

# Weed and Brush Control Guide

## For Forages, Pastures and Non-Cropland

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Published by University Extension, University of Missouri-Columbia

MP 581

\$5.00

# **Weed and Brush Control Guide for Forages, Pastures and Non-Cropland**

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## Introduction

Information in this guide is based on research conducted at the University of Missouri Agricultural Experiment Station and elsewhere. All herbicide information conforms to federal and state regulations at the time of writing. Consult the label attached to the herbicide container for current use precautions and restrictions.

Use this publication as a guide in selecting and comparing herbicides. It is not a substitute for reading the product labels before use. The University of Missouri does not warrant commercial products and regrets any errors or omissions in this guide. Cost of herbicides was not considered in making these recommendations because prices vary with location and time. Herbicides may perform better or worse than indicated in this guide due to variability in the weeds infesting the field, rainfall, soil type, temperature and many other environmental factors. Therefore, no effort has been made to list herbicides in order of preference.

Herbicides should be applied only to labeled crops. Do not exceed the maximum recommended rate for a herbicide. Excessive herbicide application rates are expensive and can result in injury to the crop, or make the crop unsafe as food or forage. Apply herbicides only at times specified on the label. Observe label restrictions for required intervals between time of treatment and time of planting, pasturing or harvesting of a crop. Guard against herbicide drift or volatility, which can injure nearby susceptible crops or plants.

## Endangered species

You should check with your local University Extension office, State Game and Fish Office or your pesticide dealer to determine whether the area you are planning to spray with any pesticide is protected for endangered species. You should request the **Pesticide Use Bulletin for Protection of Endangered Species** for your county. The bulletin indicates which areas are protected for endangered species and lists the pesticides that may and may not be used in that area.

## Forage and pasture weed management

Annual broadleaf and grass weeds can become a serious problem in pastures and forages unless proper management is practiced. Weeds can interfere with forage and pasture crops to reduce the longevity and nutritional value of the crops. Controlling weeds improves the quality of forage legumes since most weeds are lower in protein and less palatable to livestock. In addition, certain weed species are poisonous to livestock

and can become a problem when pastures are overgrazed.

Good management practices that encourage a vigorous, thick stand of pasture grass or forage legumes are important for good weed control. Weed seeds germinate and become established wherever pasture or forage stands are thin. Maintaining optimum soil fertility and pH favor the pasture or forage crop. Rotational grazing and periodic mowing of grass pastures enhances the ability of the pasture grass to compete with most annual weeds. Establishing and maintaining vigorous forage stands by using well-adapted, long-lived varieties, weed-free seed, proper seedbed preparation, and timely cutting or grazing reduces weed problems. Deep rooted, broadleaf perennial weeds are a common problem in pastures and forage crops. Crop rotation with cultivated crops can reduce some perennial weed problems.

## Herbicide application and timing

Herbicide application timing varies with the weed species. Annual and biennial weeds (1 and 2 year life-cycles, respectively) are easier to control when they are young. A fall or early spring treatment is usually best for winter annuals or for biennials in the rosette stage of growth. Spring and early summer treatments are best for summer annuals.

Established perennials are most susceptible in the bud to bloom stage, or in the fall when food reserves are moving into the roots. Spray woody brush species when they are fully leafed out and actively growing. Multiple applications are usually needed to obtain complete control of perennial weeds.

The use of herbicides without good cultural practices will generally give poor results. A thin or irregular pasture or forage stand will not be able to fill in areas left empty by weed control before new weeds can become established. Use herbicides only where the pasture grass or forage stand is thick and vigorous enough to fill in the areas where weeds are killed. Consider reestablishment if forage stands are sparse.

Forage legumes are frequently grown with a companion crop such as orchardgrass. However, most herbicides registered for use in forage legumes will severely injure or kill a grass companion crop. Be sure the herbicide is registered for both forage species before use. If the weed problem is severe, reestablishment may be necessary.

Some herbicides must be used when the pasture or forage crop is dormant to prevent injury. Others may be applied to actively growing pasture or forage crops.

Herbicides are generally applied at the following times:

1. **Preplant-surface (PPS)** onto the soil surface or any early emerged weeds before the crop is planted.
2. **Preplant-incorporated (PPI)** into the top 2 to 3 inches of soil before crop planting.

3. **Preemergence (PRE)** onto the soil after crop planting, but before weed or crop emergence.
4. **Postemergence-overtop (POST)** onto weeds after the crop and weeds have emerged.
5. **Spot spray**
  - A. Onto the foliage of weeds or brush.
  - B. Basal spray to soil and/or stem of weeds or brush.
  - C. Cut surface treatments include hypohatchet, frill and injection. These methods are designed to get the herbicide below the bark into the cambium tissue of woody plant species.

Good coverage of the entire weed is necessary to obtain maximum control with postemergence or foliar spot-sprayed herbicides. Consult the herbicide label for recommended spray volumes, pressures and application equipment.

## Types of herbicide formulations

Several types of herbicide formulations are listed in this guide. The abbreviations used are: aqueous, AQ; emulsifiable concentrates, E or EC; liquids, L; solutions, S; flowables, F; dry flowables, DF; wettable powders, WP; water-dispersible granules, WDG; and pellets, P. Most spray mixtures require constant agitation to prevent the herbicide from settling to the bottom of the spray tank. Granular formulations, G, are dry formulations that cannot be mixed with water. Do not mix granular herbicides with other granular pesticides or fertilizers.

## Herbicide additives

Additives are substances added to the spray mixture to enhance the effectiveness of the herbicide or spray mix. Common additives used for weed control are:

**Adjuvant:** Any substance added to a herbicide to improve its activity.

**Emulsifier:** A substance that promotes the suspension of one type of liquid in another (for example, oil into water).

**Wetting agent or surfactant:** A material that modifies wetting, spreading, dispersing, or emulsifying of liquids. A common term for a surfactant is a *wetting agent*.

Wetting agents or surfactants improve foliar herbicide contact and spreading on the plant surface. Most herbicides that require surfactants specify *nonionic surfactants*. Most surfactants sold for agricultural use are nonionic. Many surfactants sold for home or industrial use are not nonionic, so you should not use them.

**Dry and liquid fertilizers:** Dry fertilizers such as ammonium sulfate and liquid fertilizers such as 10-34-0 and 38-0-0 are gaining popularity as additives for certain postemergence herbicides.

**Oil concentrates:** (Also crop oil concentrates). These are normally a mixture of non-phytotoxic oil and 10 to 20 percent surfactant.

**Methylated oils:** These can be manufactured from seed oils such as soybean or sunflower or from petroleum oils. Be sure to consult the herbicide label for compatibility with these oils.

**Utility modifiers:** Two types are commonly used with herbicides.

1. *Compatibility agents* are frequently used to allow herbicides to be mixed with liquid fertilizers
2. *Antifoaming agents* can be added to the tank or sprayed onto the solution surface to prevent foam or suds from forming when filling the spray tank.

**Spray modifiers:** The most common spray mix modifier used with herbicides is the *thickening agent* or *drift control agent*. These materials thicken the spray solution to reduce drift problems. These are usually used by aerial applicators.

**Be sure you are using the proper additive for the herbicide you are using.** Most herbicide labels specify the type and amount of additive to use. Failure to follow the recommendation can result in poor weed control or excessive crop injury. The proper additive is included in this guide when required or suggested by the label.

## Spray equipment

Proper herbicide application is necessary to obtain the best weed control. Check spray equipment frequently for even and proper spray output. Herbicides are generally applied at pressures ranging from 20 to 40 psi *at the boom*. Most herbicide labels recommend a flat fan or hollow cone spray nozzle. Use stainless steel or nylon tips and 50-mesh screens with wettable powder, flowable, or dry flowable formulations.

Provide adequate agitation to keep herbicides suspended in the tank mix. Wettable powders and flowables are especially susceptible to settling in the tank.

Most herbicide labels contain recommendations for proper spray volume, pressure, and nozzle types.

Accurate sprayer calibration is essential for proper herbicide application and weed control. Sprayer calibration is not difficult, but is usually not done often enough. Screens may become blocked with trash, and nozzles wear, which alters delivery patterns and spray rates. Thoroughly inspect and calibrate spray rigs at least once a year.

## Sprayer calibration

It is absolutely essential to know how much spray liquid the sprayer is delivering per acre at the speed and pressure the tractor is operating. Here is a simple method

for calibrating a sprayer for broadcast or banding applications.

### Ounce calibration method

Step 1. Measure the specified distance in the field as determined in the following table. Select the distance that matches the nozzle spacing for broadcast, or the row spacing for band applications. This assumes that nozzle spacing equates to the effective band width per nozzle.

Nozzle spacing or bandwidth (inches)	Distance to time for calibration (feet)
40	102
38	107
36	113
34	120
32	127
30	136
28	146
26	157
24	170
22	185
20	204
18	227
16	255
14	291

- Step 2. Drive the measured distance at the desired speed and record in seconds the amount of time it takes. Note: Perform the test in the field in which you will be spraying. Attach and operate any equipment you will be using during spraying.
- Step 3. Using a measuring cup or baby bottle marked in fluid ounces, catch the discharge from a nozzle for as long as it took to travel your measured distance. If you use more than one nozzle to spray the same band or row (directed banding rigs) catch the spray from each nozzle.
- Step 4. The total discharge per nozzle or row measured in Step 3 in ounces equals the gallons per acre applied. If you used row spacing in Step 1, you must measure all nozzles directed on the row to determine gallons per acre.
- Step 5. Repeat the test for each nozzle to ensure even spray distribution. Nozzles should vary no more than 5 percent across the boom.
- Step 6. Divide tank capacity by gallons per acre determined in Step 4 to calculate the number of acres one tank full of spray will cover.

$$\frac{\text{Tank capacity (gal.)}}{\text{GPA}} = \# \text{ of acres covered}$$

Step 7. Multiply the recommended herbicide rate by the number of acres covered per tank. (Measure rate and amount in ounces, pints, quarts, etc.)

$$\text{Rate} \times \text{acres covered} = \text{Amount to add to tank}$$

Step 8. Band Application. All rates given in the guide are *broadcast* rates. You must adjust the rate for band applications using the following formula.

$$\frac{\text{Band width} \times \text{Broadcast rate}}{\text{Row width}} = \text{Band rate}$$

Use the above formula to adjust rates if you have calibrated your sprayer on a row width basis for band spraying.

### Calibration examples

#### Example A. Broadcast.

A grower will apply 2,4-D with a broadcast boom having nozzles spaced 18 inches apart.

- Step 1. The distance to travel for an 18-inch nozzle spacing is 227 feet. Measure the distance in the field to be sprayed.
- Step 2. Measure the time to drive the distance with any equipment you will be using. In this example, it took 39 seconds to cover 227 feet (4 mph).
- Step 3. Set the pressure to be used and catch the output of one nozzle for 39 seconds.
- Step 4. The output in ounces equals the amount of spray applied in gallons per acre. If the nozzle output was 20 ounces in 39 seconds, then the sprayer is applying 20 gpa.
- Step 5. Repeat Step 4 for each nozzle.
- Step 6. Assume you have two 200-gallon saddle tanks and wish to apply 1.5 pints of 2,4-D per acre.

$$\frac{400 \text{ gal per fill}}{20 \text{ gpa}} = 20 \text{ acres covered per fill}$$

Step 7. Since one of the recommended rates is 1.5 pints per acre, you would use 30 pints of 2,4-D per refill (15 pints per 200 gallon tank).

$$\frac{30 \text{ pints}}{2 \text{ tanks}} = 15 \text{ pints per tank}$$

### Tank mix compatibility

Some liquid or dry fertilizers, adjuvants, or herbicide combinations may be incompatible. Check herbicide labels carefully for compatibility restrictions. If none are listed, determine the compatibility of the herbicide with the specific fertilizer to be used. A compatibility agent may be necessary for certain liquid fertilizer/herbicide mixes. Use a jar test if you are uncertain about the compatibility of the mix.

- Mix an approved compatibility agent and the fertilizer or water to be used in two 1-quart jars.

2. Add the herbicides and adjuvants in both of the jars in the same proportion as that used in the spray tank. Add dry herbicides first, flowables next, and emulsifiable concentrates last. The amount and proportion vary with the herbicide. Check the label for each herbicide used. Add compatibility agent to one of the jars.
3. Invert or shake each jar at least 10 times to mix. Let the mixtures stand for 15 minutes.
4. If no separation, large flakes, precipitation, gels, or heavy oil films form, you can use the mixture. If the mixture can be remixed after separation, the tank-mix can be used if good agitation is provided.
5. If the mixture is incompatible, try slurring dry herbicides in water before mixing. Also try adding half the compatibility agent to the fertilizer and to emulsifiable concentrate or flowable herbicides before mixing. If the mixture still separates the mix cannot be used. Always consult the label for compatibility tests and agents to use for the herbicides involved.

## Mixing chemicals in the tank

1. Fill tank to 1/4 full with water, liquid nitrogen or other desired carrier.
2. Start agitation.
3. Add wettable powders (WP) or water dispersible granules (WDG) first, then flowables (F) or dry flowables (DF).
4. Add liquids (L), aqueous solutions (AS) or emulsifiable concentrates (E or EC) next.
5. Add surfactants last when tank is nearly full, to minimize foaming.

## Cleaning spray equipment

After using a sprayer, you should flush tanks, lines, booms and nozzles with water for a minimum of 5 minutes. After using any herbicide and flushing the sprayer with water, add detergent, surfactant, or spray tank cleaner to the filled tank, then flush the cleaning solution through the boom, hoses, and nozzles. Add more water and then clean again by running the pump and agitation for at least 15 minutes. Remove nozzle and screens and clean separately in a bucket of the cleaning agent and water. Add the following in 50 gallons of water to make the cleaning solution:

- 0.5 gallon of household ammonia (let stand in sprayer overnight for growth regulator type herbicides such as 2,4-D, Banvel, or Tordon).
- 4 pounds trisodium phosphate cleaner.
- 2.5 pounds sal soda.

## Algae and moss control in tanks

Moss and algae will appear in plastic tanks during warm weather. There are three ways to prevent or eliminate algae and moss:

1. Keep tanks dry when not in use.
2. Paint tanks black to block sunlight. Algae will not grow without sunlight.
3. Use copper sulfate. Measure copper sulfate by dissolving 1 ounce in a pint of water. Then add 7.5 tablespoons of the copper sulfate solution to each 100 gallons of water and mix.

## Pesticide container disposal

Triple rinse all pesticide containers and puncture them before disposing of them in an approved burial site or sanitary landfill. Missouri has a pesticide container recycling program. Contact your dealer or local University Extension center for information. Follow local regulations.

## Ground and surface water protection

Contamination of ground and surface water with pesticides has become a growing public concern. Well water monitoring of pesticides in Missouri indicates very little pesticide contamination in the state. The levels that have been detected are generally in the parts per billion (ppb) range and are below current health advisory levels considered safe for drinking water. Point source contamination is usually suspected where levels over a few ppb are detected in water supplies.

Point-source problems are related to a confined area, event or site such as mixing, storage or transport sites. Point-source contamination is probably responsible for a majority of the pesticide detections in wells. These sources of contamination are relatively easy to correct.

The potential for point-source contamination can be reduced by following these suggestions:

1. Mix chemicals in the field away from wells and water sources.
2. If chemicals must be mixed or stored at the well site, use hoses to maintain at least a 150-foot buffer from the well to the spray tank.
3. Keep filling hoses out of the spray tank, maintain an air gap, use check valves, and do not leave tanks unattended while filling to avoid back siphoning or overflow.
4. Never dump rinsate or concentrated product in a localized area. Spilling 4 ounces of a chemical in a 100-square-foot area is the equivalent of applying 100 pounds per acre! Dispose of rinsate by applying to a labeled crop site.



5. Triple rinse herbicide containers into the spray tank before disposal or return.
6. Properly construct, grout, and case new well construction. Properly cap and seal abandoned wells.

Spills or back siphoning of any consequence have the potential to contaminate ground or surface water unless handled properly and promptly. Report spills to the Missouri Department of Natural Resources and local authorities.

Missouri Department of Natural Resources:  
**Environmental Emergency Response**  
**(573) 634-2436**

Non-point-source water pollution occurs over a broad, generally ill-defined area and the direct cause of contamination may not be readily apparent. Leaching from general field applications within labeled guidelines is often mentioned as a possible cause of nonpoint source pollution. However, the following steps will further minimize the potential for water contamination.

1. Select herbicides with shorter residual half-lives and strong soil adsorption characteristics, especially for late-season herbicide applications.
2. Leave buffer strips around sinkholes, streams, and bodies of water.
3. When possible, banding herbicides, using herbicides with higher unit activity (applied at low lb/A rates), and the use of the reduced-rate herbicide recommendations can all reduce the overall pesticide load on the environment.
4. Properly calibrate and maintain sprayer equipment to avoid over application
5. Use practices such as crop rotation, herbicide rotation, and cultivation in addition to herbicides for weed control.
6. Use conservation or no-tillage practices on erodible land to reduce off-site herbicide movement that occurs with surface water runoff.
7. See special information for atrazine products.

Good land stewardship dictates that herbicide characteristics be assessed in relation to their ground or surface water pollution potential. Reducing the potential for groundwater pollution (especially point-source contamination) will help ensure the continued availability of agricultural chemicals as an important tool in crop production while protecting our water resources.

**Warning:** The chance of having herbicide crop injury is increased when several herbicides are applied to the same crop. Adherence to labeled rates is especially important when making multiple herbicide applications.

## Weed resistance to herbicides

Weed resistance to many herbicides has been confirmed around the world. The newer ALS/AHAS inhibiting herbicides (including Accent, Beacon, Ally/Escort, Arsenal, Broadstrike, Classic, Exceed, Harmony Extra, Permit, Pinnacle, Pursuit, Scepter and others) seem particularly likely to cause herbicide-resistant weed populations to develop. It is a good general practice to rotate herbicides and herbicide families in a field. Other practices such as mowing, controlled grazing, adequate fertility, cultivation and sequential applications of herbicides from different families can help to reduce the probability of herbicide-resistant weed populations from appearing. Additional information on herbicide family groups, and suggestions for preventing weed resistance problems can be obtained from your county Extension office, your dealer and herbicide manufacturers.

## Special information for atrazine

New Environmental Protection Agency maximum rates for atrazine are now in effect. Atrazine may be mixed, loaded or used within 50 feet of any well, including abandoned drainage wells and sinkholes. Atrazine may be applied aerially or by ground within 66 feet of points where field surface water runoff enters perennial or intermittent streams and rivers or within 200 feet of natural or impounded lakes and reservoirs. On highly erodible land as defined by the USDA Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, the 66-foot buffer for runoff points from fields must be planted to crop or seeded with grass. Unless it is a tile inlet on a terrace. On tile inlets on terraces, there are no buffer requirements if the herbicide is incorporated or no-till production practices are implemented around the tile inlet.

The maximum annual rate for preemergence application on land designated as having "highly erodible soils" as defined by the NRCS will be 2.0 lb/A active ingredient (a.i.) of atrazine on fields with greater than 30 percent surface residue and 1.6 lb a.i./A on fields with less than 30 percent surface residue. The maximum preplant or preemergence rate on soils not designated as highly erodible is 2.0 lb a.i./A of atrazine. The maximum annual rate for postemergence applications of atrazine is 2.0 lb a.i./A in fields with no soil-applied atrazine in the same year. The maximum annual amount must not exceed 2.5 lb a.i./A where a soil-applied plus a postemergence application of atrazine is made to a field in the same year.

## List of herbicides, formulations and manufacturers

Trade name	Common name	Formulation	Manufacturer
Ally 60DF	metsulfuron-methyl	60%	DuPont
Arsenal 2S	imazapyr	2 lb/gal	American Cyanamid
Atrazine 4L	atrazine	4 lb/gal	DuPont, Novartis
Atrazine Accu-Pack	atrazine	85%	
Aatrex Nine-O	atrazine	90%	
Balan 60DF	benefin	60%	United Agr. Products
Banvel 4EC	dicamba	4 lb/gal	BASF
Banvel 720	dicamba + 2,4-D amine	1 + 1.9 lb/gal	
Bicep II 5.9L	metolachlor + atrazine	3.2 + 2.7	Novartis
Buctril 2E	bromoxynil	2 lb/gal	Rhone-Poulenc
Buctril/Atrazine 3F	bromoxynil + atrazine	1 + 2 lb/gal	
Butyrac 200/Butoxone 200	2,4-DB	2 lb/gal	Rhone-Poulenc
Casoron 4G	dichlobenil	4%	Uniroyal
Chopper RTU	imazapyr	3.6%	American Cyanamid
Crossbow 3E	2,4-D + triclopyr	2 + 1 lb/gal	DowElanco
Contain 1S	imazapyr	1 lb/gal	American Cyanamid
DSMA	DSMA	Several	Several
Dual II 7.8E	metolachlor	7.8 lb/gal	Novartis
Eptam 7E	EPTC	7 lb/gal	Zeneca
Escort 60DF	metsulfuron-methyl	60%	DuPont
Garlon 3A	triclopyr	3 lb/gal	DowElanco
Garlon 4	triclopyr	4 lb/gal	
Gramoxone Extra 2.5L	paraquat	2.5 lb/gal	Zeneca
Grazon P + D	2,4-D + picloram	2 + 0.54 lb/gal	DowElanco
Hi-Dep	2, 4-D	4 lb/gal	PBI Gordon
Hyvar X-L	bromacil	2 lb/gal	DuPont
Karmex 80DF	diuron	80%	DuPont
Kerb 50W	pronamide	50%	Rohm & Haas
Krenite S	fosamine	4 lb/gal	DuPont
Krovar I DF	bromacil + diuron	40% + 40%	DuPont
Lexone DF	metribuzin	75%	DuPont
Laddok S-12	bentazon + atrazine	2.5 + 2.5 lb/gal	BASF
MSMA	MSMA	Several	Several
Oust 75DG	sulfometuron-methyl	75%	DuPont

Trade name	Common name	Formulation	Manufacturer
Pathway	picloram + 2,4-D amine	5.4% + 20.9%	DowElanco
Poast 1.5E	sethoxydim	1.5 lb/gal	BASF
Poast Plus 1E		1 lb/gal	
Pramitol 25E	prometon	2 lb/gal	Novartis
Pramitol 5PS	prometon + simazine + sodium chlorate + sodium metaborate		
Pursuit 70DG	imazethapyr	70%	American Cyanamid
Remedy 4E	triclopyr	4 lb/gal	DowElanco
Roundup Ultra 3AS	glyphosate	3 lb acid eq./gal	Monsanto
Select 2E	clethodim	2 lb/gal	Volent
Sencor DF	metribuzin	75%	Bayer
Sinbar 80W	terbacil	80%	DuPont
Spike 20P	tebuthiuron	20%	DowElanco
Spike 40P		40%	
Spike 80W		80%	
Stalker 2S	imazapyr	2 lb/gal	American Cyanamid
Stinger 3E	clopyralid	3 lb/gal	DowElanco
Tordon 22K	picloram	2 lb/gal	DowElanco
Tordon 101 Mixture	picloram + 2,4-D amine	0.54 + 2 lb/gal	
Tordon RTU	picloram + 2,4-D amine	5.4 %+ 20.9%	
Touchdown 6AQ	glyphosate trimesium	6 lb/gal	Zeneca
Velpar 2L	Hexazinone	2 lb/gal	DuPont
Velpar 75DF		75%	
2,4-D amine	2,4-D amine	Several	Several
2,4-D ester	2,4-D ester	Several	Several
Weedmaster	Dicamba + 2,4-D amine	1 + 2.8 lb/gal	BASF
Weedone 170	2,4-D ester + 2,4-DP	1.8 + 1.85 lb/gal	Rhone-Poulenc
Weedone CB	2,4-D ester + 2,4-DP	0.66 + 0.66 lb/gal	
Zorial 80DF	norflurazon	80%	Novartis

# FORAGE CROPS

## Guide to weed response to herbicides

Herbicide	Winter annuals										Summer annuals										Perennials*																
	Cheat	Downy brome	Chickweed	Henbit	Horseweed	Field pennycress	Shepherdspurse	Wild mustard	Yellow rocket	Musk thistle (biennial)	Barnyardgrass	Crabgrass	Fall panicum	Foxtails	Goosegrass	Johnsongrass (seeding)	Kochia	Common lambsquarters	Pigweed spp.	Common ragweed	Lanceleaf ragweed	Smartweed spp. (Annual)	Curly dock	Dandelion	Tall fescue	Goldenrod spp.	Horsenettle	Johnsongrass (rhizome)	Orchardgrass	Plantain spp.	Quackgrass	Red sorrel	Wild garlic	Yellow nutsedge			
<i>Preplant incorporated</i>																																					
Balan	G	G	F	P	-	P	P	P	P	-	G	G	G	G	G	G	G	G	P	P	P	P	P	P	-	-	-	-	P	P	P	-	-	P			
Eptam	G	F	F	F	P	P	P	P	P	P	G	G	G	G	F	F	F	G	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F		
<i>Postemergence</i>																																					
Buctril	P	P	F	F	P	G	F	G	F	P	P	P	P	P	P	F	G	F	G	P	G	P	P	P	P	P	P	P	P	P	P	P	F	P	P		
2,4-DB	P	P	F	P	P	F	F	F	F	F	P	P	P	P	P	F	G	F	F	P	F	P	F	P	F	P	P	P	P	F	P	P	P	P			
Gramoxone Extra	G	G	G	F	P	F	F	G	P	P	F	F	F	G	G	F	F	G	F	F	P	F	P	F	F	P	P	P	F	F	P	P	F	P			
Karmex	F	P	F	F	F	F	F	F	P	P	F	G	F	F	G	F	F	G	F	F	F	F	P	P	P	P	P	P	-	-	P	P	P	P			
Kerb	F	G	F	F	P	P	F	F	P	P	F	F	F	F	-	P	F	F	P	P	P	P	P	P	P	P	P	P	F	P	F	F	P	P			
Poast/Poast Plus	F	-	P	P	P	P	P	P	P	P	G	G	G	G	G	G	P	P	P	P	P	P	P	P	P	F	P	P	F	F	P	F	P	P			
Pursuit	P	P	G	F	F	G	G	G	G	P	F	F	F	G	F	G	G	F	G	F	-	G	P	F	P	P	P	P	P	P	P	G	P	F			
Roundup	F	G	F	F	F	G	G	G	G	F	G	F	G	G	G	G	G	G	F	F	-	G	F	G	G	P	P	G	G	G	G	F	G	F			
Select	G	G	P	P	P	P	P	P	P	P	G	G	G	G	G	P	P	P	P	P	P	P	P	P	P	P	P	G	F	P	F	P	P	P			
Sencor/Lexone	F	G	G	F	P	G	G	G	F	P	F	F	F	F	P	G	G	G	G	-	G	F	F	P	P	P	P	F	-	P	P	P	P				
Sinbar	G	G	G	G	P	G	F	G	G	P	F	G	F	F	-	F	G	G	F	F	P	F	P	F	P	P	P	-	F	-	F	P	P	P			
Velpar	G	G	G	F	P	G	G	G	G	P	G	F	F	F	F	-	G	G	F	F	P	F	F	G	P	P	P	-	F	G	F	P	P	P			
Zorial	G	G	-	-	-	-	G	G	-	-	G	F	-	F	F	-	F	-	G	F	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-		

Weed Control: G = Good, F = Fair\*\*, P = Poor, - = No data available

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables. If you are obtaining satisfactory results under your growing conditions, changing products as a result of information in table is not necessarily recommended.

\*Repeated herbicide applications over several years may be necessary for complete control of perennial weeds.

\*\*Fair = Partial control or suppression

## Guide to forage tolerance for herbicides

Herbicide	Grass forage tolerance	Legume forage tolerance
<i>Preplant incorporated</i>		
Balan	F	G
Eptam	P	G
<i>Postemergence</i>		
Buctril	G	F
2,4-DB	G	G
Gramoxone Extra	F	F
Karmex	F	G
Kerb	G	G
Poast/Poast Plus	P	G
Pursuit	P	G
Roundup	P	P
Select	P	G
Sencor/Lexone	P	G
Sinbar	P	F
Velpar	P	F
Zorial	P	G

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
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### New legume seedings — Pure stands

#### *Preplant incorporated*

Balan 60DF	2 to 2.5 lb/A	benefin 1.2 to 1.5 lb/A	Foxtails, seedling, johnsongrass, fall panicum, crabgrass, barnyardgrass, chickweed, common lambsquarters, pigweed.	<b>Alfalfa, Birdsfoot trefoil, Clovers (Alsike, Ladino, Red):</b> Balan must be incorporated 1 time within 4-8 hrs after application. Variable weed control may result if incorporation is delayed more than 8 hrs.
Eptam 7E	3.5 to 4.5 pt/A	EPTC 3.1 to 3.9 lb/A	Cheat, barnyardgrass, crabgrass, fall panicum, foxtails, pigweed.	<b>Alfalfa, Birdsfoot trefoil, Clovers (Alsike, Ladino, Red), Lespedeza:</b> Incorporate immediately after application. See label for incorporation directions. Temporary stunting may occur if soil is cool and wet during germination and emergence.

#### *Postemergence*

Buctril 2E	1 to 1.5 pt/A	bromoxynil 0.25 to 0.38 lb/A	Pennycress, wild mustard, lambsquarters, common ragweed, smartweed.	<b>Alfalfa:</b> Crop leaf burn can occur following application. Do not add a surfactant or crop oil. Do not treat when temperatures exceed 70°F at, and 3 days following application or severe crop injury will occur. Do not apply when alfalfa is under stress. Spray after legume emergence when weeds are less than the 4 leaf stage or 2 inches high. May be tank-mixed with 2,4-DB, but leaf burn will be greater.
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## FORAGE CROPS

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Butyrac 200 / Butoxone 200	2 qt/A	2,4-DB 1 lb/A	Lambsquarters.	<b>Alfalfa, Birdsfoot trefoil, Clover (Alsike, Ladino, Red):</b> Apply in fall or spring. Spray after legume emergence when weeds are less than 2 to 3 inches high or rosettes are less than 2 inches across and not bolting.
Kerb 50W	1 to 3 lb/A	pronamide 0.5 to 1.5 lb/A	Downy brome.	<b>Alfalfa, Birdsfoot trefoil, Clover, Crownvetch:</b> Apply after legume has reached the trifoliolate leaf stage. Do not use more than 4 lb/acre per season. See label for use rate for specific weeds. <b>Restricted use pesticide.</b>
Poast 1E or Poast Plus 1.5E + crop oil concentrate or Dash	0.75 to 2.5 pt/A or 18 to 60 oz/A + 2 pt/A or 2 pt/A	sethoxydim 0.14 to 0.47 lb/A	Crabgrass, fall panicum, foxtails, johnsongrass.	<b>Alfalfa, Birdsfoot trefoil:</b> See label directions for specific weed stages and rates for application. Apply to actively growing weeds. Allow time for regrowth if applying after cutting. Apply higher rates to perennial grasses.
Pursuit 70 DG + crop oil concentrate + UAN	1.08 to 2.16 oz/A + 1 qt/A + 1-2 qt/A	imazethapyr 0.047 to 0.094 lb/A	Foxtails, shattercane, chickweed, cocklebur, mustard sp., pennycress yellow rocket, shepherdspurse.	<b>Alfalfa:</b> Apply postemergence to seedling alfalfa when alfalfa is in the second trifoliolate or later and when the majority of weeds are 1-3 inches tall. Pursuit may be tank mixed with other herbicides, see label for rates and restrictions.
Select 2E + crop oil concentrate	6 to 8 oz/A + 1 qt/A	clethodim 0.094 to 0.125 lb/A	Crabgrass, fall panicum, foxtails johnsongrass.	<b>Alfalfa, Birdsfoot trefoil:</b> See label directions for specific weed stages and rates for application. Apply to actively growing weeds. Allow time for regrowth if applying after cutting.

## Established pure legume stands

### *Dormant*

Gramoxone Extra 2.5 L + nonionic surfactant (80%)	1.5 to 2 pt/A + 1 pt/100 gal	paraquat 0.47 to 0.625 lb/A	Cheat, downy brome, chickweed, henbit, wild mustard, foxtails, lambsquarters, many other annual weeds.	<b>Alfalfa:</b> At least 1 year old. Apply after last fall cutting when crop is dormant or before spring growth reaches 1 inch. Do not apply if fall regrowth following last fall cutting is more than 6 inches tall. Do not apply more than once in one season. <b>Restricted use pesticide.</b>
Karmex 80DF	1.5 to 3 lb/A	diuron 1.2 to 2.4 lb/A	Lambsquarters, pigweed, crabgrass.	<b>Alfalfa:</b> Apply only to pure, dormant stands established 1 year or more. Apply in March or early April, but before spring growth begins. Do not apply to alfalfa under stress from disease, insect damage, shallow root penetration (especially from shallow, rocky soils), or flooded fields as crop injury may result. Do not spray on snow-covered or frozen ground. See label for use rate for specific weeds.
Pursuit 70DG + crop oil concentrate + UAN	1.08 to 2.16 oz/A + 1 qt/A + 1-2 qt/A	imazethapyr 0.047 to 0.094 lb/A	Foxtails, shattercane chickweed, cocklebur, mustard sp., pennycress yellow rocket, shepherdspurse.	<b>Alfalfa:</b> Apply postemergence to seedling alfalfa when alfalfa is in the second trifoliolate or later and when the majority of weeds are 1-3 inches tall. Pursuit may be tank mixed with other herbicides, see label for rates and restrictions.

## FORAGE CROPS

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Sencor/Lexone 75DF	0.5 to 1.3 lb/A	metribuzin 0.38 to 1 lb/A	Downy brome, chickweed, pennycress, shepherdspurse, wild mustard, kochia, lambsquarters, pigweed, common ragweed, smartweed.	<b>Alfalfa:</b> Apply only to dormant, established alfalfa. Apply in late fall or early spring before new growth starts. For best control apply when weeds are less than 2 inches tall or before rosettes exceed 2 inches in diameter. See label for use rate for specific weeds.
Sinbar 80W	0.5 to 1.5 lb/A	terbacil 0.4 to 1.2 lb/A	Cheat, downy brome, chickweed, henbit, field pennycress, wild mustard, yellow rocket, crabgrass, kochia, lambsquarters.	<b>Alfalfa:</b> Apply only to dormant alfalfa that has been established for at least one year. Apply in fall or winter after last cutting or in spring before new growth starts. Apply before or after emergence of weeds but before they are 2 inches tall or wide. Do not replant treated areas within 2 years after last application. Do not apply on snow covered or frozen ground.
<b><i>Dormant or non-dormant</i></b>				
Butyrac 200 / Butoxone 200	2 qt/A	2,4-DB 1 lb/A	Lambsquarters.	<b>Alfalfa:</b> Apply in late fall or early spring when weeds are small.
Buctril 2E	1 to 1.5 pt/A	bromoxynil 0.25 to 0.38 lb/A	Pennycress, wild mustard, lambsquarters, common ragweed, smartweed.	<b>Alfalfa:</b> Crop leaf burn can occur following application. Do not add a surfactant or crop oil. Do not treat when temperatures exceed 70°F at, and 3 days following application or severe crop injury will occur. Do not apply when alfalfa is under stress. Spray after legume emergence when weeds are less than the 4 leaf stage or 2 inches high. May be tank-mixed with 2,4-DB, but leaf burn will be greater.
Kerb 50W	1 to 3 lb/A	pronamide 0.5 to 1.5 lb/A	Downy brome.	<b>Alfalfa, Birdsfoot trefoil, Clover, Crownvetch:</b> Apply after last cutting in fall when weather and soil temperatures are cool. Do not use more than 4 lb per acre per season. See label for use rate for specific weeds. <b>Restricted use pesticide.</b>
Poast 1.5E or Poast Plus 1E + crop oil concentrate or Dash	0.75 to 2.5 pt or 18 to 60 oz/A + 2 pt/A or 2 pt/A	sethoxydim 0.14 to 0.47 lb/A	Crabgrass, fall panicum, foxtails, johnsongrass.	<b>Alfalfa, Birdsfoot trefoil:</b> See label directions for specific weed stages and rates for application. Apply to actively growing weeds. Allow time for regrowth if applying after cutting. Apply higher rates to perennial grasses.
Pursuit + crop oil concentrate + UAN	1.08 to 2.16 oz/A + 1 qt/A + 1-2 qt/A	imazethapyr 0.047 to 0.094 lb/A	Foxtails, shattercane chickweed, cocklebur, mustard sp., pennycress yellow rocket, shepherdspurse	<b>Alfalfa:</b> Apply in the fall following the last cutting or in the spring to dormant alfalfa or as it breaks dormancy. Apply in spring prior to 3 inches of growth to reduce spray interference. <b>Alfalfa grazing:</b> Apply following cutting and prior to 3 inches of growth.
Roundup (spot treatment)	2.6 oz/gal of water	glyphosate 2% solution	Downy brome, field pennycress, shepherdspurse, wild mustard, yellow rocket, barnyardgrass, fall panicum, johnsongrass, foxtails, smartweed, dandelion, plantains, quackgrass, wild garlic.	<b>Alfalfa, Clover:</b> Apply to actively growing weeds. Avoid contact with desirable vegetation. Will kill treated areas. No more than one-tenth of any acre should be treated at one time. Further applications may be made in the same area at 30-day intervals.

## FORAGE CROPS

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Select 2E + crop oil concentrate	6 to 8 oz/A + 1 qt/A	clethodim 0.094 to 0.125 lb/A	Crabgrass, fall panicum, foxtail, johnsongrass.	<b>Alfalfa, Birdsfoot trefoil:</b> See label directions for specific weed stages and rates for application. Apply to actively growing weeds. Allow time for regrowth if applying after cutting.
Velpar L or 90SP	1 to 3 qt or 0.5 to 1.5 lb/A	hexazinone 0.5 to 1.5 lb/A	Cheat, downy brome, chickweed, field pennycress, sheperdspurse, wild mustard, yellow rocket, barnyardgrass, Kochia, lambsquarters, pigweed, dandelion, plantains.	<b>Alfalfa:</b> Treat alfalfa established for 1 year or more. Make a single application in fall or winter after alfalfa becomes dormant. May be applied in spring before new growth exceeds 2 inches, or to stubble after cutting and hay removal but before regrowth exceeds 2 inches in height. See label for use rate on specific soils and weeds. Do not plant treated areas to any other crop within 2 years of treatment.
Zorial 80DF	1.25 to 2.5 lb/A	norflurazon 1 to 2 lb/A	Downy brome, cheat, mustard sp., shepherdspurse, barnyardgrass, crabgrass, foxtail, pigweed.	<b>Alfalfa:</b> Apply 1.25 lb/A to established alfalfa between cuttings or as a dormant season treatment no earlier than 5 months following emergence. An additional 1.25 lb/A may be applied later in the first year to extend late-season weed control. 0.5 to 1 inch of precipitation is needed for activation. Application may be made during dormancy as long as soil is not frozen, or in actively growing stands. On non-dormant alfalfa, application should always follow hay removal to insure spray reaches soil surface.

### Between harvest

Gramoxone 2.5L + nonionic surfactant (80%)	12.8 oz/A + 1 pt/100 gal	paraquat 0.25 lb/A	Cheat, downy brome, chickweed, henbit, many other annual weeds.	<b>Alfalfa:</b> Apply within 5 days of cutting after alfalfa has been removed for silage or hay. Do not treat more than 5 days after cutting. Apply to established alfalfa stands at least 1 year old. Alfalfa foliage present at the time of application will be burned. <b>Restricted use pesticide.</b>
Zorial 80DF	1.25 to 2.5 lb/A	norflurazon 1 to 2 lb/A	Downy brome, cheat, mustard sp., shepherdspurse, barnyardgrass, crabgrass, foxtail, pigweed.	<b>Alfalfa:</b> Apply 1.25 lb/A to established alfalfa between cuttings or as a dormant season treatment no earlier than 5 months following emergence. An additional 1.25 lb/A may be applied later in the first year to extend late-season weed control. 0.5 to 1 inch of precipitation is needed for activation. Application should be made following hay removal to ensure spray reaches soil surface.

### Legume-grass mixtures — Established stands

Roundup (spot treatment)	2.6 oz/gal of water glyphosate 2% solution		Downy brome, field pennycress, shepherdspurse, wild mustard, yellow rocket, barnyardgrass, fall panicum, foxtails, johnsongrass, lambsquarters, smartweed, dandelion, plantains, quackgrass, wild garlic.	<b>Alfalfa or clover-grass mixtures:</b> Apply to actively growing weeds. Avoid contact with desirable vegetation. Forages in treated areas will be killed. See label for timing of application for specific weeds. No more than one-tenth of any acre should be treated at one time. Further applications may be made in the same area at 30-day intervals. Remove livestock before application.
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## FORAGE CROPS

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Sencor 75DF or Lexone 4L	0.5 to 1 lb or 0.75 to 1.5 pt	metribuzin 0.38 to 0.75 lb/A	Downy brome, chickweed, field pennycress, shepherdspurse, wild mustard kochia, lambsquarters, pigweed, common ragweed, smartweed.	<b>Alfalfa-grass mixtures:</b> Treat only dormant, established alfalfa-grass mixtures. Apply once in late fall or early spring before new growth starts. Apply before or after emergence of weeds but before they are 2 inches tall or wide. See label for use rate for specific soil textures. Rates of 1 to 1.5 pt of 4L or 0.6 to 0.8 lb DF will give partial reduction of forage grass stands. Higher rates will severely reduce forage grass stands.

### Forage sorghum or sorghum-sudan

#### *Preplant incorporated or preemergence*

Atrazine AccuPak or 4L or Aatrex Nine-O	1.9 to 2.35 lb or 3.2 to 4 pt or 1.7 to 2.2 lb	atrazine 1.6 to 2 lb/A	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, smartweed, velvetleaf, barnyardgrass, red rice.	Do not use on coarse (light, sandy) soils. Do not use on medium (loam) or fine (heavy, clay) soils with less than 1% organic matter. Use lower rates on medium (loam, silt loam) soils, and higher rates for heavy (fine, clay) soils. Do not plant small grains or small seeded legumes in the fall of the same year.
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#### *Postemergence over-the-top*

Atrazine AccuPak or 4L or Aatrex Nine-O	2.4 lb or 2 qt or 2.2 lb	atrazine 2 lb/A	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, smartweed, sunflower, velvetleaf, barnyardgrass, red rice.	Apply before weeds exceed 1.5 inches in height and before grain sorghum exceeds 12 inches in height. Do not use on sandy or loamy sand soils.
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Atrazine AccuPak or 4L or Aatrex Nine-O + crop oil concentrate	2.4 lb or 2 qt or 2.2 lb + 1 qt/A	atrazine 2 lb/A	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, smartweed, sunflower, velvetleaf, barnyardgrass, red rice.	May cause crop injury. Apply after grain sorghum reaches 3-leaf stage and before it exceeds 12 inches in height. Do not use on sandy or loamy sand soils.
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Buctril 2E	1 to 1.5 pt/A	bromoxynil 0.25 to 0.38 lb/A	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, common ragweed, smartweed, sunflower, velvetleaf.	See label for specific rates and weed stages for application. Do not spray when grain sorghum foliage is wet. Application may be made from the 3-leaf stage of sorghum up to 14 inches tall.
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## FORAGE CROPS

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Buctril 2E + Atrazine Accu-Pak, or 4L or Aatrex Nine-O <b>or</b> (Buctril/Atrazine 3F package-mix)	0.75 to 1.5 pt + 0.6 to 1.4 lb or 0.5 to 1.2 qt or 0.6 to 1.3 lb <b>or</b> (1.5 to 3 pt/A)	bromoxynil 0.19 to 0.38 lb + atrazine 0.5 to 1.2 lb/A <b>or</b> (bromoxynil + atrazine 0.19 + 0.38 to 0.38 + 0.75 lb/A)	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, smartweed, sunflower, velvetleaf.	See label for specific rates, crop and weed stages for application. Buctril and/or atrazine may be added to the package-mix to improve control in heavy infestations or for hard-to-control weeds. Application may be made from the 2-leaf stage (0.19 lb Buctril rate), the 3-leaf stage (0.25 lb rate) or the 4-leaf stage (0.38 lb rate) of sorghum up to 10 inches tall.
2,4-D amine (4 lb/gal formulation)	1pt/A	2,4-D amine 0.5 lb/A	Cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, sunflower, velvetleaf.	Treat only after sorghum is over 6 inches tall and before it is 15 inches tall. If crop is over 8 inches tall, use drop nozzles to keep spray off leaves.
Laddok S-12 + crop oil concentrate	1.33 to 2.33 pt/A + 1 qt/A	bentazon + atrazine 0.4 + 0.4 to 1.5 + 1.5 lb/A	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common and giant ragweed, smartweed, sunflower, velvetleaf.	Treat before sorghum is 12 inches tall.

### Forage sorghum only — Preplant incorporated or preemergence

Dual II 7.8E	1.5 to 2.5 pt/A	metolachlor 1.5 to 2.5 lb/A	Black nightshade, pigweed, barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, red rice, yellow nutsedge.	<b>Use Concep-treated seed.</b> Use lower rates on coarse (light, sandy) soils, and higher rates for heavy (fine, clay) soils. Small grains can be planted 4.5 months after application.
Dual II 7.8E + Atrazine AccuPak or 4L or Aatrex Nine-O <b>or</b> (Bicep 5.9L)	1.5 to 2 pt + 1.4 to 1.9 lb or 1.2 to 1.6 qt or 1.3 to 1.8 lb <b>or</b> (1.5 to 2.4 qt/A)	metolachlor 1.5 to 2 lb/A + atrazine 1.2 to 1.6 lb/A <b>or</b> (metolachlor + atrazine 1.0 + 1.25 to 1.6 + 2.0 lb/A)	Black nightshade, cocklebur, jimsonweed, lambsquarters, morningglories, pigweed, prickly sida, common ragweed, smartweed, barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, red rice, yellow nutsedge.	<b>Use Concep-treated seed.</b> Do not use on coarse (light, sandy) soils. Do not use on medium (loam) soils with less than 1.5% organic matter. Use lower rates on medium (loam, silt loam) soils, and higher rates for heavy (fine, clay) soils. Do not plant small grains or small seeded legumes in the fall of the same year.

# GRASS PASTURE AND RANGELAND

## Guide to weed response to herbicides

Herbicide	Winter annuals				Summer annuals						Biennials			Perennials*															
	Chickweed	Henbit	Horseweed	Field pennycress	Bitter sneezeweed	Dogfennel	Hemp	Common ragweed	Giant ragweed	Lanceleaf ragweed	Spiry amaranth	Mullein	Bull thistle	Musk thistle	Aster spp.	Buttercup spp.	Oxeye daisy	Dandelion	Curly dock	Goldenrod	Ironweed	Muliflora rose	Prickly pear	Red sorrel	Perennial sowthistle	Canada thistle	White clover	White snakeroot	
<i>Postemergence</i>																													
2,4-D amine	F	G	F	G	G	F	G	G	G	F	F	P	G	F	F	F	F	G	F	F	F	F	P	P	F	F	F	F	F
2,4-D ester	G	G	F	G	G	F	G	G	G	F	F	P	G	F	F	F	F	G	F	F	F	F	P	P	F	F	F	F	F
Ally	G	G	F	G	G	F	-	P	P	P	F	G	G	G	-	G	-	G	G	P	-	G	P	G	F	F	F	-	-
Banvel	G	G	G	G	G	G	G	G	G	F	G	P	G	G	G	G	F	G	G	G	G	G	P	G	G	G	G	G	G
Crossbow	F	F	G	G	G	F	G	G	G	F	F	P	G	G	F	G	F	G	G	G	G	F	P	F	F	G	G	F	-
Grazon P+D	G	G	G	G	G	F	G	G	G	G	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Karmex	F	F	F	F	-	-	-	F	-	F	-	-	-	P	-	-	-	P	P	P	-	-	-	-	-	P	G	-	-
Remedy	-	-	G	-	-	-	-	P	-	-	-	-	G	G	-	-	-	G	G	G	F	G	P	-	-	-	G	-	-
Roundup	F	P	F	F	G	F	G	F	F	P	G	F	F	F	G	G	G	G	F	F	G	F	P	F	G	G	F	G	
Stinger	-	-	F	-	-	-	-	G	G	-	-	-	G	G	G	-	-	G	P	P	P	P	P	-	F	G	G	G	
Tordon	-	-	G	G	-	-	G	G	G	G	-	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Weedmaster	G	G	G	G	G	G	G	G	G	G	F	G	G	G	-	-	-	G	G	G	F	G	P	F	F	G	G	G	

Weed Control: G = Good, F = Fair\*\*, P = Poor, - = No data available

Use this table as a guide for comparing the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables. If you are obtaining satisfactory results under your growing condition, changing products as a result of information in this table is not necessarily recommended.

\*Repeated herbicide applications over several years may be necessary for complete control of perennial weeds. \*\*Fair = Partial control or suppression

## GRASS PASTURE AND RANGELAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Herbicide guide</b>				
2,4-D amine (4 lb/gal formulation) (many brands)	2 to 4 pt/A	2,4-D amine 1 to 2 lb/A	Henbit, field pennycress, hemp, common ragweed, giant ragweed, bull thistle, dandelion, many other broadleaf weeds.	<p><b>Fall:</b> The best time to obtain broadleaf weed control is in the fall after rains when weeds are actively growing. Biennial and perennial weeds should be in the rosette stage.</p> <p><b>Spring:</b> Apply to actively growing weeds, preferably before they exceed 4 to 6 inches in height. Repeated treatments in the fall or spring for 2 or more years may be necessary for good control.</p>
2,4-D ester (4 lb/gal formulation) (many brands)	2 qt/A	2,4-D ester 2 lb/A	Common ragweed, bull thistle, musk thistle, many other broadleaf weeds.	<p><b>Fall:</b> The best time to obtain broadleaf weed control is in the fall after rains when weeds are actively growing. Biennial and perennial weeds should be in the rosette stage.</p> <p><b>Spring:</b> Apply to actively growing weeds, preferably before they exceed 4 to 6 inches in height. Repeated treatments in the fall or spring for 2 or more years may be necessary for good control.</p>
2,4-D ester (4 lb/gal formulation) (many brands)	2 to 3 qt/A	2,4-D ester 2 to 3 lb/A	Wild garlic, wild onion, many broadleaf weeds, and brush species.	Use a multiple application program of late fall and early spring applications. A minimum of 3 applications (fall-spring-fall or spring-fall-spring) is necessary for garlic or onion control. Several years may be needed for satisfactory control of perennial broadleaf weed and brush species.
Ally 60DF / Escort 60 DF + nonionic surfactant (80%)	0.1 to 2 oz/A + 1 pt/100 gal	metsulfuron-methyl 0.0038 to 0.075 lb/A	Chickweed, henbit, pennycress, mullein, bull and musk thistle, buttercup, dandelion, curly dock, multiflora rose, red sorrel.	<p><b>Bermudagrass, orchardgrass, bromegrass and timothy</b> have good tolerance. May cause yellowing, stunting, and seedhead suppression of <b>fescue</b>. One cutting of fescue may be lost. Italian and perennial ryegrass are highly sensitive and should not be treated. Legume pasture species will be severely stunted or killed. Desirable grasses should be established 60 days. Do not use on grasses grown for seed. Apply before weeds are 4 inches tall. Do not apply to soils with pH greater than 7.9. See label for use rates on specific pasture grasses and weeds, and crop rotation restrictions.</p>
Banvel (4 lb/gal formulation)	0.5 to 2 gal	dicamba 0.25 to 8 lb/A	Chickweed, henbit, horseweed, field pennycress, dogfennel, hemp, common and giant ragweed, bull thistle, musk thistle, asters, buttercup, dandelion, curly dock, goldenrod, ironweed, multiflora rose, red sorrel, sowthistle, Canada thistle, white snakeroot, other broadleaf weeds.	<p><b>Fall:</b> The best time to obtain broadleaf weed control is in the fall after rains when weeds are actively growing. Biennial and perennial weeds should be in the rosette stage.</p> <p><b>Spring:</b> Apply to actively growing weeds, preferably before they exceed 4 to 6 inches in height. Repeated treatments in spring or fall for 2 or more years may be necessary for good control. See label for use rates for specific weeds and woody plants</p>

## GRASS PASTURE AND RANGELAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Banvel + 2,4-D amine or (Weedmaster)	0.5 + 1.5 pt to 1 + 3 pt/A or (1 to 2 qt/A)	dicamba + 2,4-D amine 0.25 + 0.75 to 0.5 + 1.5 lb/A or (dicamba + 2,4-D amine 0.25 + 0.7 to 0.5 + 1.4 lb/A)	Chickweed, henbit, horseweed, field pennycress, dogfennel, hemp, common, giant, and lanceleaf ragweed, bull thistle, musk thistle, asters, dandelion, curly dock, goldenrod, multiflora rose, Canada thistle, white snakeroot, other broadleaf weeds.	<p><b>Fall:</b> The best time to obtain broadleaf weed control is in the fall after rains when weeds are actively growing. Biennial and perennial weeds should be in the rosette stage.</p> <p><b>Spring:</b> Apply to actively growing weeds, preferably before they exceed 4 to 6 inches in height. Repeated treatments in spring or fall for 2 or more years may be necessary for good control. See label for use rates for specific weeds. Use lower rates for annual weeds and higher rates for perennial weeds and woody plants.</p>
Crossbow 3E	2 to 4 qt/A or (1 to 1.5% solution)	triclopyr + 2,4-D ester 0.5 + 1 to 1 + 2 lb/A	Horseweed, pennycress, hemp, common and giant ragweed, bull thistle, musk thistle, buttercups, dandelion, curly dock, goldenrod, ironweed, Canada thistle, many brush species (see brush chapter).	<p>Use 2 qt rate for horseweed, ragweed, pennycress, bull and musk thistle, curly dock, and dandelion. Use 4 qt/A rate for other weeds. Apply in spring to actively growing weeds, and to biennials before the flower stalk elongates or bolts above the rosette.</p> <p>Spot treatment: Use 4 to 6 fl. oz. in 3 gal of water and spray to thoroughly wet all foliage.</p>
Grazon P+D	1 to 4 pt/A	picloram + 2,4-D 0.068 + 0.25 to 0.27 + 1 lb/A	Horseweed, field pennycress, hemp, common, giant, and lanceleaf ragweed, bull and musk thistle, asters, buttercup, oxeye daisy, dandelion, curly dock, goldenrod, ironweed, multiflora rose, prickly pear, red sorrel, sowthistle, Canada thistle, white snakeroot, other broadleaf weeds.	<p><b>Fall:</b> The best time to obtain broadleaf weed control is in the fall after rains when weeds are actively growing. Biennial and perennial weeds should be in the rosette stage.</p> <p><b>Spring:</b> Apply to actively growing weeds, preferably before they exceed 4 to 6 inches in height. Repeated treatments in the fall or spring for 2 or more years may be necessary for good control.</p>
Karmex 80DF	1 to 3 lb/A	diuron 0.8 to 2.4 lb/A	Lambsquarters, pigweed, crabgrass.	<p><b>Bermudagrass only:</b> For newly sprigged apply after planting and before bermudagrass or weed emergence. Do not treat where sprigs are planted less than 2 inches deep or crop injury may occur.</p>
Karmex 80DF + nonionic surfactant (80%)	0.5 to 1 lb/A + 1 pt/100 gal	diuron 1.4 to 0.8 lb/A	Lambsquarters, pigweed, crabgrass.	<p><b>Bermudagrass only:</b> For control of emerged weeds up to 4 inches in height. Temporary crop injury (burn) on bermudagrass may occur.</p>
Remedy 4E + nonionic surfactant (80%)	1.5 to 3 pt/A + 2 pt/100 gal	triclopyr 0.25 to 1.5 lb/A	Horseweed, bull and musk thistle, dandelion, curly dock, goldenrod, multiflora rose.	<p>Use at 2 pt/A for general broadleaf weed control in enough water to make a minimum of 10 gallons of total spray mixture. Remedy at 0.5 to 3 pt may be tank-mixed with 1 to 2 qt of 2,4-D amine or low volatile ester.</p>
Stinger 3E	0.66 to 1.33 pt/A	clopyralid 0.25 to 0.5 lb/A	Common and giant ragweed, bull and musk thistle, asters, dandelion, Canada thistle, white snakeroot, and other broadleaf weeds.	<p>Use 0.66 to 1.33 pt/A for actively growing musk and Canada thistle, and other weeds after grass is well established. Apply to actively growing weeds. Use higher rate after thistles have bolted. May be tank-mixed with 0.5 to 1 lb/A of 2,4-D for broader spectrum of weed control. Application prior to the flowering stage is recommended.</p>

## GRASS PASTURE AND RANGELAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Tordon 22K	0.38 to 1 pt/A	picloram 0.09 to 0.25 lb/A	Horseweed, field pennycress, hemp, common, giant, and lanceleaf ragweed, bull and musk thistle, asters, buttercup, oxeye daisy, dandelion, curly dock, goldenrod, ironweed, multiflora rose, prickly pear, red sorrel, sowthistle, Canada thistle, white snakeroot, other broadleaf weeds.	Use 0.38 to 0.5 pt/A rate for musk thistle and goldenrod. Use 1 pt/A for ironweed. Apply in late fall to rosette stage of weeds, or in spring to actively growing weeds before the flower stalk elongates or bolts above the rosette. Do not use where runoff may flow to adjacent broadleaf crop areas. Do not transfer livestock from treated grass area onto a broadleaf crop area without first allowing 7 days of grazing on untreated grass pasture. Do not rotate treated pasture or rangeland to other crop uses. <b>Restricted use pesticide.</b>

### Selective application equipment

Roundup (wick or wiper application)	1 gal/ 2 gal water	glyphosate 33% by volume	Many annual and perennial broadleaf and grass weeds.	Apply when weeds are at least 6 inches above desirable pasture grass. Avoid contact with crop plants.
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# GRASS PASTURE, RANGELAND AND NON-CROPLAND

## Guide to woody plant response to herbicides

Herbicide	Ash	Birch	Blackberry	Buckbrush	Cedar	Dogwood	Elm	Greenbrier	Hawthorn	Hickory	Honeylocust	Honeysuckle	Kudzu	Maple	Mulberry	Multiflora rose	Oaks	Osage orange	Persimmon	Pines	Poison ivy	Poplar	Sassafras	Sumac	Sweetgum	Sycamore	Trumpet creeper	Willow	Grazing land	Forestry	Noncropland	Ditch banks
2,4-D amine (FS)	P	F	P	G	P	P	F	P	F	F	P	P	P	P	F	F	P	P	P	P	P	F	P	F	P	F	P	L	L	L	L	
2,4-D amine (CS)	P	F	P	P	P	F	G	P	F	F	F	P	P	P	F	F	F	F	F	F	F	G	G	F	F	F	F	G	L	L	L	L
2,4-D ester (FS)	P	-	P	G	P	P	P	P	-	P	P	P	P	P	F	P	P	P	P	P	P	-	P	F	P	-	P	P	L	L	L	L
Arsenal/Contain (FS)	G	P	P	P	P	G	P	G	G	G	G	G	G	G	G	G	G	P	F	P	G	F	G	G	G	F	G	G	N	N	L	L
Banvel (FS)	P	-	F	F	F	F	F	P	F	P	P	F	G	P	N	G	F	P	G	G	F	-	F	F	F	-	F	F	L	N	L	L
Crossbow (FS)	F	F	G	F	P	P	F	P	F	F	F	P	P	F	P	F	F	F	F	F	F	F	F	G	F	F	P	F	L	N	L	L
Escort (FS)	G	P	G	F	P	F	G	P	G	P	P	P	F	G	P	F	F	P	P	P	P	P	P	P	P	P	P	G	N	L	L	N
Garlon 3A (FS)	F	F	G	P	P	F	F	P	F	F	F	P	P	F	F	F	G	P	F	G	F	F	F	G	G	F	P	F	N	L	L	L
Garlon 3A (CS)	F	F	P	P	F	F	F	P	F	F	F	P	P	G	F	F	G	F	F	F	G	F	F	G	G	F	P	F	N	L	L	L
Garlon 4 (FS)	F	F	G	P	P	F	F	P	F	F	F	P	P	F	F	F	G	P	F	G	F	F	F	G	G	F	P	F	N	L	L	L
Garlon 4 (BS)	F	F	G	P	F	G	F	P	F	G	F	P	P	G	F	F	G	P	F	G	P	F	F	G	G	F	P	F	N	L	L	L
Grazon P+D (FS)	P	F	F	P	F	G	F	F	P	F	G	G	F	F	F	F	F	F	G	G	P	F	F	F	F	F	P	F	L	N	L	N
Hyvar X-L (FS)	F	F	F	F	F	F	F	P	F	F	F	P	F	F	F	F	F	F	P	G	F	F	P	F	F	F	P	F	N	N	L	L
Hyvar X-L (ST)	F	F	F	F	F	F	F	P	F	F	F	P	P	F	F	F	F	F	P	G	F	F	P	F	F	F	P	F	N	N	L	L
Krenite (FS)	F	G	G	F	P	F	F	P	P	P	F	F	G	F	F	F	G	F	F	G	P	F	P	G	G	F	F	F	N	N	N	N
Pathway (CS)	F	F	P	P	F	F	F	P	F	F	F	P	F	P	P	F	P	F	G	P	P	P	P	F	F	P	P	P	N	L	L	N
Remedy FS	F	F	G	P	P	F	F	P	F	F	F	P	P	F	F	F	F	P	F	G	F	F	F	G	G	F	P	F	L	N	L	N
Roundup (FS)	F	F	F	F	P	P	F	P	F	P	P	F	F	P	P	F	G	P	F	P	F	F	P	F	F	P	F	F	L	L	L	L
Roundup/Touch. (CS)	F	F	F	P	F	F	F	P	F	F	F	F	P	F	F	P	G	F	F	G	G	F	F	F	G	G	P	F	L	N	L	L
Spike (ST)	F	F	F	F	P	G	G	F	P	F	G	G	P	F	F	G	G	P	P	F	P	F	P	G	F	F	F	F	L	N	L	L
Tordon 22K (FS)	P	-	F	P	P	F	F	P	-	P	F	-	-	F	F	G	F	F	G	-	P	P	F	F	P	P	P	-	L	L	L	N
Tordon 101 (FS)	P	F	F	P	F	G	F	F	P	F	G	G	F	F	F	F	F	F	G	G	P	F	F	F	F	F	P	F	N	L	L	N
Tordon 101 (CS)	F	F	F	P	F	F	F	P	F	G	G	G	G	F	G	F	G	P	F	G	P	F	F	F	G	G	F	F	N	L	L	N
Velpar (ST) + (BS)	F	F	G	F	F	F	F	P	P	P	G	P	P	F	F	G	F	P	P	F	F	F	P	F	F	F	P	F	L*	L	L	L
Weedmaster (FS)	P	F	F	G	P	P	P	P	P	P	P	F	P	P	P	G	P	P	F	F	F	F	F	F	P	F	P	L	N	L	L	
Weedone 170 (FS)	P	F	F	F	P	P	P	P	-	F	P	G	P	P	P	G	F	P	P	F	F	F	F	G	F	-	P	P	N	L	L	L
Weedone 170 (BS)	P	F	F	F	P	P	P	P	-	G	P	G	P	P	P	G	F	P	P	F	F	F	F	G	F	-	P	P	N	L	L	L
Weedone CB (BS)	F	F	P	P	P	P	F	P	F	F	P	F	P	F	P	F	F	P	F	F	F	F	P	P	P	F	P	P	N	L	L	L

Weed Control: G = Good, F = Fair\*\*, P = Poor, - = No data available, FS = Foliar spray, BS = Basal spray, CS = Cut surface, ST = Soil treatment, L = Labeled, N = Not labeled

NOTE: Repeated herbicide applications over several years may be necessary for complete control of woody plants. \*Basal soil or cut-surface applications only. \*\*Fair = Partial control or defoliation. Touch = Touchdown.

Use this table to compare the relative effectiveness of herbicides on individual weeds. Herbicides may perform better or worse than indicated due to extreme weather conditions and other variables. If you are obtaining satisfactory results under your growing conditions, changing products as a result of information in this table is not necessarily recommended.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

### Woody plant control in permanent grass pastures and rangeland

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Ally 60DF + nonionic surfactant (80%)	1 oz/100 gal + 1 pt/100 gal	metsulfuron	Multiflora rose, blackberry.	Spot spray. Apply as foliar spray to runoff. Do not exceed 75 gal of total spray per acre.
Banvel 4EC	1 pt to 2 gal	dicamba 0.5 to 8 lb/A	Kudzu, persimmon, pines.	Apply as foliar treatment at full leaf-out. May be tank-mixed with 2,4-D for control of additional brush species (see instructions for Weedmaster).
Banvel + 2,4-D amine or (Weedmaster)	1 to 2 pt/A or 1 to 2 qt/A	dicamba + 2,4-D amine 0.25 + 0.7 to 0.5 + 1.4 lb/A or (dicamba + 2,4-D amine 0.24 + 0.7 to 0.5 + 1.4 lb/A)	Buckbrush and other brush weed species.	Spot treatment foliar spray. Apply to actively growing plants.
Crossbow 3E	1.5 to 4 gal/A	triclopyr + 2,4-D ester 1.5 + 3 lb to 4 + 8 lb/A	Blackberry, sumac, and other annual and brush weed species.	The most favorable time for application is in the spring after full leaf-out and into early summer. Repeated treatments for 2 or more years may be necessary for good control of some perennial brush species.
Grazon P+D	1.5 to 8 pt/A	picloram + 2,4-D 0.1 + 0.38 to 0.54 + 2 lb/A	Multiflora rose, oak, and other annual and brush weed species.	Add a surfactant and use 20-25 gal/A (ground) or 5 gal/A (air) spray volume. Avoid spraying earlier than 9-12 months following mowing or when plants have a high percentage of new growth. Repeated treatments may be necessary. Can be applied in spring or fall.
Remedy 4E + nonionic surfactant (80%)	2 pt/A + 2 pt/100 gal of water	triclopyr 1 lb/A	Blackberry, oaks, pines, sumac, sweetgum, and other annual and brush weed species.	Apply in enough water to make a minimum of 10 gallons of total spray per acre. May be tank-mixed with 2 to 3 quarts of 2,4-D amine or low volatile ester. Apply when leaves are fully developed during good growing conditions. Best performance will be in May through June. Use higher rates of 2,4-D when plants are mature late in the summer.
Roundup	2 to 5 qt/A or 1 to 2% solution for spot treatment, or 50% solution as cut-stump treatment.	glyphosate 1.5 to 3.75 lb/A	Oaks, poison ivy, poplar, sweetgum, sycamore, and other annual and brush weed species	Spot treatment. Roundup will kill or severely injure most vegetation that comes in contact with the solution. See label for use rates for specific plants.
Spike 20P or 40P	2.5 to 20 lb/A of 20P or 5 to 10 lb/A of 40P	tebuthiuron 0.5 to 4 lb/A	Dogwood, elm, honeylocust, honeysuckle, multiflora rose, oaks, sumac and other annual and brush weed species.	<b>Warning:</b> Spike will cause some injury to perennial pasture grass species. Apply when grass is dormant. Do not apply when soil is frozen or snow covered. Rainfall is required to initiate activity. It may take 1 to 3 years following application to completely kill some species.
Velpar 2L	2 to 4 ml per 1 inch of stem diameter of brush. Do not exceed 1/3 gal/A per season.	hexazinone	Honeylocust, multiflora rose, oaks, and other annual and brush weed species.	Do not apply to snow-covered or frozen ground. Will injure grass. Apply during dormant season. Late winter or early spring applications are most effective. See label for detailed restrictions and use instructions.



## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
<b>Woody plant control in non-cropland — (rights-of-way, fence rows, industrial sites, etc.)</b>				
<b><i>Foliar sprays</i></b>				
Arsenal 2SL or Contain ISL	0.5 + 6 pt or 1 to 12 pt	imazapyr 0.125 to 1.5 lb/A	Ash, boxelder, cherry, dogwood, hickory, honeylocust, honeysuckle, kudzu, maple, mulberry, multiflora rose, oaks, poison ivy, sassafras, sumac, sweetgum, willow, other broadleaf plants.	Apply during warm weather after full leaf out and before leaf drop. Apply to foliage in 10 to 60 gal/A is using ground equipment. Use 0.5 to 1% for low volume hand application. Spray to wet but do not allow runoff. Keep away from foliage or roots of desirable plants.
Bavel 720 or (Weedmaster)	3 gal or (1 pt to 2 qt/A)	dicamba + 2,4-D amine 3 + 5.7 lb/A or (dicamba + 2,4-D amine 0.125 + 0.35 to 0.5 + 1 lb/A)	Persimmon, poison ivy, other broadleaf plants.	Apply uniformly as a foliar spray after leaves are fully developed until three weeks before a frost. Wet foliage to point of runoff with a backpack sprayer. Apply in 200 to 300 gal per acre with a hydraulic sprayer. See label for application directions for specific brush species.
Crossbow 3E	1 qt to 4 gal/A	2,4-D ester + triclopyr 0.5 + .25 to 8 + 4 lb/A	Blackberry, sumac, and other broadleaf plants.	Apply during warm weather when brush is actively growing. Apply broadcast sprays in enough water to deliver 15 to 30 gal of spray per acre. Apply in 100 gal per acre with a hydraulic sprayer. <b>Spot treatment of broadleaf weeds:</b> See label for application directions for specific brush species.
Escort 60DF	1 to 3 oz/A	metsulfuron 0.0375 to 0.113 lb/A	Control of many annual, biennial, and perennial weeds and brush, and suppression of growth and seedhead inhibition of unimproved turf in noncropland fescue and bluegrass.	Apply to young actively growing weeds any time of year except when ground is frozen. Foliar applications should be made after brush is fully leafed until the beginning of fall leaf coloration. Apply to turf anytime from after greenup until seed stalk (boot) appearance. May be tank-mixed with Embark for improved performance on turf. May also be used for conifer site preparation and release.
Garlon 3A or 4	0.75 to 1 gal	triclopyr 2.25 to 4 lb/A	Blackberry, oaks, pines, sumac, sweetgum, and other broadleaf plants.	Apply uniformly as honeylocust foliar spray after leaves are fully developed until 3 weeks before a frost. Wet foliage to point of runoff with a backpack sprayer. Apply in 100 to 400 gal per acre with a hydraulic sprayer. See label for application directions for specific brush species.
Grazon P+D	1 to 2 gal/100gal	picloram + 2,4-D	Multiflora rose, oaks, dogwood, honeylocust, honeysuckle, persimmon.	Apply in water alone or in an oil-water emulsion. Apply in spring or fall. Thoroughly wet foliage and stems. Do not use more than 1 gallon of Grazon P+D/A.
Hyvar X-L	2.25 to 12 gal/A	bromacil 4.5 to 24 lb/A	Controls many brush and tree species.	Do not apply to brush standing in water, do not use in irrigation ditches nor on right of ways or other sites where marketable timber or other desirable trees or shrubs are immediately adjacent to the treated areas.
Krenite S + nonionic surfactant (80%)	1.5 to 6 gal/A + 1 qt/100 gal of water	fosamine 6 to 24 lb/A	Kudzu, oaks, pines, and other woody plants.	Apply as a foliar spray from full leafout to first fall coloration. Complete coverage is required for control. See label for application directions for specific brush species.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Roundup + nonionic surfactant (80%)	2 to 5 qt/A + 2 qt/100 gal of water	glyphosate 1.5 to 3.75 lb/A	Oaks, and other woody plants.	Apply to actively growing brush. See label for use rates for specific brush species. Apply in 10 to 40 gpa of water.
Tordon 101 Mixture	1 to 4 gal/A	picloram + 2,4-D amine 0.54 + 2 lb to 2.2 + 8 lb/A	Dogwood, honeylocust, honeysuckle, persimmon, pines, and other woody plants.	Use 15 to 25 gpa spray mix. Apply to actively growing plants. See label for use rates for specific woody plant species. <b>Restricted use pesticide.</b>

### Soil treatments

Weedone 170	2 to 9 gal/A	2,4-DP + 2,4-D 3.7 + 3.7 to 16.6 + 16.6 lb/A	Honeysuckle, multiflora, rose, sumac, and other woody plants.	Apply uniformly to foliage of actively growing plants. Use 100 to 300 gals of mix per acre. See label for use rates for specific woody plant species. Follow label precautions and restrictions for use.
Hyvar X-L	2.25 to 12 gal/A	bromacil 4.5 to 24 lb/A	Many woody plant species.	Use higher rates (greater than 5 gpa) on high organic soils. Use as a soil treatment or basal treatment. For use on drainage ditches, use only as basal treatment. Apply broadcast treatments using at least 200 gal per acre of water. Basal treatment may be applied undiluted using a hand-gun applicator, or mixed with water in a ratio of 1 gal Hyvar in 5 gals of water. Apply to actively growing plants when rainfall is expected for activation. Do not apply near desirable vegetation. See label for use rates for specific woody plant species.
Spike 40 P or 80W	5 to 15 lb/A or 2.5 to 7.5 lb/A	tebuthiuron 2 to 6 lb/A	Dogwood, elm, honeylocust, honeysuckle, multiflora rose, oaks, sumac, and other woody plants.	Apply in 15 to 150 gal of water per acre before or during the period of active growth of target plants. See label for use rates for specific plant species to be controlled. Do not broadcast where maintenance of a grass cover is desired. Has some postemergence activity on some herbaceous weeds. May be used as an individual plant treatment on forage or pasture area when used at less than 5 lb/A. Do not cut for hay for 1 year after application.
Velpar 2L	1 to 4 gal	hexazinone 2 to 8 lb	Honeylocust, multiflora rose, oaks, and other woody plants.	Apply in late winter through summer, prebud break until new growth hardens off. Direct spray to the soil beneath woody plants to be controlled.

### Cut surface (frill, injection, hypo-hatchet, stump)

2,4-D amine (4 lb/gal formulation)	undiluted	1 to 2 ml of concentrate per injection.	Elm, poplar, sassafras, willow and many woody species.	Make injections as near the root collar as possible. Injections should be made during the growing season (May to October). See label for instructions for specific woody plant species.
Arsenal 2SL / Stalker 2S	2 qt per 1 qt of water (concentrated), or 8 to 12 fl. oz. per gal of water (dilute)	imazapyr	Many woody plant species.	May be used as a cut stump, injection, frill, or gridle treatments. See label for instructions for specific uses and rates.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Banvel	1 part Banvel to 1-3 parts water	dicamba	Many woody plant species.	<b>Frill or girdle treatments:</b> Make a continuous cut or series of overlapping cuts to girdle tree trunk. Spray or paint at surface with Banvel-water mixture. Also maybe applied to freshly cut stump.
Crossbow 3E	4 gallons in enough No. 1 or No. 2 diesel fuel to make 100 gallons of spray mixture	2,4-D ester + triclopyr	Many woody plant species.	<b>Stump:</b> Cut larger trees and treat fresh stumps with thorough spraying or painting.
Garlon 3A	undiluted	triclopyr	Maple, oaks, poison ivy, sumac, sweetgum, and other woody plant species.	Apply 1 ml of concentrate to cuts spaced 3 inches apart around the true trunk. Apply during active growth in spring or summer. May also be applied with frill or girdle method.
Roundup	undiluted	glyphosate	Oaks, pines, poison ivy, sweetgum, sycamore, and other woody plant species.	Apply 1 ml in cuts spaced 2 to 3 inches apart around the trunk. Apply during active growth.
Tordon RTU or Pathway	undiluted	picloram + 2,4-D amine	Pines and other woody plant species.	Apply 0.5 ml of undiluted solution to cuts spaced 3 inches apart around the trunk. Or use 1 ml of 50% solution in a continuous cut girdling the trunk. Use any time except during heavy sap flow. Use undiluted for frill method. <b>Restricted use pesticide.</b>

### ***Basal spray***

Banvel 4EC	1 pt + 1.5 gallons water + 1 oz emulsifier + 2.5 pt No. 2 diesel fuel	dicamba	Multiflora rose and many woody plant species	Spray basal stem region from ground line up to 1.5 to 2 ft. Thorough wetting needed for control especially the root crown. Apply any time of the year except when snow or water prevent spraying the ground line.
Crossbow 3E	4 gal in enough diesel oil, No. 1 or No. 2 fuel oil, or kerosene to make 100 gal of spray mixture.	2,4-D ester + triclopyr	Many woody plant species.	Spray basal parts of brush or trees to a height of 15 to 20 inches from the ground. Thoroughly wet all the basal bark area including crown buds and ground sprouts. Applications can be made any time of the year except when snow or water prevent spraying to the ground line. Best results have been obtained with winter to early spring applications.
Garlon 4	4 gal in enough Arborchem Basal Oil, diesel fuel, No. 1 or No. 2 fuel oil, or kerosene to make 100 gal of spray mixture.	triclopyr	Blackberry, dogwood, hickory, maple, oaks, pines, sumac, sweetgum, and other woody plant species.	For control of weedy plants with stems less than 6 inches in diameter. Spray the basal parts of trunks to a height of 12 to 15 inches from the ground. Apply at any time, except when snow or water prevent spraying to the ground line. May be mixed in oil-water mixtures as well. Refer to label for rates and directions.
Stalker 2S	undiluted	imazapyr	Many woody plant species.	For control of woody species with stems less than 4 inches DBH (tree diameter at breast height). Apply undiluted to lower 12 - 18 inches of the plant stem. Thoroughly wet the application area. Use cut stump treatments when stem diameter is greater than 4 inches.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Weedone 170 + Diesel or fuel oil	3 to 4 gal in 100 gal of oil	2,4-D ester + 2,4-DP	Hickory, honeysuckle, multiflora rose, sumac and other woody plant species.	Spray the lower part of the brush or tree trunk from the ground line up to 1.5 to 2 ft. Thorough wetting is needed for control especially the root crown. Apply any time of year except when snow or water prevent spraying the ground line.
Weedone CB	undiluted	2,4-D ester + 2,4-DP	Many woody plant species.	Spray the lower part of the brush or tree trunk from the ground line up to 1.5 to 2 ft. Thorough wetting is needed for control especially the root crown. Apply any time of year except when snow or water prevent spraying the ground line. Also may be applied to freshly cut stump.

### General herbaceous weed control for non-cropland (rights-of-way, fence rows, industrial sites, etc.)

Arsenal 2SL / Contain 1SL	2 to 6 pt/A 2 to 12 pt/A	imazapyr 0.5 to 3 lb/A	Ash, dogwood, greenbrier, hawthorne, and many other grass, broadleaf and brush weeds.	May be applied preemergence or as postemergence spray. Post sprays are usually more effective. Apply to wet foliage. Apply to actively growing vegetation.
2,4-D amine (4 lb/gallon, many brands)	1 to 4 qt/A	2,4-D amine 1 to 4 lb/A	Many annual and perennial broadleaf weeds.	Apply as a foliar spray in 15 to 30 gpa of water to young, vigorously growing weeds. Avoid drift to susceptible crops or other desirable vegetation.
Banvel 4EC	1 pt to 2 gal	dicamba 1.5 to 8 lb /A	Many annual and perennial broadleaf weeds.	Apply to actively growing weeds and brush. May be tank-mixed with 2,4-D, Karmex, Dalapon, Princep, Tordon, Amitrole, Hyvar, Velpar, Spike, Garlon, and other herbicides to broaden spectrum of weed and brush control. See label for more information.
Banvel 720	1% solution	dicamba + 2,4-D amine	Many annual and perennial broadleaf weeds.	Apply to actively growing weeds and brush. May be tank-mixed with Hyvar, Karmex, Krenite, Pramitol, Spike, Velpar, and other herbicides to broaden spectrum of weed control. See label for more information.
DSMA or MSMA	Many formulations	DSMA or MSMA 2.7 to 5.4 lb/A	Johnsongrass control in other perennial grasses.	Apply when johnsongrass is 6 inches tall until early head stage. Repeat applications may be needed.
Garlon 3A or 4 + nonionic surfactant (80%)	0.33 to 1.5 gal/A of Garlon 3A, or 1 to 4 qt/A of Garlon 4 + 0.25 to 1 pt per 20 to 100 gal of water.	triclopyr 1 to 4.5 lb/A	Many annual and perennial broadleaf weeds.	Apply any time during growing season. May be tank-mixed with 2,4-D, or Tordon 22K to broaden spectrum of weed and brush control. See labels for more information.
Krovar I	4 to 30 lb/A	bromacil + diuron 1.6 + 1.6 to 12 + 12 lb/A	Many annual and perennial weeds	Apply just before weed emergence or in early stages of weed growth. See label for use rates for specific weeks.
Touchdown 6AQ	0.67 to 5.33 pts/A	glyphosate trimesium 0.5 to 4 lb/A	Many annual and perennial weeds	Apply to as a foliar spray to actively growing weeds. See label for rates for specific weeds.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide and formulation	Formulated material per broadcast acre	Herbicide (lb active per acre)	Weeds controlled	Application method and precautions
Oust 75DG	1.33 to 8 oz/A	sulfometuronmethyl 1.6 to 0.38 lb/A	Johnsongrass, fescue, most annual grass and broadleaf weeds.	Apply preemergence or early postemergence in late spring to early summer. Use nonionic surfactant for postemergence applications. Do not apply where runoff water may flow onto agricultural land or where other desirable vegetation is growing. May be tank-mixed with Karmex, Krovar I, Velpar and other herbicides for broader spectrum weed control. See label for more information.
Roundup	2 to 5 qt/A	glyphosate 1.5 to 3.75 lb/A	Johnsongrass, bermudagrass, fescue, dandelion, multiflora rose, thistles, most annual weeds, and many perennial plants.	Apply as foliar spray to actively growing plants. See label for use rates for specific plant species.

### Bare ground herbicides for rights-of-way, fence rows, industrial sites, etc.

Casoron 4G	100 to 200 lb/A	dichlobenil 4 to 8 lb/A	Many annual and perennial weeds and woody plant species.	See label for application instructions, use rates and specific weeds.
Hyvar X-L	1.5 to 12 gal/A	bromacil 3 to 24 lb/A	Many annual and perennial broadleaf and grass weeds.	Apply as spray in 100 to 200 gal of water per acre. See label for use rates for specific weeds.
Karmex 80DF	5 to 15 lb/A	diuron 4 to 12 lb/A	Many annual and perennial broadleaf and grass weeds.	Apply to soil shortly before weed growth begins. See label for use rates for specific weeds.
Krovar I DF	4 to 30 lb/A	bromacil + diuron 1.6 + 1.6 to 12 + 12 lb/A	Many annual and perennial broadleaf and grass weeds.	Apply just before weed emergence or in early stages of weed growth. See label for use rates for specific weeds.
Pramitol 25E	4 to 10 gal/A	prometon 8 to 20 lb/A	Many annual and perennial broadleaf and grass weeds	Apply prior to emergence until 3 months after weed emergence. Will give residual control for over 1 year. See label for use rates for specific weeds and uses.
Pramitol 5PS	0.35 to 0.92 lb/100 sq. ft.	prometon + simazine + sodium chlorate + sodium metaborate	Many annual and perennial broadleaf and grass weeds	Apply prior to emergence until 3 months after weed emergence. Will give residual control for over 1 year. See label for use rates for specific weeds and uses.
Spike 20P or 40P or 80W	10 to 30 lb/A of 20P, or 5 to 15 lb/A of 40P, or 1.25 to 7.5 lb/A of 80W	tebuthiron 1 to 6 lb/A	Many annual and perennial broadleaf and grass weeds	May be applied any time except when ground is frozen or the soil is saturated with moisture. Do not apply near desirable vegetation where roots may come in contact with the herbicide. Avoid contamination of irrigation water. See label for use rates for specific weeds.
Velpar 2L	1 to 4 gal/A	hexazinone 2 to 8 lb/A	Many annual and perennial broadleaf and grass weeds	Apply to soil from late winter through summer, prebud break until new growth hardens off. Avoid areas where roots of desirable trees may be present. Needs rainfall for activation. See label for use rates for specific weeds.

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide	Labeled crops	Restriction	Time interval	Precautions
<b>Grazing restrictions and labeled crop species for forage and pasture herbicides</b>				
2,4-D amine	FG, BP, SS	B L,S H	I 14 days* 30 days	* Varies by manufacturer. Refer to label.
2,4-D ester	FG, GP, SS	B L S H	I 7 days 14 days 30 days	
2,4-DB Butyrac 200 / Butoxone 200	AC, AL, BT,LC, RC***	*B, L, S, H **B, L, S, H	*30 days **60 days	*Established forage crops. **Seedling forage crops. ***Do not use on established clovers grown for seed.
Ally 60DF	B, BG, TF	No grazing restrictions.		
Atrazine	PS, SS	B, L, H S	21 days No information on label.	
Balan 60DF		No information on label.		
Banvel 4EC	FG S	B 30 days *L, H	I  1 pt/A 1 qt/A 2 qt/A up to 8 qt/A	*Interval depends on rate used.  L = 7 days      H = 37 days L = 21 days     H = 51 days L = 40 days     H = 70 days L = 60 days     H = 90 days
Bicep II 5.9L	FS	No information on label.		
Buctril 2E	AL, FS	H, B,L  S	30 days (Spring-treated alfalfa, forage sorghum) 60 days (Fall/Winter-treated alfalfa) No information on label.	
Buctril/Atrazine 3F	FS	H, B, L S	30 days No information on label	
Crossbow 3E	GP	B B S L  H	I 14 days 3 days 14 days Next growing season. Next growing season. 7 days 14 days	Less than 2 gal/A. If treated with more than 2 gal/A. Interval in effect during the season of application. Less than 2 gal/A. More than 2 gal/A. Lactating dairy animals. Other livestock when less than 2 gal/A applied. Other livestock when more than 2 gal/A applied.
Dual II 7.8E	FS	No information on label.		
Eptam 7E	AC, AL, BT, L, LC, RC	B, L, H S	14 days No information on label.	

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide	Labeled crops	Restriction	Time interval	Precautions
Gramoxone Extra 2.5L	AL	B, L, H B, L, H	60 days * 30 days**	*Fall dormant season **Between cutting application.
Grazon P+D	GP GP GP	L H B	7 days 30 days 3 days	
Karmex 80DF	AL	H, B, L S	70 days No information on label	
Kerb 50W	AC, AL, BT, CV, LC, WC	H, B, L  S	Depends on rate used and crop. AL below 3.0 lb/A - AL 3 to 4 lb/A - All other crops - No information on label.	25 days. 45 days. 125 days.
Poast/Poast Plus	AL	B, L, S H	7 days 20 days	
Pursuit 70DG	AL	H	30 days	Do not feed, graze or harvest alfalfa for 30 days following application.
Remedy 4E	GP	B B S L  H	I 14 days 3 days 14 days  Next growing season. Next growing season. 7 days 14 days Next growing season.	Less than 2 qt/A. If treated with more than 2 qt/A. Interval in effect during season of application. Less than 2 qt/A. More than 2 qt/A. Lactating dairy animals. Other livestock when less than 2 qt/A applied. Other livestock when 2 to 4 qt/A is applied. More than 4 qt/A.
Roundup Ultra 3A	AL*, GP, FL	B, L, H  S	14 days *8 weeks if applied before seeding No information on label	
Select 2E	AL, BT	B,L,S,H	15 days	
Sencor/Lexone	AL*	B, L, S, H	28 days	*Also for alfalfa-grass mixtures.
Sinbar 80W	AL	H, B, S, L	70 days No information on label.	
Spike	GP	B, L, H S	I 1 year No information on label.	
Stinger 3E	GP	H, B, S, L	No restrictions.	Do not transfer livestock from treated grass area without first allowing 7 days grazing on untreated grass pastures.
Tordon	GP	H, B, S, L	No restrictions.	Do not transfer livestock from treated grass area without first allowing 7 days grazing on untreated grass pastures.
Velpar	AL, GP	H, B, S, L	30 days	

## GRASS PASTURE, RANGELAND AND NON-CROPLAND

Herbicide	Labeled crops	Restriction	Time interval	Precautions
Weedmaster	GP	B L S H	I 7 days 30 days 37 days	
	AL	H	28 days	Do not harvest alfalfa within 28 days of application.

### Key

#### Crop

AC = Alsike clover  
 AL = Alfalfa  
 B = Bermudagrass  
 BB = Big bluestem  
 BG = Bluegrass  
 BT = Birdsfoot trefoil  
 CV = Crownvetch

#### Crop

FG = Forage grasses  
 FL = Forage legumes  
 FS = Forage sorghum  
 GP = Permanent grass pasture (B, BB, BG, IN, SW, TF)  
 IN = Indiangrass  
 L = Lespedeza (All types)  
 LC = Ladino clover

#### Crop

RC = Red clover  
 SC = Sweet clover  
 SS = Sorghum-sudan  
 SW = Switchgrass  
 TF = Tall fescue  
 WC = White clover

#### Restriction type

B = interval before grazing beef cattle  
 L = interval before grazing lactating dairy cattle

S = interval before slaughter  
 H = interval before cutting hay  
 I = immediately

\*This table applies to the major forage crops of Missouri. Refer to herbicide labels for the latest crop labeling and grazing restriction information. The University of Missouri does not warrant herbicides and regrets any omissions or errors in this guide. Always refer to product labels before using pesticides.