control. Weed control is often enhanced by the addition of ammonium sulfate at 3 lb/acre to the spray solution. Ignite 280 can be applied to non-Liberty Link cotton if applied with a hooded sprayer that prevents the spray from contacting foliage and stems of cotton plants.
Glyphosate	0.56 to 0.75 lb ae 1.5 to 2 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Use only on Roundup Ready cotton varieties. Controls many emerged grass and broadleaf weeds. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding herbicide to the spray tank. To avoid problems with fruit set on Roundup Ready cotton, broadcast apply before cotton exceeds 4-leaf stage or apply between cotton rows with a hooded sprayer if cotton exceeds the 4-leaf stage. Broadcast salvage treatments can be applied after Roundup Ready cotton exceeds the 4-leaf stage but can result in loss of bolls. Broadcast applications can be made to Roundup Ready Flex cotton from cracking until 60% boll opening.
Pyrithiobac-sodium 0.0625	1.2 oz Staple or 2.6 oz Staple LX	Controls certain broadleaf weeds. Apply to small, actively growing broadleaf weeds less than 2 inches tall after cotton has at least 1 true leaf. Apply with nonionic surfactant or crop oil concentrate. Staple LX can be used at lower rates in tank mixes with glyphosate on Roundup Ready Flex cotton for residual control and enhanced control of morningglory, cutleaf eveningprimrose, and prickly sida. Do not rotate to grain sorghum in the year following Staple application.
Quizalofop 0.34 to 0.69	5 to 10 oz Assure II	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Apply with crop oil concentrate or nonionic surfactant.
Sethoxydim 0.09 to 0.375	0.75 to 3 pt Poast Plus	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on label. Higher rates are recommended in the western third of Kansas than in the eastern part of the state. Always apply with crop oil concentrate. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COTTON

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
DIRECTED POSTEMERGENCE		
S-metolachlor + Glyphosate 0.75 to 0.94 + 0.56 to 0.7	2 to 2.5 pt Sequence	Use only on Roundup Ready cotton varieties when cotton is between 3 inches tall and the 4-leaf stage of growth. Controls emerged weeds and can provide residual control of annual grasses and pigweeds.
Carfentrazone 0.013 to 0.025	0.8 to 1.6 oz Aim EC	Controls certain broadleaf weeds. Apply with crop oil concentrate with a hooded sprayer that completely prevents coverage of cotton or with directed spray after cotton is at least 6 inches tall.
Diuron 0.4 to 0.6	0.5 to 0.75 lb Karmex DF or 0.4 to 0.6 qt Diuron 4L	Apply between rows after cotton is at least 6 inches tall but before blooming and before weeds are 2 inches tall. Do not use on sand or loamy sand soils or soils with less than 1% organic matter. Follow label directions for use guidelines and crop-rotation restrictions.
Flumioxazin 0.6	2 oz Valor	Apply after cotton is at least 6 inches tall with a hooded or shielded sprayer that prevents spray from contacting cotton plants. Provides foliar and residual control of certain broadleaf weeds. Apply with nonionic surfactant at 0.25% v/v. Can be tank mixed with glyphosate or MSMA. Lay-by applications directed no higher than the lowest two inches of cotton stems can be applied after cotton is 18 inches tall and has a minimum of 4 inches of bark.
Lactofen 0.2	12.5 oz Cobra	Apply between rows after cotton is at least 6 inches tall for control of small broadleaf weeds. Apply with crop oil concentrate. Cobra can be tank mixed with Karmex or MSMA.
MSMA or DSMA 2.5	3 pt of 6 lb/gal product	Apply between rows after cotton is at least 3 inches tall but before blooming and before weeds are 2 inches tall.
Prometryn 0.8 to 1.2	1.6 to 2.4 pt Caparol	Apply with hooded sprayer to minimize contact and injury to cotton. Do not use on sand or sandy loam soils. Controls small-seeded broadleaves and some grasses.
HARVEST AIDS		
Carfentrazone 0.016 to 0.025	1 to 1.6 oz Aim EC	Apply with crop oil concentrate when 60 to 70% of bolls are open and at least 7 days before harvest.
Glyphosate 0.75 to 1.5 lb ae	1 to 2 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply when at least 20% of bolls are cracked and at least 7 days before harvest for control of annual and perennial weeds and to inhibit regrowth of non-Roundup Ready cotton. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations.
Paraquat 0.05 to 0.17	3 to 11 fl oz Gramoxone Inteon	A restricted-use pesticide. Apply for boll opening and plant desiccation when 75% or more of bolls are open and remaining bolls to be harvested are mature. Do not harvest for 3 days after application. Do not allow grazing on treated fields or feed treated foliage.
Tribufos 0.75 to 1.125	1 to 1.5 pt Def/Folex	Apply when 50% or more of bolls are open and at least 7 days before harvest. A minimum spray volume of 10 gal/acre by ground or 5 gal/acre by air is required

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CANOLA

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BURNDOWN, PREPLANT, AND/OR PREEMERGENCE		
Ethalfuralin 0.56 to 0.94	1.5 to 2.5 pt Sonalan	Controls grasses more effectively than it controls broadleaf weeds. Apply before planting and incorporate within 48 hours. Do not graze or forage crop grown in treated soil or cut for hay or silage. Follow label directions.
Glyphosate 0.38 to 1.5 lb ae	1 to 4 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply to control emerged weeds before or after canola planting but before crop emergence. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank. Follow label directions.
Trifluralin 0.5 to 1	1 to 2 pt Trifluralin 4E*	Controls grasses more effectively than broadleaf weeds. Apply before planting and incorporate within 24 hours. Follow label directions.
POSTEMERGENCE		
Glyphosate 0.38 to 0.56 lb ae	1 to 1.5 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Apply only to Roundup Ready canola from emergence through the 6-leaf stage of growth. Application to conventional canola varieties will result in severe injury or death of the crop. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Controls many annual weeds and suppresses perennial weeds at the labeled rates for canola. Can be applied twice at the lower application rate, but allow a 10-day interval between applications, with the last application no later than the 6-leaf stage of canola. Do not apply after the 6-leaf stage of canola or injury may occur. Condition spray solution with 1 to 2% spray-grade ammonium sulfate by weight (8.5 to 17 lb/100 gal water) before adding glyphosate to the tank. Follow label directions.
Clethodim 0.07 to 0.09	4 to 6 oz Select, Section, Arrow, or Volunteer, or 9 to 12 oz Select Max	Controls annual and perennial grasses. Apply before canola begins to bolt and when grasses are growing actively but before they reach size limits listed on the label. Always apply Select and comparable products with crop oil concentrate at 1% v/v. Always apply Select Max with nonionic surfactant at 0.25% v/v.
Quizalofop 0.05 to 0.0625	8 to 10 oz Assure II	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on the label. Always apply with crop oil concentrate or nonionic surfactant. Follow label directions and precautions.
Sethoxydim 0.19 to 0.38	1 to 2 pt Poast	Controls annual and perennial grasses. Apply when grasses are growing actively but before they reach size limits listed on the label. Higher rates are recommended in the western third of Kansas than in the eastern part of the state. Always apply with crop oil concentrate or Dash. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CONSERVATION RESERVE PROGRAM (NATIVE GRASSES)

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
For control of noxious weeds, refer to the section Herbicides for Noxious Weeds.		
GRAIN SORGHUM COVER CROP		
Short-residual herbicides for grain sorghum can be applied as directed on a grain sorghum cover crop.		
PREPLANT AND PREEMERGENCE		
Glyphosate 0.38 to 0.75 lb ae	1 to 2 pt of 3 lb ae/gal Glyphosate* (See glyphosate table)	For control of actively growing volunteer grains and annual weeds up to 6 inches tall. Apply in 3- to 10-gal spray/acre with nonionic surfactant. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal water can increase performance of Roundup. Use flat-fan nozzles for best results. Dust on plants can reduce performance of Roundup. Follow label directions and precautions.
Metsulfuron methyl 0.0038	0.1 oz Escort XP*	Controls susceptible broadleaf weeds. Apply preplant or preemergence for some native grasses. See label for species. Do not use on soil with pH above 7.9. Follow label directions and precautions.
Paraquat 0.5 to 1	2 to 4 pt Gramoxone Inteon	A restricted-use pesticide. A contact herbicide. Apply in clean water to annual weeds 1 to 6 inches tall. Use flat-fan nozzles for best results. Always add nonionic surfactant or crop oil concentrate. Dust on plants can inactivate paraquat. Follow label directions and precautions.
Imazapic	2 to 6 oz Plateau	For annual weed control in new plantings of labeled warm-season grasses and forbs. Follow label directions and precautions.
Imazapic + Glyphosate	5.3 to 16 oz Journey	For annual weed control in new plantings of labeled warm-season grasses and forbs. Follow label directions and precautions.
POSTEMERGENCE FOR SEEDLING GRASSES		
Dicamba 0.13 to 0.5	0.25 to 1 pt Clarity or Sterling Blue	Controls annual broadleaf weeds in seedling grasses. Do not apply until seedling grasses exceed the 3-leaf stage of growth. Can be tank mixed with 2,4-D. Follow label directions and precautions.
Metsulfuron methyl 0.0038	0.1 oz Escort XP* + 2 qt surfactant/100 gal	Controls susceptible broadleaf weeds. Apply to some native grasses after the 3- to 4-leaf stage. See label for species. Apply after weeds have emerged but while they are small and actively growing. Do not use on soil with pH greater than 7.9. Follow label directions and precautions.
2,4-D 0.25 to 0.5	0.5 to 1 pt 4 lb/gal 2,4-D* amine	Controls many broadleaf weeds. Do not use on new seedlings until established (6 or more leaves or tillered). Because buffalo and grama grass seedlings are more susceptible to injury by 2,4-D, do not apply it unless broadleaf weeds provide a canopy over grasses. Follow label directions and precautions.
Alternative method: Sickle-bar or rotary mower	- - - -	Mow grasses to 4 to 6 inches in height after spring seeding and after vegetation is 6 to 8 inches tall. Use of rotary mower in heavy weed growth can cause windrows and smothering of grass seedlings. To avoid this, use sickle-bar mower.
POSTEMERGENCE FOR ESTABLISHED GRASSES		
Aminopyralid 0.047 to 0.109	3 to 7 fl oz Milestone	Apply to control broadleaf weeds in established grass stands no earlier than the growing season after planting. Can be tank mixed with other herbicides. Follow label directions and precautions.
Aminopyralid + 2,4-D	1.5 to 2.6 pt ForeFront R&P	Apply to control broadleaf weeds in established grass stands no earlier than the growing season after planting. Can be tank mixed with other herbicides. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CONSERVATION RESERVE PROGRAM (NATIVE GRASSES)

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE FOR ESTABLISHED GRASSES		
Bromoxynil 0.25 to 0.5	1 to 2 pt Buctril or Brox	Apply in fall or spring after grasses have reached the 2- to 3-leaf stage. Apply to weeds up to the 4-leaf stage or 2 inches in height, whichever comes first. Consult label for mixing and application instructions. See label for tank mix recommendations with MCPA.
Dicamba 0.13 to 2	0.25 to 4 pt Clarity or Sterling Blue	Apply to control susceptible broadleaf weeds in established grasses, that is, the season after planting. Certain grasses, such as smooth brome and buffalograss, can be injured at rates exceeding 1 pt (0.5 lb ai/treated acre). Can be tank mixed with 2,4-D. Follow label directions and precautions.
Dicamba + 2,4-D 0.13 to 0.5 + 0.36 to 1.44	1 to 4 pt Range Star	Apply when weeds are actively growing. Injury may occur to seeded grasses with fewer than 6 leaves or before grasses are well established. Do not apply to buffalograss.
Dicamba + Diflufenzopyr	2 to 8 oz Overdrive	Controls wide range of broadleaf weeds. Addition of a nonionic surfactant or methylated seed oil needed to achieve consistent weed control. Can be tank mixed with other CRP-labeled herbicides to enhance control. Overdrive may injure buffalograss.
Imazapic 0.063 to 0.188	4 to 12 oz Plateau	Controls most annual grasses and broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on label. Apply with nonionic surfactant, crop oil concentrate, or fertilizer/surfactant blend.
Imazethapyr 0.063	4 oz Pursuit	For postemergence application only. Additions of an adjuvant and a liquid fertilizer solution are required. For use on big bluestem, little bluestem, switchgrass, and western wheatgrass. Follow label directions and precautions.
Metsulfuron methyl + Chlorsulfuron 0.009 to 0.038 + 0.012 to 0.047	0.5 to 2 oz Cimarron X-tra	For broadleaf weed control in established stands. Treat when weeds are less than 4 inches tall or in diameter. See label for precautions.
Metsulfuron methyl + Chlorsulfuron 0.004 to 0.008 + 0.001 to 0.002	0.125 to 0.25 oz Cimarron Plus	For broadleaf weed control in stands planted the previous season and fully tillered. Treat when weeds are less than 4 inches tall or in diameter. See label for precautions.
Metsulfuron methyl + Dicamba + 2,4-D amine 0.0053 + 0.125 + 0.36 to 0.11 + 0.25 + 0.72	Rate I and II Cimarron Max	Apply for control of broadleaf weeds in established stands (planted previous year or earlier). See label for list of tolerant grasses.
Picloram	Tordon 22K See label for specific rates.	A restricted-use pesticide. Primarily for noxious weed control. Controls susceptible annual and perennial broadleaf weeds in established grasses. Can be tank mixed with 2,4-D. Apply only after established grasses have a good secondary root system and are growing actively. Can be applied as a spot treatment. See label for rates, directions, and precautions.
Picloram + 2,4-D 0.068 + 0.25 to 0.27 + 1	1 to 4 pt Grazon P+D	A restricted-use pesticide. For season-long control of annual and perennial broadleaf weeds. Apply after perennial grasses are well established (have developed a good secondary root system and show good vigor).

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR CONSERVATION RESERVE PROGRAM (NATIVE GRASSES)

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
POSTEMERGENCE FOR ESTABLISHED GRASSES		
Triasulfuron + Dicamba 0.011 + 0.069 to 0.028 + 0.172	2 to 5 oz Rave	Controls many broadleaf weeds. Apply to actively growing weeds at least 60 days after emergence of seedlings in early spring. Can be tank mixed with 2,4-D, Grazon P+D, Tordon 22K, and others. See label for list of tolerant grasses.
2,4-D 0.25 to 2	0.5 to 4 pt of 4 lb/gal 2,4-D* amine or LVE	Controls many broadleaf weeds. Consider native grasses as "established grasses" in the year following seeding, unless many new seedlings are present. Use label rate to control hard-to-kill annual or perennial weeds. Follow label directions and precautions.
2,4-D + Triclopyr 0.5 + 0.25 to 3 + 1.5	1 qt to 1.5 gal Crossbow	Apply to control susceptible broadleaf weeds in established grasses, that is, the season after planting. Certain grasses, such as smooth brome and buffalograss, can be injured at the high rates. Higher rates are for control of deep-rooted perennial and susceptible woody species.

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HERBICIDES FOR BERMUDAGRASS

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BROADLEAF WEEDS-POSTEMERGENCE		
Dicamba 0.25 to 1	0.25 to 1 qt Clarity	Apply when the problem weed is in the prebud growth stage and growing actively. Use 20 or more gal of solution/acre for ground application. Repeat applications may be necessary but do not exceed 1 qt/acre during a growing season. Depending on rate, do not let dairy animals graze on treated areas for 7 to 40 days after treatment. Follow directions, precautions, and grazing limitations on product label.
Dicamba + 2,4-D 0.25 to 0.5 + 0.72 to 1.44	2 to 4 pt Range Star	Apply at the germinating stage of weeds. Control will be reduced if weeds are greater than 1 inch in height. See label for grazing and haying restrictions.
Picloram up to 1	Up to 2 qt Tordon 22K	A restricted-use pesticide. Primarily for noxious weed control. Controls susceptible annual and perennial broadleaf weeds in established grasses. Can be tank mixed with 2,4-D. Apply only after established bermudagrass has a good secondary root system and is growing actively. Can be applied as a spot treatment. See label for rates, directions, and precautions.
Picloram/2,4-D	Grazon P+D (see label for notes)	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
Triasulfuron + Dicamba 0.011 + 0.069 to 0.028 + 0.172	2 to 5 oz Rave	Controls many broadleaf weeds. Apply to actively growing weeds in early spring. Can be tank mixed with 2,4-D, Grazon P+D, Tordon 22K, and others. See label for list of tolerant grasses.
2,4-D 0.5 to 2	0.5 to 2 qt of 4 lb/gal 2,4-D* amine, LVE, or mixed formulations	Apply when the problem weed is in the prebud growth stage and growing actively. Use 20 or more gal of solution/acre for ground application. Repeat applications may be necessary. Do not let dairy animals graze on treated areas within 7 days after treatment.
2,4-D + Dicamba 1 + .25	1 qt of 4 lb/gal 2,4-D* + 0.25 qt Clarity	Same as above. Follow directions, precautions, and grazing limitations on product label(s).
Metsulfuron methyl 0.0038 to 0.038	0.1 to 1 oz Metsulfuron*	Apply when weeds are less than 4 inches tall or in diameter. Can be tank mixed with Clarity, Grazon P+D, 2,4-D, Tordon 22K, or WeedMaster. Include a nonionic surfactant at 0.25 to 0.5% v/v.
Metsulfuron methyl + Chlorsulfuron 0.009 to 0.038 + 0.012 to 0.047	0.5 to 2 oz Cimarron X-tra	Same as for Metsulfuron (see above).
Metsulfuron methyl + Chlorsulfuron 0.004 to 0.038 + 0.001 to 0.012	0.125 to 1.25 oz Cimarron Plus	Same as for Metsulfuron (see above).
Metsulfuron methyl + Dicamba + 2,4-D	Rates I, II, and III Cimarron Max	Same as for Metsulfuron (see above).
Aminopyralid 0.047 to 0.109	3 to 7 fl oz Milestone	Apply to control broadleaf weeds in established grass stands no earlier than the growing season after planting. Can be tank mixed with other herbicides. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

WEED AND BRUSH CONTROL PRACTICES FOR PASTURE AND RANGELAND

Chemical and mechanical practices are available for control of weeds and brush. Identify the problem plant and select the effective control practice(s).

Common names	Life cycle	Season	Mechanical	Burning	Herbicides	Common names	Life cycle	Season	Mechanical	Burning	Herbicides
TAME PASTURES						Grasses					
Broadleaf weeds						Cheatgrass	A	C	M	CN	F
Bull thistle	A,B	W	—	—	F	Downy brome	A	C	M	CN	F
Cocklebur	A	W	M	—	F	Japanese brome	A	C	M	CN	F
Common ragweed	A	W	M	—	F	Little barley	A	C	M	CN	—
Common sunflower	A	W	M	—	F	Brush					
Musk thistle (nodding thistle)	A,B	C	M-R	—	F**	Ash	P	W	CU	M-A	F,B
Tall thistle	A,B	W	M	—	F	Blackberry	P	W	—	M-A	F-R
Wavyleaf thistle	P	W	M	—	F	Blackjack oak	P	W	CU	CN-A	F,S,B
Western ragweed	P	W	M	—	F-R	Buckbrush (coralberry)	P	W	M-R	CN-A	F-R,S
Brush						Eastern persimmon	P	W	CU	—	F,R
Eastern red cedar	P	E	C	CN	F,S	Eastern red cedar	P	E	C	CN	F,S
Buckbrush (coralberry)	P	W	M-R	—	F-R	Honey locust	P	W	CU	R,A	F,S,B
Honey locust	P	W	CU	—	F,S,B	Indigo bush	P	W	—	M-A	—
Multiflora rose	P	W	—	—	F,S	Mutiflora rose	P	W	—	M-A	F,S
Osage orange (hedge)	P	W	CU	—	F,S,B	Osage orange (hedge)	P	W	CU	R-A	F,S,B
RANGELAND						Poison ivy	P	W	—	—	F
Broadleaf weeds						Post oak	P	W	CU	CN-A	F,S,B
Annual broomweed	A	W	—	—	F	Pricklypear cactus	P	W	—	R-A	F
Broom snakeweed	P	W	—	—	F	Raspberry	P	W	—	—	F-R
Bull thistle	A,B	W	—	—	F	Rough-leaved dogwood	P	W	—	M-A	S,F-R
Cocklebur	A	W	M	CN	F	Russian olive	P	W	CU	R-A	S,F,B
Common mullein	B	W	—	—	F	Sand plum	P	W	—	R,CN-A	F
Common ragweed	A	W	M	—	F	Sand sagebrush (sandhill sage)	P	W	—	R	F
Common sunflower	A	W	M	—	F	Siberian elm	P	W	CU	R	F,S,B
Goldenrods	P	W	—	CN	F	Smooth sumac	P	W	—	IP	F,S
Hoary vervain	P	W	—	—	F	Tamarisk (saltcedar)	P	W	CU	IP	F
Lanceleaf ragweed	A	W	M	—	F	Willow	P	W	CU	—	F,S,B
Musk thistle (nodding thistle)	A,B	C	M-R	—	F**	Yucca (small soapweed)	P	W	—	M	S
Tall thistle	A,B	W	M	—	F						
Sericea lespedeza	P	W	M-R	IP	F						
Wavyleaf thistle	P	W	—	—	F						
Western ironweed (Baldwin ironweed)	P	W	—	R-A	F-R						
Western ragweed	P	W	—	R-A	F-R						

Key:

Life Cycle

A = Annual
P = Perennial
B = Biennial

Season

C = Cool season
E = Evergreen
W = Warm season

Mechanical

CU = Cut and treat cut surface
M = Mow
C = Cut below green growth
R = Repeat treatments needed
— = No recommendation

Burning

- A = with 2 or more yearly treatments
CN = Controls
IP = Increases population
M = Maintains population
R = Reduces population
— = No recommendation

Herbicides

- R = Repeat treatments needed
F = Foliar treatment
B = Basal bark treatment
S = Soil treatment
** = Refer to table Herbicides for Noxious Weeds
— = No recommendation

GRAZING RESTRICTIONS FOR CERTAIN RANGE AND PASTURE HERBICIDES¹

Herbicide	Beef and Non-Lactating Animals			Lactating Dairy Animals	
	Before Grazing	Before Hay Harvest	Removal Before Slaughter	Before Grazing	Before Hay Harvest
2,4-D	0	30 days	3 days	7 days	30 days
Arsenal	0	7 days	0	0	7 days
Cimarron Max	0	37 days	30 days	7 days	37 days
Cimarron Plus	0	0	0	0	0
Cimarron X-tra	0	0	0	0	0
Dicamba ²	0	0	30	7 to 40 days	37 to 70 days
Crossbow	0	14 days	3 days	Next growing season	14 days
Escort XP	0	0	0	0	0
ForeFront R&P	0	7	0	0	7
Glyphosate	(Check label. Restrictions vary by product, rate, and method of application)				
Grazon P+D	0	30 days	3 days	7 days	30 days
Journey	0	7 days	0	0	7 days
Milestone	0	0	0	0	0
Overdrive	0	0	0	0	0
PastureGard	0	14 days	3 days	Next growing season	14 days
Plateau	0	7 days	0	0	7 days
Pronone Power Pellets	0	0	0	0	0
Rave	0	0	30 days	7 days	0
Redeem R&P	0	14 days	3 days	Next growing season	Next growing season
Remedy Ultra	0	14 days	3 days	Next growing season	14 days
Spike 20P	0	1 year	0	0	1 year
Surmount	0	7 days	3 days	14 days	7 days
Tordon 22K	0	0 to 14 days	3 days	14 days	0 to 14 days
Velpar L ³	0	0	0	0	0
Weedmaster/RangeStar	0	37 days	30 days	7 days	30 days

¹ Check individual product labels for restrictions.

² Dicamba is the active ingredient in Banvel, Clarity, and Sterling Blue. Restrictions vary with rate.

³ No restrictions for grazing or hay when applied as a basal soil treatment.

HERBICIDES FOR COOL-SEASON PASTURES

Weeds and brush	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
ANNUAL AND BIENNIAL WEEDS			
Ragweed Sunflower Thistles	Picloram 0.063 to 0.125 lb	0.25 to 0.5 pt Tordon 22K	A restricted-use pesticide. Apply before bud stage when plant is growing actively. Follow directions, grazing limitations, and precautions on label.
	Picloram/2,4-D	Grazon P+D (see label for rates)	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	Dicamba + Diflufenzopyr	2 to 8 oz Overdrive	Controls wide range of broadleaf weeds. Addition of a nonionic surfactant or methylated seed oil needed to achieve consistent weed control. Can be tank mixed with other herbicides to enhance control.
	Aminopyralid	3 to 7 fl oz Milestone	Apply to control broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and precautions.
	Aminopyralid + 2,4-D	1.5 to 2.6 pt ForeFront R&P	Apply when broadleaf weeds are actively growing. Follow label directions and precautions.
	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb	1 to 2 qt 4 lb/gal 2,4-D* amine or LVE	Apply when the problem weed is in the early leaf stage and growing actively. Use 20 or more gal of solution/acre for ground application. Repeat applications may be necessary. Do not apply when grass is in early boot to milk stages if grass seed production is desired. Do not let dairy animals graze on treated areas within 7 days after treatment. Follow label directions.
	Dicamba + 2,4-D	2 to 4 pt Range Star	See label for weed-specific rates and grazing restrictions. Legumes interseeded with cool-season grasses will likely be injured.
	Metsulfuron methyl +2,4-D amine + Dicamba	Cimarron Max	See label for rates, directions, restrictions, and cautions.
	Metsulfuron methyl	0.1 to 1.0 oz Metsulfuron*	Use maximum of 0.4 oz/acre on fescue and timothy. Use non-ionic surfactant at 2 pt/100 gal.
	Metsulfuron methyl + Chlorsulfuron	0.5 to 2 oz Cimarron X-tra	Use maximum of 0.5 oz/acre on fescue. Do not use on timothy, Garrison creeping foxtail, or ryegrass. See label for additional precautions and recommendations.
	Metsulfuron methyl + Chlorsulfuron	0.125 to 1.25 oz Cimarron Plus	Use maximum of 0.5 oz/acre on fescue. Do not use on timothy, Garrison creeping foxtail, or ryegrass. See label for additional precautions and recommendations.
Most annual weeds	Clopyralid + Triclopyr	Redeem R&P (see label for rates)	Apply before bud stage when plant is actively growing. Add a surfactant. Follow label instructions for specific weed.
	Triasulfuron+ Dicamba	Rave (see label for rates)	Controls many broadleaf weeds. Apply to actively growing weeds in early spring. See label for tank mix instructions and list of tolerant grasses.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COOL-SEASON PASTURES

Weeds and brush	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
PERENNIAL WEEDS			
Asters Western ironweed Western ragweed	Picloram 0.25 to 0.5 lb	1 to 2 pt Tordon 22K	A restricted-use pesticide. Apply before bud stage when plant is actively growing. Follow directions, grazing limitations, and precautions on label.
	Picloram + 2,4-D	Grazon P+D (see label for rates)	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb	1 to 2 qt of 4 lb/gal 2,4-D* amine or LVE	Apply when the problem weed is in the early leaf stage and actively growing. Use 20 or more gal of solution/acre for ground application. Do not apply when grass is in early boot to milk stages if grass seed production is desired. Do not let dairy animals graze on treated areas within 7 days after treatment. Follow label directions.
	2,4-D* amine + Dicamba 1 lb + .25 lb	1 qt of 4 lb 2,4-D + 0.5 pt Clarity or Banvel	Dicamba can injure cool-season grasses. Follow directions, grazing limitations, and precautions on Clarity label.
		1 to 4 pt WeedMaster or Range Star	See label for rates, directions, and species controlled. Do not graze lactating dairy animals within 7 days of treatment. Do not harvest treated grasses for hay within 37 days of treatment.
	Metsulfuron methyl + 2,4-D amine + dicamba	Cimarron Max	See label for rates, directions, restrictions, and cautions.
Most perennial weeds	Clopyralid + Triclopyr	Redeem R&P (see label for rates)	Apply before bud stage when plant is actively growing. Add a surfactant. Follow label instructions for specific weed.
	Triasulfuron+ Dicamba	Rave (see label for rates)	Controls many broadleaf weeds. Apply to actively growing weeds in early spring. See label for tank mix instructions and list of tolerant grasses.
	Aminopyralid	3 to 7 fl oz Milestone	Apply to control broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and precautions.
	Dicamba + Diflufenzopyr	4 to 8 oz Overdrive	Addition of a nonionic surfactant or methylated seed oil needed to achieve consistent weed control. Lower rate should be tank mixed with other herbicides to enhance control.
Summer and winter annual grasses and many broadleaves	Imazapic 0.063 to 0.125 lb	4 to 8 oz Plateau	Apply in spring after 100% greenup of smooth brome grass, Kentucky bluegrass, and wheatgrass. See label for precautions and use of adjuvants.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COOL-SEASON PASTURES

Weeds and brush	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
WOODY PLANTS			
Multiflora rose	Glyphosate 1% solution	Glyphosate*	Apply as spot treatment by hand equipment before leaves lose green color. Damage can occur in surrounding vegetation. Follow label directions.
	Metsulfuron methyl 0.3-0.6 oz/A	0.5 to 1 oz Escort XP	Apply in the spring, shortly after full-leaf stage. Complete coverage is necessary for effective control. Application to tall fescue may reduce production or produce chlorosis.
	Picloram/2,4-D + Triclopyr	2 qt Grazon P+D + 1 pt Remedy Ultra	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
Buckbrush	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb	1 to 2 qt of 4 lb/gal 2,4-D* amine or LVE	Apply to foliage in spring when brush is nearing full-leaf stage (normally about May 1 to May 15) and growing actively. Do not let dairy animals graze on treated areas within 7 days after treatment. Follow directions and precautions on label.
Eastern red cedar Honey locust Multiflora rose Osage orange	Hexazinone	Velpar L 2 to 4 ml of product/inch stem diameter	Apply before or during period of active growth with exact delivery, hand-gun applicator. Rainfall is needed for activation. Surrounding vegetation can be damaged. See label for additional instructions.
Eastern red cedar	Picloram	Tordon 22K 3 to 4 ml of product/3 feet of plant height	A restricted-use product. Apply on upslope side of plant during April and May or September and October with exact delivery, hand-gun applicator. Rainfall is needed for activation. Surrounding vegetation can be damaged. See label for additional instructions.
	Metsulfuron methyl	1 to 2 oz Escort XP to 100 gal water	Use high volume application. Spray to wet during period of active growth. See label for additional instructions.
Many woody plants and broadleaf weeds	Picloram/2,4-D + Triclopyr	2 qt Grazon P+D + 1 pt Remedy Ultra	Grazon P+D is a restricted-use pesticide. For control of many woody plants on rangeland, pasture, and noncropland. Apply to foliage and green stems when woody plants are growing actively. Follow label directions.
	2,4-D* + Triclopyr	2 to 3 qt + 2 to 4 pt 2,4-D + Remedy Ultra	Foliar applications should be made when woody plants and weeds are actively growing. See label for additional instructions.
	Triclopyr + Fluoroxypyr	1.5 to 8 pt PastureGard	Foliar applications should be made when woody plants and weeds are actively growing. See label for additional instructions.
	Picloram + Fluoroxypyr	1.5 to 6 pt Surmount	A restricted-use pesticide. Foliar applications should be made when woody plants are actively growing. See label for additional instructions.
FESCUE PASTURE RENOVATION			
Established fescue	Glyphosate 0.75 lb ae	1 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	In fall, apply to actively growing plants when most are 4 to 12 inches tall. If tall fescue has been mowed or grazed before application, do not treat until new growth has occurred. Remove livestock before application. Do not allow grazing or harvest for 8 weeks after application.
Seedling fescue	Glyphosate 0.3 lb ae	0.4 qt of 3 lb ae/gal Glyphosate*	In the spring after fall application, apply to seedlings that are 4 inches or less in height. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR COOL-SEASON PASTURES

Weeds and brush	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
FESCUE PASTURE RENOVATION			
Established fescue	Paraquat 0.25 to 0.5 lb	1 to 2 pt Gramoxone Inteon	A restricted-use pesticide. Apply to fescue when actively growing and no more than 4 inches tall. Apply a second time at the same rate 10 to 21 days after the first treatment.
	Imazapic	8 to 12 oz Plateau	For control of tall fescue and conversion to warm-season grasses. Follow label directions and precautions.
	Imazapic + Glyphosate	24 to 32 oz Journey	For control of tall fescue and conversion to warm-season grasses. Follow label directions and precautions.
BASAL BARK APPLICATION			
Many woody plants	Triclopyr	Remedy Ultra 25% in diesel oil or kerosene	Controls woody plants such as cottonwood, elm, locust, oaks, and osage orange (hedge). Spray basal parts of brush or trees to a height of 15 to 20 inches above ground. Thoroughly wet all basal bark areas, including crown buds and ground sprouts. Best root control is obtained when application is made from mid-July to mid-January. Periods of dry weather also will aid in root control.
		Pathfinder II	A ready-to-use product. No mixing required. Use on susceptible woody plants with less than 6-inch basal diameter. Spray basal parts of brush and trees to thoroughly wet lower 12 to 15 inches of stems. Apply at any time, except when snow or water prevent spraying to the ground line.
	Triclopyr + Fluroxypyr	PastureGard 50% in diesel oil or kerosene	Apply to susceptible woody plants less than 6 inches in diameter at any time, except when snow or water prevent spraying to the ground line. Thoroughly wet the lower 12 to 15 inches of stems.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR RANGELAND WEEDS

Weeds	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
For control of noxious weeds, refer to section Herbicides for Noxious Weeds.			
ANNUAL AND BIENNIAL WEEDS			
Annual broomweed Cocklebur Common ragweed Sunflower Thistles	Picloram + 2,4 -D	Grazon P+D (see label for rates)	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	Dicamba + 2,4-D	1 to 4 pt Range Star	See label for weed specific rates and grazing restrictions. Do not use on buffalograss as injury will occur.
	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb		Apply when problem weed has leaves and is growing actively. Do not let dairy animals graze on treated area within 7 days after treatment. Do not cut for hay for 30 days. Use 20 gal or more solution/acre for ground application. Repeat applications may be necessary. Follow label directions.
	Clopyralid + Triclopyr 0.375 to 0.56 lb	Redeem R&P (see label for rates)	Apply when weeds have emerged. Add a surfactant.
	Triasulfuron/ Dicamba	2 to 5 oz Rave	See label for directions, species, and restrictions.
	Aminopyralid 0.047 to 0.109 l	3 to 7 fl oz Milestone	Apply to control broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and precautions.
	Aminopyralid +2,4-D	1.5 to 2.6 pt ForeFront R&P	Apply when broadleaf weeds are actively growing. Follow label directions and precautions.
	Metsulfuron methyl	0.1 to 1 oz Metsulfuron*	Apply when weeds are less than 4 inches tall or in diameter. Can be tank mixed with Clarity, Grazon P+D, 2,4-D, Tordon 22K, or WeedMaster. Include a nonionic surfactant at 0.25 to 0.5% v/v.
	Metsulfuron methyl + 2,4-D amine + dicamba	Cimarron Max	See label for rates, directions, restrictions, and cautions.
	Metsulfuron methyl + Chlorsulfuron	0.5 to 2 oz Cimarron X-tra	Apply when weeds are less than 4 inches tall or in diameter. Do not apply more than 1 oz/acre to buffalograss. See label for tank mix and surfactant recommendations.
	Metsulfuron methyl + Chlorsulfuron	0.125 to 1.25 oz Cimarron Plus	Apply when weeds are less than 4 inches tall or in diameter. Do not apply more than 0.625 oz/acre to buffalograss. See label for tank mix and surfactant recommendations.
	Dicamba + Diflufenzopyr	2 to 8 oz Overdrive	Controls wide range of broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and precautions.
Common mullein	Aminopyralid	5 to 7 fl oz Milestone	Apply to rosettes in the spring. Add a nonionic surfactant at 0.25 to 0.5%. Follow label directions and precautions.
	Aminopyralid + 2,4-D	2 to 2.6 pt ForeFront R&P	Apply to rosettes in the spring. Add a nonionic surfactant at 0.25 to 0.5%. Follow label directions and precautions.
	Picloram + 2,4-D	4 pt Grazon P+D	Apply during the rosette stage in spring or fall before bolting. Add a surfactant.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR RANGELAND WEEDS

Weeds	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
ANNUAL AND BIENNIAL WEEDS			
Common mullein	Metsulfuron methyl	0.2 oz Metsulfuron* or 0.375 to 0.625 oz Cimarron Plus	Apply during the rosette stage in the spring when the plants are actively growing. Add a surfactant.
Lanceleaf ragweed	Dicamba 0.25 to 0.5 lb	0.5 to 1 pt Clarity or Banvel	Apply when weed has leaves and is growing actively. Do not let dairy animals graze on treated area within 7 days after treatment. Do not cut for hay for 37 days. Repeat applications may be necessary. Follow label directions and precautions.
	2,4-D* amine + Dicamba 1 lb + 0.25 lb	1 qt of 4 lb/gal 2,4-D* amine or LVE + 0.5 pt Clarity or Banvel	Apply when weed has leaves and is growing actively. Do not let dairy animals graze on treated area within 7 days after treatment. Do not cut for hay for 37 days. Repeat applications may be necessary. Follow label directions and precautions.
Annual bromes	Glyphosate 0.28 to 0.39 lb ae	8 to 11 fl oz of 4.5 lb ae/gal Glyphosate* (See glyphosate table)	Apply to rangeland when native grasses are dormant in the fall or early spring and annual bromes (downy brome and Japanese brome) are actively growing. Desirable cool-season grasses such as western wheatgrass will be damaged. Do not use ammonium sulfate. See various labels for rates, directions, and precaution
Annual grasses and many broadleaves	Imazapic 0.032 to 0.188 lb	2 to 12 oz Plateau	See label for tolerance of native grasses to imazapic and recommended use rates, timing, and use of adjuvants.
PERENNIAL WEEDS			
Goldenrod Hoary vervain Western ironweed Western ragweed	Dicamba 0.5 to 2 lb	1 to 4 pt Clarity or Sterling Blue	Apply when problem weed has leaves and is growing actively. Ironweed can be treated until bud stage. Use 20 or more gal of solution/acre. Repeat applications may be necessary. Consult herbicide labels for grazing and haying instructions. Follow directions and precautions on label.
	Dicamba + Diflufenzopyr	4 to 8 oz Overdrive	Addition of a nonionic surfactant or methylated seed oil needed to achieve consistent weed control. Lower rate should be tank mixed with other herbicides to enhance control.
	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb	1-2 qt of 4 lb/gal 2,4-D* amine or LVE	Apply when problem weed has leaves and is growing actively. Ironweed can be treated until bud stage. Use 20 or more gal of solution/acre. Repeat applications may be necessary. Consult herbicide labels for grazing and haying instructions. Follow directions and precautions on label.
	2,4-D* amine + Dicamba 1 lb + 0.25 lb	1 qt of 4 lb/gal 2,4-D* amine or LVE + 0.5 pt Clarity or Banvel	Apply when problem weed has leaves and is growing actively. Ironweed can be treated until bud stage. Use 20 or more gal of solution/acre. Repeat applications may be necessary. Consult herbicide labels for grazing and haying instructions. Follow directions and precautions on label.
	Metsulfuron methyl +2,4-D amine + dicamba	Cimarron Max	See label for rates, directions, restrictions, and cautions.
	Aminopyralid 0.047 to 0.109 lb	3 to 7 fl oz Milestone	Apply to control broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR RANGELAND WEEDS

Weeds	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
PERENNIAL WEEDS			
Goldenrod Hoary vervain Western ironweed Western ragweed	Aminopyralid	1.5 to 2.6 pt ForeFront R&P	Apply when broadleaf weeds are actively growing. Follow label directions and precautions.
	Picloram 0.25 to 0.5 lb	1 pt to 1 qt Tordon 22K	A restricted-use pesticide. Apply before bud stage when plant is growing actively. Follow directions, grazing limitations, and precautions on label.
	Picloram + 2,4-D	Grazon P+D (see label for rates)	A restricted-use pesticide. Apply according to label directions. There are no grazing restrictions for non-lactating dairy animals or other livestock including horses, sheep, goats, and other animals in the treated area.
	Picloram + Fluroxypyr	Surmount (see label for rates)	A restricted-use pesticide. Apply when weeds are small and actively growing.
	Clopyralid + Triclopyr	Redeem R&P (see label for rates)	Apply in fall when the plant is actively growing. Follow directions and precautions on label.
Broom snakeweed	Metsulfuron methyl 0.019 to 0.038 lb	0.5 to 1 oz Escort XP or 0.625 oz Cimarron Plus	Apply in fall when the plant is actively growing. Follow directions and precautions on label.
	Picloram 0.25	1 pt Tordon 22K	A restricted-use pesticide. Apply during active growth between the full-leaf and early-bloom stages. Follow directions and precautions on label.
	Picloram + 2,4-D	1 to 2 qt Grazon P+D	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	Metsulfuron methyl +2,4-D amine + dicamba	Cimarron Max	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
Sericea lespedeza	Metsulfuron methyl 0.015 to 0.038 lb	0.4 to 0.5 oz Metsulfuron* 0.5 to 1 oz Escort XP	Apply from flower bud initiation through the full-bloom stage. For aerial application, use 3 to 5 gal spray/acre, flat fan nozzles, and NIS. See label for additional instructions and precautions. Note: Do not apply if drought conditions exist at intended time of application.
	Metsulfuron methyl +2,4-D amine + dicamba	Cimarron Max	Apply at Rate II from the beginning of flower bud initiation through the full-bloom stage. See label for additional instructions and precautions.
	Metsulfuron methyl + Chlorsulfuron	Cimarron X-tra	Apply at Rate II from the beginning of flower bud initiation through the full-bloom stage. See label for additional instructions and precautions.
	Metsulfuron methyl + Chlorsulfuron	Cimarron Plus	Apply at 0.625 oz/acre beginning at flower bud initiation through the full-bloom stage. See label for additional instructions and precautions.
	Triclopyr 0.5 to 1.0 lb	1 pt to 1 qt Remedy Ultra	Apply when the plants are growing actively in the vegetative stage (June) or in flower (flowers open) (late July to September). Use a minimum of 20 gal spray/acre for ground application. For aerial application, use 3 to 5 gal spray/acre. See label for additional instructions and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR RANGELAND WEEDS

Weeds	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
PERENNIAL WEEDS			
Sericea lespedeza	Triclopyr + Fluroxypyr	1.5 to 2 pt PastureGard	Apply when plants are 12 to 15 inches tall in the late spring to early summer before bloom. Use higher rate for dense stands or later stages of growth.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR BRUSH AND TREES ON RANGELAND

Brush or tree	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
FOLIAR APPLICATION			
Buckbrush Plum, sand and American Smooth sumac	2,4-D* amine, LVE, or mixed formulations 1 to 2 lb	1 to 2 qt of 4 lb/gal 2,4-D	Apply to foliage in spring when brush is nearing full-leaf stage and growing actively. Repeat applications may be necessary in following years. Normal treatment time: buckbrush (May 1-15); sand plum (May 20-June 10); and sumac (June 10-25).
	Picloram/2,4-D	1 to 2 qt Grazon P+D	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	Picloram/2,4-D + Triclopyr 0.54/2 lb + 0.5-1 lb	1 gal Grazon P+D + 1 to 2 pt Remedy Ultra in 100 gal water	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
Sand sagebrush	2,4-D* amine, LVE, or mixed formulations 1 lb	1 qt of 4 lb/gal 2,4-D*	Leave untreated strips in areas with high wind-erosion hazard. Apply when sagebrush is in the bud stage.
Russian olive	2,4-D* amine + Dicamba 1 lb + 0.25 lb	1 qt 2,4-D* + 0.5 pt Clarity or Banvel	Apply from late May to mid-June when plant is growing actively. For aerial application, use 3 gal or more of total solution/acre. For individual plant treatment, use 25 gal of solution; wet leaves for complete coverage.
Blackberry Roughleaf dogwood	2,4-D* amine + Dicamba 2 lb + 0.5 lb	2 qt of 4 lb/gal 2,4-D* + 1 pt Banvel or Clarity	Use for suppression. Apply between bud and full-bloom stages (blackberry: April 15 to May 15; dogwood: May 15 to June 15). Mix chemicals in 100 gal of water; wet leaves. Repeat applications may be necessary.
	2,4-D*/Triclopyr 1/0.5 lb	2 qt Crossbow	Crossbow is a premix of 2 lb 2,4-D and 1 lb triclopyr/gal for control of many woody plants on rangeland and pasture. Apply to foliage and green stems when woody plants are growing actively. Apply Crossbow in water at 1.5% spray mix or 1.5 gal/100 gal spray mix. Follow label directions.
	2,4-D* + Triclopyr 1 lb + 0.5 lb	1 qt 4 lb/gal 2,4-D* + 1 pt Remedy Ultra	
	Picloram/2,4-D + Triclopyr 0.135/0.5 + 0.5 lb	1 qt Grazon P+D + 1 pt Remedy Ultra in 100 gal water	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label. Label recommends 1 gal Grazon P+D plus 1 to 2 qt Remedy Ultra/100 gal spray solution.
Multiflora rose Poison ivy	Glyphosate 1% solution	Glyphosate*	Apply as spot treatment by hand equipment before leaves lose green color. Vegetation in treated area can be damaged. Avoid drift outside target area. Follow label directions and precautions.
Multiflora rose	Metsulfuron methyl 0.019 to 0.038 lb	0.5 oz Escort XP , 0.5 to 1.0 oz Metsulfuron* , or 0.625 oz Cimarron Plus	Apply in the spring, shortly after full-leaf stage. Complete coverage is necessary for effective control. Do not apply to tall fescue.
	Picloram + 2,4-D	Grazon P+D (see label for rates)	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label.
	Picloram/2,4-D + Triclopyr 0.27/1 + 0.5 lb	2 qt Grazon P+D + 1 pt Remedy Ultra in 100 gal water	A restricted-use pesticide. Apply according to label directions. Follow directions, grazing limitations, and precautions on label. Label recommends 1 gal Grazon P+D plus 1 to 2 qt Remedy Ultra/100 gal spray solution.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR BRUSH AND TREES ON RANGELAND

Brush or tree	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
FOLIAR APPLICATION			
Prickly pear	Picloram 0.125 to 0.25 lb	Tordon 22K 0.5 to 1 pt	A restricted-use pesticide. Apply before full-bloom stage while plant is growing actively (May-June). Use higher rate for more complete control. Follow directions, grazing limitations, and precautions on label.
	Picloram + Fluroxypyr	3 to 4 pt Surmount	A restricted-use pesticide. See label for proper timing, spray volumes, and other directions and precautions.
Many woody plants and broadleaf weeds	2,4-D*/Triclopyr 1/.05 lb	2 qt Crossbow	Crossbow is a premix of 2 lb 2,4-D and 1 lb triclopyr/gal for control of many woody plants on rangeland and pasture. Apply to foliage and green stems when woody plants are growing actively. Apply Crossbow in water at 1.5% spray mix or 1.5 gal/100 gal spray mix. Follow label directions.
	2,4-D* + Triclopyr 1.0 lb + 0.5 lb	1 qt of 4 lb/gal 2,4-D* + 1 pt Remedy Ultra	
	Picloram + Fluroxypyr	3 to 6 pt Surmount	
Mixed brush including Osage orange (hedge) and locust	2,4-D + Triclopyr + Picloram 1 lb + 0.5 lb + 0.25 lb	1 qt of 4 lb/gal 2,4-D* + 1 pt Remedy Ultra + 1 pt Tordon 22K	Tordon 22K is a restricted-use pesticide. Apply before full-leaf stage to foliage and green stems when woody plants are growing actively. See label for methods of application, rates for tank mixes, and precautions.
Saltcedar (tamarisk)	Imazapyr	2 qt Arsenal	Add 1 qt/acre methylated seed oil. For high-volume foliar sprays, use 1% Arsenal + 1% MSO. Apply to wet, not run off.
	Imazapyr + Glyphosate	Arsenal + Glyphosate*	For high-volume foliar sprays, use 0.5% Arsenal + 0.5% glyphosate + 1% MSO or 0.25% NIS.
DORMANT STEM APPLICATION			
Mixed brush including blackberry and multiflora rose	2,4-D*/Triclopyr	Crossbow 1 to 4% in diesel oil or kerosene	Crossbow is a premix of 2 lb 2,4-D and 1 lb triclopyr/gal for control of many woody plants on rangeland and pasture. Thoroughly wet all stems. Treat any time when brush is dormant and the bark is dry. Follow label directions.
Multiflora rose	Dicamba	Banvel , Clarity , or Sterling Blue	Apply as undiluted spot treatment or as lo-oil basal bark treatment when plants are dormant. See label for rates, directions, and precautions.
Many woody plants	Triclopyr	Remedy Ultra 0.75 to 1.5% in diesel oil or kerosene	Thoroughly wet upper and lower stems, including root collar and any ground sprouts. Treat when brush is dormant and bark is dry. Follow label directions.

NOTE: Do not apply herbicides when grass is in boot to milk stage where grass seed production is desired. Do not apply to newly seeded areas or after grasses begin to head. See herbicide labels for directions, precautions, and grazing limitations.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR BRUSH AND TREES ON RANGELAND

Brush or tree	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
SOIL APPLICATION			
Buckbrush, Cottonwood, Dogwood, Elm, Multiflora rose, Oaks, Smooth sumac, Willow	Tebuthiuron	Spike 20P (see label for rates)	Apply to soil surface on grid pattern or evenly spaced under drip line of plants. See label for rates, directions, and precautions. Spike 20P is recommended for multistemmed species, such as dogwood, buckbrush, and smooth sumac.
Elm, Hackberry, Honey locust, Multiflora rose, Oaks, Osage orange, Russian olive, Willow	Hexazinone	Velpar L 2 to 4 ml of product/ inch of stem diameter or 1 to 2 pellets Pronone Power Pellet Herbicide /inch stem diameter	Apply from April through June in period of active growth. Apply Velpar L with exact delivery hand-gun applicator. Precipitation is needed for activation. Do not apply to brush in standing water or use on marshy or poorly drained areas. Expect to see some grass damage. See label for additional instructions.
Eastern red cedar	Picloram	Tordon 22K 3 to 4 ml of product/ 3 feet of plant height	A restricted-use product. Apply on upslope side of plant during April and May or September and October with exact delivery hand-gun applicator. Rainfall is needed for activation. Surrounding vegetation can be damaged. See label for additional instructions.
Yucca (small soapweed)	Hexazinone	Velpar L 4 ml of product/inch of stem diameter or 1 to 2 pellets Pronone Power Pellet Herbicide / plant	Apply from April through June when the plants are actively growing. Apply Velpar L with an exact delivery hand-gun applicator. Apply on the uphill side at the edge of the plant. Expect to see some grass damage. See label directions for instructions and precautions.
BASAL BARK APPLICATION			
Many woody plants	Triclopyr	Remedy Ultra 25% in diesel oil or kerosene	Controls woody plants such as elm, Osage orange, ash, locust, mulberry, and oaks. Spray basal parts of brush or trees to a height of 15 to 20 inches above the ground. Thoroughly wet all basal bark areas, including crown buds and ground sprouts. Best root control is obtained when application is made from mid-July to mid-January. Periods of dry weather also will aid in root control.
	Triclopyr	Pathfinder II	A ready-to-use product. No mixing required. Use on susceptible woody plants with less than 6-inch basal diameter. Spray basal parts of brush and trees to thoroughly wet lower 12 to 15 inches of stems. Apply at any time, except when snow or water prevent spraying to the ground line.
	Triclopyr + Fluroxypyr	PastureGard 50% in diesel oil or kerosene	Use on susceptible woody plants with less than 6-inch basal diameter. Spray basal parts of brush and trees to thoroughly wet lower 12 to 15 inches of stems. Apply at any time, except when snow or water prevent spraying to the ground line.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR BRUSH AND TREES ON RANGELAND

Brush or tree	Herbicide and active ingredient needed/acre	Formulated product and amount/acre*	Comments and limitations
CUT STUMP OR FRILL APPLICATION			
Cottonwood Elm Oak species	Dicamba	Banvel, Clarity, or Sterling Blue (see label for specific directions)	Apply to stump or frill immediately after cutting. See labels for rates, directions, and precautions. Best root control is obtained when application is made from mid-July to mid-January. Periods of dry weather also will aid in root control.
Many woody plants, including saltcedar (tamarisk)	Triclopyr	Remedy Ultra 25% in diesel oil or kerosene	Apply to stump or frill immediately after cutting. See label for rates, directions, and precautions. Best root control is obtained when application is made from mid-July to mid-January. Periods of dry weather also will aid in root control.
	Triclopyr	Pathfinder II	A ready-to-use product. No mixing required. Apply product to wet the cut surface and sides of the stumps. Apply at any time, except when snow or water prevent spraying to the ground line.
	Triclopyr + Fluroxypyr	PastureGard 50% in diesel oil or kerosene	Apply to stump or frill immediately after cutting. Thoroughly wet sides of stump, root collar, and cut surface. Apply at any time, except when snow or water prevent spraying to the ground line. Use undiluted PastureGard for saltcedar control.
	Imazapyr	Arsenal 10% in water	Apply to cambium area of freshly cut stump surface.
GROWING POINT AND LEAF BASE (CROWN) TREATMENT			
Yucca (small soapweed)	Triclopyr	Pathfinder II	A ready-to-use product. Thoroughly wet the center of the plant, including growing point. Complete coverage of leaves is not necessary.
	Triclopyr	Remedy Ultra 2% in diesel or fuel oil	Thoroughly wet the center of the plant, including growing point and leaf bases to the soil surface. Complete coverage of leaves is not necessary.
	Triclopyr + Fluroxypyr	PastureGard 2% in diesel or fuel oil	Thoroughly wet the center of the plant, including growing point and leaf bases to the soil surface. Complete coverage of leaves is not necessary.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NONCROPLAND

Many herbicides, including some used for selective weed control in crops, can be used for nonselective weed control on noncropland areas such as industrial sites, around buildings, on storage areas, under fences, and in road ditches. Caution must be used to avoid damaging desirable plants. Drift during application, volatility of some materials after spraying, and water movement through or on soil surfaces can seriously injure surrounding vegetation. For more effective weed control and least injury to nearby desirable plants, follow label directions and observe precautions.

Persistent herbicides remain in the soil and can prevent plant growth for a full season or longer. Rates of breakdown and disappearance depend on several factors, including soil type, rainfall, temperature, and soil microorganisms. Rates and optimum times to apply also differ with the soil, rainfall, and weed species. When hard-to-kill species are problems or where environmental factors reduce chemical activity, (1) increase the application rate, (2) use a mixture of chemicals, or (3) repeat the treatment.

Translocated or contact herbicides control existing vegetation. The foliage must be covered thoroughly, and applications may have to be repeated for season-long control.

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
PERSISTENT HERBICIDES		
Borate, Chlorate, or mixtures of Borate or Chlorate with other chemicals	Numerous products*	Apply before spring rainy season begins. Follow label instructions.
Bromacil 3 to 24	1.5 to 12 gal Hyvar XL	Controls woody plants and many annual and perennial weeds, particularly perennial grasses. Apply before weeds start active growth in the spring. Bromacil controls deep-rooted weeds.
Bromacil + Diuron	4 to 30 lb Krovar I DF	Controls many annual and perennial weeds. Apply before weeds start active growth or shortly after weeds emerge. Krovar I is a premix containing 40% bromacil and 40% diuron.
Chlorsulfuron	0.25 to 3 oz Telar DF	For control of many annual and perennial broadleaf weeds in noncrop areas. Can be applied preemergence or postemergence, but for best results, apply to young weeds growing actively. Do not use on food or feed crops. Do not apply on or near desirable trees or plants. Do not contaminate water. Follow label directions and precautions.
Diuron	5 to 15 lb Karmex DF	Controls many annual and perennial weeds. Apply in the spring. Remove heavy top-growth before treatment. Karmex controls shallow-rooted weeds.
Hexazinone 2 to 8	1 to 4 gal Velpar L	Controls annual and perennial weeds and some woody plants. Apply before or soon after weeds emerge. For best results, apply when weeds are young and growing actively.
Imazapic 0.063 to 0.188 lb	4 to 12 oz Plateau	Controls most annual grasses and broadleaf weeds. Apply to small, actively growing weeds before they reach size limits listed on label. Apply with nonionic surfactant, crop oil concentrate, or methylated seed oil plus fertilizer solution.
Imazapyr	2 to 6 pt Arsenal	Controls most annual and perennial grasses and broadleaf weeds, in addition to many woody plants and vines. Mix in water and add a surfactant. Follow label directions and precautions.
Imazapyr + Diuron 0.4 + 3.1 to 1.5 + 11.8	5 to 19 lb Sahara	Controls most annual and perennial weeds and some woody plants on noncropland areas. Can be applied preemergence, but applying postemergence to actively growing weeds is preferred. Apply with nonionic surfactant or crop oil concentrate. Do not treat where roots of desirable plants may extend into the treated zone or allow drift to nontarget areas. Do not contaminate water. Sahara can be applied to nonirrigation ditches and low-lying areas when water has drained but can be isolated in pockets because of uneven or unlevel conditions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NONCROPLAND

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
PERSISTENT HERBICIDES		
Metsulfuron	0.25 to 2 oz Escort XP	Controls many annual and perennial broadleaf weeds and some woody plants. Do not use on food or feed crops. Prevent drift of spray to desirable plants. Follow label directions.
Picloram	Tordon RTU	Tordon RTU is a ready-to-use product that is effective in cut-surface applications for killing unwanted trees in noncrop areas, such as fence rows and rights-of-way. Spray or paint freshly cut surfaces of trees, such as cedar, dogwood, elm, oaks, and persimmon. Follow label directions and precautions.
Picloram + 2,4-D 0.25 + 1 to 2 + 8	0.5 to 4 gal Tordon 101	A restricted-use pesticide. Tordon 101 is a premix of 0.5 lb picloram and 2 lb 2,4-D/gal for control of broadleaf weeds, woody plants, and vines. Does not mix readily with oil. Avoid application to sites susceptible to contamination of groundwater or surface water.
Prometon 10 to 60	5 to 30 gal Pramitol 25E	Controls annual and many perennial weeds. Apply before or after plant growth begins. Mix in water or oil; oil spray kills top-growth faster than water spray.
Simazine 4.8 to 22.5	4L, 90 WDG, or 80 W Simazine*	Controls many annual weeds and suppresses perennials. Clean Crop Simazine can be tank mixed with herbicides such as glyphosate, Karmex, 2,4-D, or Oust to broaden control spectrum. Follow label directions.
Sulfometuron methyl	1.33 to 8 oz Oust XP	For control of many annual and perennial weeds on noncropland areas. Can be applied preemergence or postemergence to weeds, but best results are obtained if application is made before or during early stages of weed growth. Do not use on food or feed crops. Do not apply on or near desirable trees or plants. Do not contaminate water. Follow label directions and precautions. In areas where kochia and Russian thistle are present or are target species, this product should be tank mixed to guard against resistant biotypes.
Tebuthiuron 1 to 4	5 to 20 lb Spike 20P	For control of woody plants and vines in noncrop areas. Apply broadcast or as an individual-plant treatment, depending on size, density, and location of brush. For best results, apply before active seasonal growth in spring and/or periods of rainfall. Do not apply on any area into which roots of desirable plants may extend. Do not contaminate water. Follow label directions and precautions.
NONSELECTIVE, TRANSLOCATED, OR CONTACT HERBICIDES		
Dicamba	Banvel, Clarity, or Sterling Blue	Herbicide for cut-surface treatment to control undesirable trees in noncrop areas, such as fence rows, drainage-ditch banks, and rights-of-way. Spray or paint freshly cut surfaces of trees, such as ash, cedar, cottonwood, dogwood, elm, oak, persimmon, sumac, and willow. Follow label directions and precautions.
Fosamine 6 to 24	1.5 to 6 gal Krenite S	Controls many susceptible brush species and some perennial plants, including field bindweed. Apply as foliar spray to mature vegetation. Can use on noncropland adjacent to domestic water-supply reservoirs, lakes, and ponds. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NONCROPLAND

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
NONSELECTIVE, TRANSLOCATED, OR CONTACT HERBICIDES		
Glyphosate 0.75 to 3.75 lb ae	1 to 5 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Controls annual and perennial weeds. Apply to annual weeds before they head and to perennial weeds from early bud to early seed stages. The addition of 2% ammonium sulfate by weight or 17 lb/100 gal of water can increase the performance of glyphosate. Can be tank mixed with Princep. Do not apply when wind or other conditions might cause spray mist to drift.
Paraquat 0.625 to 1	2.5 to 4 pt Gramoxone Inteon	A restricted-use pesticide. Spray young weeds. Repeat as necessary to maintain control. Kills annual weeds and tops of perennials.
Triclopyr	Remedy Ultra	See label for methods, rates, tank mixes, and precautions.
Triclopyr 1 to 8	0.25 to 2 gal Garlon 4 Ultra	Controls broadleaf weeds and woody plants. Keep out of streams, lakes, and irrigation ditches.
Triclopyr	Pathfinder II	A ready-to-use product for woody plant control. Apply as a low-volume basal bark treatment or on cut stumps. See label for species controlled, methods, and precautions.
2,4-D + Triclopyr	1 to 4 gal Crossbow	Crossbow is a premix of 2 lb 2,4-D and 1 lb triclopyr (Garlon)/gal for control of many woody plants. Apply to foliage and green stems when woody plants are growing actively. Apply Crossbow in water at 1 to 1.5% spray mix or at 1 to 1.5 gal/100 gal spray mix. Follow label directions.
Aminopyralid 0.047 to 0.109 lb	3 to 7 fl oz Milestone	Apply to control broadleaf weeds. Can be tank mixed with other herbicides. Follow label directions and instructions.
PREEMERGENCE FOR TANK MIXING		
Pendimethalin	Pendulum	See label for methods, rates, tank mixes, and precautions.
Oryzalin	Surflan A. S.	See label for methods, rates, tank mixes, and precautions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NOXIOUS WEEDS

This table lists alternative herbicides that are registered for use on bur ragweed, field bindweed, johnsongrass, musk thistle, and sericea lespedeza. Other products are registered for use to control noxious weeds but are not included in this publication. For information on herbicides registered for use on hoary cress, hogpotato (pignut), kudzu, leafy spurge, quackgrass, and Russian knapweed, contact your local Research and Extension Office; the Plant Health Division, Kansas State Board of Agriculture, Topeka; or your county Noxious Weed Office.

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
BUR RAGWEED (WOOLLY LEAF BURSAGE)		
Dicamba 1 to 2 lb	1 to 2 qt Banvel or Clarity	Apply as broadcast or spot treatment to actively growing plants after crop harvest and before killing frost. See label for cropping limitations.
Dicamba 2 to 6 lb	2 to 6 qt Banvel or Clarity	For use on pastures, rangeland, and noncropland. For suppression and top-growth control. Can injure cool-season grasses. Follow label directions.
Dicamba + 2,4-D 0.5 + 1 lb	1 pt Banvel or Clarity + 1 qt 4 lb/gal 2,4-D* LVE	For best control of bur ragweed, apply to regrowth in late summer or fall. Follow label directions and precautions.
Glyphosate + Dicamba 1 to 2 lb + 0.38 lb ae	1 to 2 qt of 3 lb ae/gal Glyphosate* + 1 pt Banvel or Clarity	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Apply when plants are producing new growth initiated by moisture for at least 2 weeks and when plants are at or beyond flowering. Follow label directions.
Picloram + 2,4-D 0.25 lb + 1.0 lb	1 pt Tordon 22K + 1 qt of 4 lb/gal 2,4-D*	Tordon 22K is a restricted-use pesticide. For use in pastures, rangeland, noncropland, and fallow. Apply when bur ragweed is flowering or in the fall. Allow a minimum of 60 days between application of Tordon and planting wheat. Do not plant susceptible broadleaf crops for 36 months or more after application.
2,4-D LVE 2.0 lb	2 qt of 4 lb/gal 2,4-D* LVE	Apply during fallow period to actively growing plants at bud stage. Provides seasonal suppression only.
CANADA THISTLE		
Clopyralid 0.13 to 0.25 lb	0.33 to 0.67 pt Stinger	Apply to Canada thistle in field corn after corn emergence through 24-inch corn and when thistles are at least 4 inches in diameter or height but before bud stage. Do not cultivate before or within 2 weeks after treatment. Apply over-the-top of the crop or with drop nozzles in 10 or more gal spray/acre. Can rotate to small grains anytime. Other crops may require a waiting period of 12 months or more. Do not apply aerially. Do not contaminate irrigation ditches or water used for irrigation or domestic purposes. Can be tank mixed with 2,4-D. See label for uses in rangeland, CRP, and fallow.
Clopyralid + Triclopyr	1.5 to 4 pt Redeem R&P	Apply after the majority of the plants have emerged and before bud stage. A nonionic surfactant should be used.
Clopyralid + 2,4-D	2 to 4 pt Curtail	Use the 2 pt rate in small grains and higher rates in fallow, CRP, and noncropland. Apply after small grains have four leaves and two tillers until early jointing. Treat Canada thistle after it is 4 inches in diameter or height but before the bud stage. The best control is obtained with treatment during the rosette to early bolting stages of growth. Do not harvest hay from treated grain fields. Note rotation guidelines on label.
Dicamba 1 to 2 lb	1 to 2 qt Banvel or Clarity	For use in grassland, CRP, and fallow. Can injure forage grasses. Do not use on leaching type soils. Can persist up to 2 years.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NOXIOUS WEEDS

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
CANADA THISTLE		
Glyphosate 0.75 to 2.25 lb ae	1 to 3 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Use in fallow and noncropland or as a spot treatment in cropland. Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Treated crop and nontarget plants will be injured or killed. Apply to Canada thistle that is growing actively and at or beyond the bud stage of growth or to actively growing rosettes in the fall. Wait at least 3 days after treatment before tilling treated areas.
Picloram 0.5 to 1 lb	1 to 2 qt Tordon 22K	Restricted-use pesticide. Use for spot treatment only in noncropland, CRP, range, and pastureland. Can injure forage grasses. Apply to actively growing Canada thistle in fall or in spring at early flower bud. Do not allow grazing for 2 weeks after treatment. Not recommended for coarsely textured soils. Picloram can remain in the soil for 3 or more years.
Aminopyralid 0.078 to 0.109 lb	5 to 7 fl oz Milestone	Use for broadcast or spot treatment in rangeland, pastures, noncropland, or CRP. Apply in the fall to vegetative plants or in the spring to plants in the pre-bud growth stage. Follow label directions and precautions.
Aminopyralid + 2,4-D	2 to 2.6 pt ForeFront R&P	Use for broadcast or spot treatment in rangeland, pastures, and CRP. Apply when plants are actively growing. Follow label directions and precautions.
FIELD BINDWEED		
Picloram + 2,4-D 0.25 to 0.5 lb + 1 lb	1 to 2 pt Tordon 22K + 1 qt 2,4-D*	Tordon 22K is a restricted-use pesticide. Can be broadcast applied to grasslands and fallow cropland. Persistent in soils. See label precautions for aerial applications.
Dicamba 1 to 2 lb	1 to 2 qt Banvel or Clarity	Apply as broadcast or spot treatment to actively growing plants after crop harvest and before killing frost. See label for cropping limitations.
Dicamba + Glyphosate 0.5 to 2 lb + 0.75 to 1.5 lb ae	1 to 4 pt Banvel or Clarity + 1 to 2 qt of 3 lb ae/gal Glyphosate*	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Apply when weed is growing actively, at or beyond full bloom, or between August and October at least 8 weeks after last tillage. Do not disturb treated areas for 7 days after application. Do not plant wheat for 45 days for each pint of Banvel or Clarity applied. For best results, use flat-fan nozzles. Always follow label directions.
Dicamba + 2,4-D 0.5 lb + 1 lb	1 pt Banvel or Clarity + 1 qt of 4 lb/gal 2,4-D* amine or LVE	Apply to pasture, rangeland, cropland, and noncropland areas. Follow label directions and note cropping limitations.
Dicamba + 2,4-D 0.25 lb + 0.25 lb	0.5 pt Banvel or Clarity + 0.5 pt of 4 lb/gal 2,4-D* amine or LVE	Apply in the fall to actively growing bindweed in wheat that has at least three leaves and before a killing freeze. Wheat injury is possible, especially with cold wet weather after application.
Fosamine 8 to 24 lb	2 to 6 gal Krenite S	Do not use on food crops. Apply in noncropland areas after plants begin to bloom.
Glyphosate 3 lb ae	1 gal of 3 lb ae/gal Glyphosate* (See glyphosate table)	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. Apply to actively growing bindweed in August to October on land not in crops. Can be applied as spot treatment in some crops. Follow label directions.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NOXIOUS WEEDS

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
FIELD BINDWEED		
Picloram + 2,4-D 0.13 to 0.25 lb + 0.5 to 2 lb	0.5 to 1 pt Tordon 22K + 0.5 to 2 qt of 4 lb/gal 2,4-D* amine or LVE	Tordon 22K is a restricted-use pesticide. For reduction of field bindweed and for control of many annual weeds after wheat harvest and before planting winter wheat, barley, or oats. Apply after grain harvest and again about mid-May during fallow season. Do not treat with Tordon more than once in each calendar year. Avoid spray drift. Follow label directions.
Quinclorac 0.25 to 0.38 lb	5.3 to 8.0 oz Paramount	Apply to actively growing bindweed with at least 4-inch vines in sorghum or in fallow before planting sorghum or wheat. Always apply with crop oil concentrate or methylated seed soil adjuvant. Do not plant any crop other than wheat or sorghum within 10 months after application. Do not plant alfalfa for at least 24 months after application.
2,4-D 0.75 to 2 lb	0.75 to 2 qt of 4 lb/gal 2,4-D* amine or LVE	Apply in spring when plant is in bud stage or in fall after 12 inches of new growth. Follow label directions.
Imazapic 0.1875 lb	12 oz Plateau	Apply with an adjuvant (2 pt/acre methylated seed oil or 0.25% nonionic surfactant) to actively growing runners. For use on CRP, roadsides, and other noncropland sites.
Imazapic + Glyphosate 0.1875 + 0.375 lb	32 oz Journey	Apply with 2 pt/acre methylated seed oil to actively growing runners on noncropland.
JOHNSONGRASS		
Imazapic 0.125 to 0.1875 lb	8 to 12 oz Plateau	Apply with an adjuvant (2 pt/acre methylated seed oil or 0.25% nonionic surfactant). For use on CRP, roadsides, and other noncropland sites. Follow label directions for application.
Imazapic + Glyphosate	24 to 32 oz Journey	Apply with 2 pt/acre methylated seed oil on roadsides and other noncropland sites. Follow label directions and precautions.
Glyphosate 0.75 to 2.25 lb ae	1 to 3 qt of 3 lb ae/gal Glyphosate* (See glyphosate table)	Glyphosate products differ in concentration and adjuvant requirements. Refer to specific product labels for rate and adjuvant recommendations. For best results, apply to actively growing plants when most are at least 18 inches tall and at the boot to head stages of growth. Do not apply after the plants turn brown in the fall. Allow 7 or more days between application and tillage. Can be used as a spot treatment in some crops. Always follow label directions. For best results, use flat-fan nozzles and 3 to 10 gal spray/acre.
Prometon 40 to 60 lb	20 to 30 gal Pramitol 25E	For use on industrial sites and noncrop areas. Apply before or up to 3 months after weeds emerge.
Sulfometuron methyl 4.5 to 6.0 oz	6 to 8 oz Oust XP	Do not apply to cropland. Apply preemergence or early postemergence to boot stage. To reduce drift, apply at low pressures with coarse-spray nozzles. Follow label directions and precautions.
Trifluralin, Fluazifop-P, Nicosulfuron, Primisulfuron and Quizalofop	Treflan, Fusilade, Accent, Beacon, and Assure	Refer to corn and soybean sections for general recommendations.

*Products often are available in several formulations or brand names and label information may vary. Refer to table names, Toxicities, and Persistence of Herbicides.

HERBICIDES FOR NOXIOUS WEEDS

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
MUSK THISTLE		
Chlorsulfuron 0.375 to 0.75 oz	0.5 to 1 oz Telar DF	For use on rangeland, permanent grass pasture, CRP, and noncropland. Apply in spring from rosette to prebloom stages of growth. Do not allow spray drift to contact nearby crops or other nontarget plants; injury can occur. Follow label directions and precautions.
Clopyralid/2,4-D 0.095 + 0.5 lb to 0.19 + 1 lb	2 to 4 pt Curtail	For use on rangeland, permanent grass pasture, CRP, and noncropland. Apply to actively growing rosettes in the spring or fall or to bolted thistles up to the bud stage. Follow label directions.
Clopyralid/Triclopyr 0.375-0.56 lb	0.5 + 1.5 qt Redeem R&P	Apply lower rates to rosettes in the spring and the higher rate from mid to late bolt to early flowering stages.
Dicamba 0.33 lb	0.67 pt Banvel or Clarity	Apply in spring during rosette stage of growth. Can be applied for control in fall if soil moisture is favorable and air temperature exceeds 50°F. Follow label directions.
Dicamba + 2,4-D 0.25 lb + 0.75 lb	0.5 pt Banvel or Clarity + 0.75 qt 2,4-D* amine or LVE	Apply in spring during rosette stage of growth. Can be applied for control in fall if soil moisture is favorable and air temperature exceeds 50°F. Follow label directions.
Diflufenzopyr/ Dicamba	4 oz Overdrive	For use on noncropland, pasture, hay, and rangeland. Apply in the spring to actively growing rosettes or bolted thistles up to the bud stage. Add a nonionic surfactant or methylated seed oil. Follow label directions.
Metsulfuron methyl 0.15 to 0.3 oz	0.25 to 0.50 oz Escort XP or Metsulfuron*	Apply in the spring or fall to rosettes. Add 0.5 lb 2,4-D to enhance activity up to flowering. Note: Do not apply if drought conditions exist at intended time of application.
Metsulfuron methyl + Dicamba + 2,4-D	Rate I Cimarron Max	Apply in the spring or early summer before flowering or in the fall. Add a nonionic surfactant or other adjuvant. Follow label directions.
Metsulfuron methyl + Chlorsulfuron	0.5 to 1 oz Cimarron X-tra	Apply in spring or early summer before flowering or to rosettes in the fall. Apply before the ground freezes.
Metsulfuron methyl + Chlorsulfuron	0.25 to 0.5 oz Cimarron Plus	Apply in spring or early summer before flowering or to rosettes in the fall. Apply before the ground freezes.
Picloram 0.13 lb	0.5 pt Tordon 22K	A restricted-use herbicide. Apply during rosette stage in the fall, before soil freezes. Follow label directions.
Picloram + 2,4-D 0.13 lb + 1.0 lb	0.5 pt Tordon 22K + 1 qt of 4 lb/gal 2,4-D* amine, LVE, or mixed formulations	A restricted-use herbicide. Apply from rosette up to flowering stage in spring after soil thawing. Follow label directions.
Triasulfuron/ Dicamba	4 oz Rave	Apply in spring to rosette stage or up to 5-inch tall bolted thistles. Add 0.5 lb 2,4-D (1 pt of 4 lb/gal) for enhanced control.
2,4-D amine 1.5 to 2 lb	1.5 to 2 qt of 4 lb/gal 2,4-D* amine, LVE, or mixed formulations	Apply during rosette stage of growth. In spring, apply 2,4-D at 1.5 lb ae/acre. For best control in fall, apply 2,4-D LVE at 2 lb/acre. 2,4-D amine can be applied in fall, if soil moisture is favorable and air temperature exceeds 50°F

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HERBICIDES FOR NOXIOUS WEEDS

Herbicide and lb active ingredient needed/acre	Formulated product/acre*	Comments and limitations
MUSK THISTLE		
Aminopyralid 0.047 to 0.078 lb	3 to 5 fl oz Milestone	Use for broadcast or spot treatment in rangeland, pastures, noncropland, or CRP. Treat plants in the spring during rosette through bolting stages of development or in the fall. Follow label directions and precautions.
Aminopyralid + 2,4-D	1.5 to 2 pt ForeFront R&P	Use for broadcast or spot treatment in rangeland, pastures, and CRP. Treat plants in the spring during rosette through bolting stage of development or in the fall. Follow label directions and precautions.
SERICA LESPEDEZA		
Metsulfuron methyl 0.24 to 0.6 oz	0.4 to 0.5 oz Metsulfuron* or 0.5 to 1 oz Escort XP	Apply after bud/bloom stage until first frost. For aerial application, use 3 to 5 gal spray/acre, flat-fan nozzles, and NIS. See label for additional instructions and precautions. Note: Do not apply if drought conditions exist at intended time of application.
Metsulfuron methyl + Dicamba + 2,4-D	Rate II Cimarron Max	Apply from beginning of flower bud initiation to full bloom. Note: Do not apply if drought conditions exist at intended time of application.
Metsulfuron methyl + Chlorsulfuron	Cimarron X-tra	Apply at Rate II from the beginning of flower bud initiation through the full-bloom stage. See label for additional instructions and precautions.
Metsulfuron methyl + Chlorsulfuron	Cimarron Plus	Apply at 0.625 oz/acre beginning at flower bud initiation through the full-bloom stage. See label for additional instructions and precautions.
Triclopyr 0.5 to 1.0 lb	1 to 2 pt Garlon 4 Ultra	Do not apply to cropland, including rangeland and pasture. Apply when the plants are actively growing. Use a minimum of 20 gal spray/acre for ground application.
Triclopyr 0.5 to 1.0 lb	1 to 2 pt Remedy Ultra	Apply when the plants are growing actively in the vegetative stage (June) or in flower (late July to September). Use a minimum of 20 gal spray solution/acre for ground application. For aerial application, use 3 to 5 gal spray/acre. See label for additional instructions and precautions.
Triclopyr + Fluroxypyr 0.28 + 0.094 lb to 0.375 + 0.125 lb	1.5 to 2 pt PastureGard	Apply when plants are 12 to 15 inches tall in the late spring to early summer before bloom. Use higher rate for dense stands or later stages of growth

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Weed Control Publications

Available from local Research and Extension Offices in Kansas or from the Distribution Center, 16 Umberger Hall, Kansas State University, Manhattan, Kansas 66506; 785-532-5830; FAX: 785-532-7938; E-mail: orderpub@lists.oznet.ksu.edu

C-402	Smooth Brome Production and Utilization	MF-2182	Water Quality: Best Management Practices for Atrazine
C-449	Soybean Production Handbook	MF-2208	Managing to Minimize Atrazine Runoff
C-529	Wheat Production Handbook	MF-2224	Using Vegetative Filter Strips in Crop Fields
C-560	Corn Production Handbook	MF-2239	Woollyleaf Bursage Biology and Control
C-667	Aquatic Plants and Their Control	MF-2339	Weed Control in Dryland Cropping Systems
C-683	Alfalfa Production Handbook	MF-2384	High Plains Sunflower Production Handbook
C-687	Grain Sorghum Production Handbook	MF-2408	Sericea Lespedeza: History, Characteristics, and Identification
C-715	Herbicide Mode of Action	MF-2461	Atrazine Herbicide: A Water Quality Concern for Kansas
C-729	Tall Fescue Production and Utilization	MF-2734	Great Plains Canola Production Handbook
L-231	Musk Thistle: Identification and Control	MF-2767	Glyphosate Stewardship, Optimizing and Preserving Glyphosate Performance
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MF-1020	Rangeland Weed Management	S-132	Weeds of the North Central States
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MF-1089	Cleaning Field Sprayers		
MF-2086	Managing Kansas Grazinglands for Multiple Benefits		

Herbicide Handbook of the Weed Science Society of America (9th edition). 493 pages. 2007. (\$95.00)

Available from Weed Science Society of America, <http://www.wssa.net>

Additional weed management information and research summaries from Kansas State University can be accessed on the World Wide Web at www.agronomy.ksu.edu/extension/DesktopDefault.aspx?tabid69

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