Texas A&M AgriLife Extension

ERM-1466
2/18

CHEMICAL WEED AND BRUSH CONTROL

SUGGESTIONS FOR RANGELAND




Chemical Weed and Brush Control

Suggestions for Rangeland

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This publication provides general suggestions for herbicides used to control brush and weeds on Texas rangelands. It also gives information on the levels of control expected. The information is presented in good faith, but no warranty, express or implied, is given. Weed and brush control results may vary tremendously if treatments are applied under less than optimum conditions.

Users of this publication may find the decision support system for rangeland weed and brush control technology selection—PestMan—helpful. PestMan is designed to recommend appropriate mechanical and chemical rangeland brush and weed control treatments for Texas and New Mexico. All herbicide treatments included in this publication are also included in PestMan, which helps in estimating costs and the economic impact of various treatment options. PestMan is an Internet-based system (*http://pestman.tamu.edu*) that can be accessed free of charge.

How to use this guide

1. Find your problem weed or brush species in the Index on page 4.
2. Click on or touch the page number that corresponds to the plant to go to the page where it is listed; find the plant name in the first column on those pages.
3. See the second column on those pages for a list of suggested herbicides (these are active ingredients).
4. Choose herbicides based on:
   a. Whether you would like to make a broadcast application or treat individual plants (third or fourth column).
   b. Check the effectiveness (VH, H, M, and L), which tells you the percentage of plants you should expect to kill with that herbicide and rate. For percent kill ranges, see page 5.
   c. See the fifth column for the method to use—how to apply the chemical. This could be foliar, stem, cut-stump, aerial, etc.
5. The three columns on the right explain other details such as how much surfactant to use, when to treat the plant, and any exceptions. Be sure to read these before choosing an herbicide.
6. Go to page 6 and match the herbicide you chose for controlling the problem plant with product names you are more likely to know.
7. For tips on measuring and mixing herbicides, see page 7.
8. This publication is divided into two sections:
   a. Section 1, pages 8 to 36, includes suggestions for herbicides that are labeled for use with grazing livestock.
   b. Section 2, pages 37 to 41, includes a chemical that is labeled for wildlife areas and fence lines but not for grazing livestock.

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Millions of acres of Texas rangeland support an excessive cover of woody plants and forbs. Dense stands of brush and weeds use valuable water for growth, reduce grass production, and cause soil erosion. Herbicides are an efficient and effective way to manage these noxious plants, control brush and weeds, improve the condition of rangeland, and maintain its productivity.

This publication lists current suggestions for herbicide use to control brush and weeds on rangeland. Some herbicides provide a high degree of control of certain species; however, seldom is a species eradicated. Consider other potential rangeland uses when developing a brush management program. Many trees, shrubs, and forbs are valuable as food and cover for wildlife and may be an important component in livestock diets. Therefore, a brush management program should provide for control methods that give optimum benefits to livestock and wildlife.

Herbicide application may increase the palatability of poisonous plants. Thus, they are more likely to be consumed by livestock. To prevent losses to toxic plants, do not graze herbicide-treated areas with poisonous plants present until the toxic plants dry up and lose their palatability.

Properly used herbicides are effective and safe. Misuse can result in poor brush and weed control, herbicidal drift, dangerous residues, or death of desirable plants. Listed below are points to follow for proper herbicide use:

- Identify the weed or brush species and evaluate the need for control.
- Consider the expected benefits, costs, and alternative control practices.
- Buy the suggested herbicide for the weed or brush species.
- Read and follow herbicide label directions for allowable uses, application rates, and special handling or mixing requirements.
- Provide and require the use of proper safety equipment.
- Calibrate spray equipment.
- Mix herbicides in a ventilated area, preferably outside.
- Spray under conditions that prevent drift to susceptible crops.
- Apply the herbicides at the suggested rate and time.
- Keep a record of the herbicide used, the time required to spray, weather conditions, rate of herbicide in the carrier, date, location, and the person using the herbicide.

The sprayer used must apply the correct quantity of herbicide mixture to a specific area. To calibrate spray equipment, see Extension publication EL-5465, *Weed Busters: Sprayer Calibration Guide*.

Suggestions on the use of herbicides made by the Texas A&M AgriLife Extension Service are based upon effectiveness under Texas conditions.

Broadcast and individual plant treatments are presented in Tables 6 and 7. Individual plant treatments are suited for controlling thin stands of brush and selective control. Broadcast treatments are useful for dense stands of brush and for weed control.

Suggested herbicides must be registered with and the labels approved by the Environmental Protection Agency. *Because the status of herbicide label clearance is subject to change, be certain that the herbicide is currently labeled for the intended use.*

The users are always responsible for the effects of herbicide residue on their livestock and crops, as well as for problems that could arise from drift or movement of the herbicide from their property to that of others. *Always read and carefully follow the instructions on the container label.*

Treatment control ratings

A control rating, based on the effectiveness of an herbicide treatment in controlling a target plant, has been assigned to each herbicide use suggestion. These ratings were determined from research and result demonstration data and from observations of commercial applications. The rating represents a degree of plant mortality of the target plant species when the treatment is applied properly under optimum conditions.

Table 1. Rating categories for herbicide treatments and degree of target plant mortality after treatment

Control rating	Percent of plants killed
Very high	76–100
High	56–75
Moderate	36–55
Low	0–35

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Table 2. Common, chemical and product names of herbicides*

Herbicide common name	Chemical name	Product name	Active ingredient or acid equivalent
aminocyclopryachlor	6-amino-5-chloro-2-cyclopropyl-4-pyrimidinecarboxylic acid, potassium salt	Method 240 SL	2 lb/gal
aminopyralid	2-pyridine carboxylic acid, 4-amino-3, 6-dichloro-2-pyrdine carboxylic acid, triisopropanolammonium salt	—	—
aminopyralid:2,4-D (1:8)	See aminopyralid and 2,4-D	GrazonNext HL	3.75 lb/gal
aminopyralid:clopyralid (1:4.6)	See aminopyralid and clopyralid	Sendero	2.8 lb/gal
aminopyralid:metsulfuron methyl (1:6.2)	See aminopyralid and metsulfuron	Chaparral	0.62 lb/lb
clopyralid	3,6-dichloro-2-pyridinecarboxylic acid	Pyramid R&P, Clopyralid 3	3 lb/gal
2,4-D	(2,4-dichlorophenoxy) acetic acid	Weedar 64, Broad Range 55, Hi-Dep, Weedone LV4, Esteron 99, others	amine salts, free acids, and esters of variable concentration
dicamba	3,6-dichloro-2-methoxybenzoic acid	Banvel, Clarity, Vision	4 lb/gal
dicamba:2,4-D(1:3)	See dicamba and 2,4-D	Weedmaster, Banvel + 2,4-D, RangeStar, Outlaw	4 lb/gal
diesel fuel oil or kerosene	refined petroleum fractions	Several manufacturers	—
fluroxypyr	1-methylheptyl ester: ((4-amino-3,5-dichloro-6-fluoropyridin-2-yl)oxy)acetic acid	Vista XRT	2.8 lb/gal
glyphosate	N-(phosphonomethyl) glycine	Several, including Rodeo**, Roundup, Roundup Ultradry, Glyphosate 417	isopropylamine salt; concentration varies depending on the product
hexazinone	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(IH, 3H)-dione	Velpar L, Pronone Power Pellet	2 lb/gal (Velpar L) 75% (Pronone Power Pellet)
imazapyr	2-[4,5-dihydro-4-methyl-4-(1-methylethy)-5-oxo-IH-imidazol-2-yl]-3-pyridinecarboxylic acid	Arsenal, Habitat**	2 lb/gal
metsulfuron methyl	methyl 2[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino] sulfonyl] benzoate	Escort, Clean Pasture, MSM 60DF	60%
metsulfuron:chlorosulfuron (3:1)	See metsulfuron methyl + 2-chloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)aminocarbonyl] benzenesulfonamide	Cimarron Plus	48% metsulfuron 15% chlorosulfuron
metsulfuron:chlorosulfuron (1:1)	See metsulfuron: chlorosulfuron	Cimarron X-Tra	30% metsulfuron 37.5% chlorosulfuron
metsulfuron methyl dicamba:2,4-D (1:3)	See metsulfuron methyl, dicamba and 2,4-D	Cimarron Max	60% (Part A) 3.87 lb/gal (Part B)
picloram	4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid	Tordon 22K, Triumph 22K, Picloram 22K	2 lb/gal
picloram:fluroxypyr (1:1)	See picloram and fluroxypyr	Surmount	1.34 lb/gal
picloram:2,4-D (1:4)	See picloram and 2,4-D	Grazon P+D, Gunslinger, Picloram + D	2.5 lb/gal
picloram:2,4-D (1:4)	See picloram and 2,4-D	Graslan L	3.8 lb/gal
tebuthiuron	N-[5-(1,1-dimethylethy)-1,3,4-thiadiazol-2-yl}-N-N'-dimethylurea	Spike 20P, Spike 80 DF	20% (Spike 20P) 80% (Spike 80 DF)
triclopyr amine	3,5,6-trichloro-2-pyridinyloxyacetic acid, triethylamine salt	Garlon 3A	3 lb/gal
triclopyr ester	3,5,6-trichloro-2-pyridinyloxyacetic acid, butoxyethyl ester	Clear Pasture, Pathfinder II, Triclopyr R&P, Remedy Ultra, Triclopyr 4 EC	0.75 lb/gal (Pathfinder II–ready to use formulation for stem sprays) 4 lb/gal (all others)
triclopyr:fluroxypr (3:1)	See triclopyr and fluroxypyr	PastureGard HL	4 lb/gal
triclopyr:2,4-D(1:2)	See triclopyr and 2,4-D	Crossbow	3 lb/gal

*Herbicides have been identified by the accepted Weed Science Society of America common name, and when practical, one or more product names.
**Aquatic label

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Table 3. Common measurement conversions for use with herbicide applications

Liquid

1 gallon (gal) = 4 quarts (qt)
1 gal = 8 pints (pt)
1 gal = 16 cups (c)
1 gal = 128 ounces (oz)
1 gal = 3784.96 milliliters (ml)
1 quart (qt) = 2 pt
1 qt = 4 c
1 qt = 32 oz
1 qt = 946.24 ml
1 pint (pt) = 2 c
1 pt = 16 oz
1 pt = 473.12 ml
1 c = 8 oz
1 oz = 2 tablespoons (tbs)
1 oz =29.57 ml
1 tablespoon (tbs) = 3 teaspoons (tsp)
1 tbs = 0.5 oz
1 tbs = 14.79 ml
1 teaspoon (tsp) = 4.98 ml

Weight

1 pound (lb) = 16 oz
1 lb = 453.6 grams (g)
1 oz = 28.35 g
1 kilogram (kg) = 2.2 lb

Area

1 acre = 43,560 square feet (sq ft)
1 hectare (ha) = 2.471 acres

Table 4. Guide to quantity of herbicide formulation for total volume of spray mix

Total spray volume desired	Herbicide concentration desired for individual plant and spot treatment											
	0.25 %	0.5 %	0.75 %	1%*	1.5%	2%	3%	4%	5%	10%	15%	25%
	Quantity of herbicide formulation											
1 gal	0.32 oz	0.64 oz	1 oz	1.28 oz	2 oz	2.56 oz	4 oz	5.12 oz	6.4 oz	12.8 oz	19 oz	1 qt
3 gal*	1 oz	2 oz	3 oz	4 oz*	6 oz	8 oz	12 oz	15.5 oz	19 oz	38 oz	57 oz	96 oz
5 gal	1.67 oz	3.33 oz	5 oz	6.5 oz	10 oz	13 oz	19 oz	26 oz	32 oz	64 oz	96 oz	1.25 gal
10 gal	3.33 oz	6.5 oz	10 oz	13 oz	19 oz	26 oz	38 oz	51 oz	2 qt	1 gal	1.5 gal	2.5 gal
25 gal	8 oz	16 oz	24 oz	32 oz	48 oz	64 oz	96 oz	1 gal	1.25 gal	2.5 gal	3.75 gal	6.25 gal
50 gal	16 oz	32 oz	48 oz	64 oz	96 oz	1 gal	1.5 gal	2 gal	2.5 gal	5 gal	7.5 gal	12.5 gal
100 gal	32 oz	64 oz	96 oz	1 gal	1.5 gal	2 gal	3 gal	4 gal	5 gal	10 gal	15 gal	25 gal

*Example: To prepare 3 gal of a spray mixture (herbicide, water, and surfactant) containing 1% herbicide, add 4 oz of herbicide.

Note: Add 0.25%–0.5% commercial, non-ionic surfactant for mixtures using only water as the herbicide carrier.
Add 5% diesel fuel if an oil-in-water emulsion is the herbicide carrier. Add an oil emulsifying agent (emulsifier) according to label directions. Agitation and the emulsifier are necessary to prevent separation of the spray mixture.

Caution: Non-ionic surfactants are not emulsifying agents and will not result in the formation of an emulsion when diesel fuel and water are mixed and agitated. Add the emulsifier at 1–3 oz/gal of the diesel fuel before adding the diesel fuel to the spray tank. Fill the spray tank to about half the desired volume with water before adding the diesel fuel-emulsifier premix. Then slowly add the diesel fuel-emulsifier premix to the spray tank, with agitation, after which fill the spray tank to the desired volume with water.

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Section 1.

Chemical Brush Control Suggestions for Rangeland Brush Control Treatments

(using herbicides labeled for areas with grazing livestock)

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Table 5. Herbicides for controlling weeds on rangeland

Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
African rue	hexazinone liquid	—	VH** 2 ml/plant	Use an exact delivery handgun to apply undiluted herbicide to soil surface at the edge of the plant canopy.	Spring–summer	Do not use on heavy clay or caliche soils.
	hexazinone pellet	—	1 pellet/plant	—		
	tebuthiuron 20% pellets	H 7.5 lb (1.5 lb)	—			
	imazapyr	H 32 oz (0.5 lb)	VH 0.5%	10–25 gal/ac for ground broadcast. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Late Sept–Oct (to first frost)	Apply to fall regrowth that is in good growing condition. Recommend using individual plant treatment when growing with desirable vegetation to reduce non-target damage. Imazapyr is a non-selective herbicide and will kill or damage desirable vegetation if sprayed.
Berlander lobelia, bitter sneezeweed, buffalobur, camphorweed, cocklebur, croton, horehound, marshelder (sumpweed, sulfaweed), prairie gerardia (see remarks), ragweed, smartweed, sunflower, thistles, western bitterweed (see remarks), western ragweed, others (continued on next page)	2,4-D amine or low volatile ester	VH** 16–32 oz (0.5–1 lb) 4 lb/gal product	VH 1% (4 lb/gal product)	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, weeds 4–6 in. high, good moisture conditions. Spray thistles in rosette stage.	With 2,4-D, use the amine formulation in areas with 25 in. of rainfall or more and the ester formulation in drier areas where no susceptible crops are nearby. **For western bitterweed control,** use 2,4-D low volatile ester or amine at 32 oz/ac before plants flower, temperature above 72° F, and soil moisture favors plant growth. When ¾ of plants are blooming, and/or temperature is less than 60°F, use dicamba:2,4-D (1:3), 2,4-D plus dicamba; picloram:2,4-D (1:4), (3.8 lb/gal product), picloram:2,4-D (1:4), (2.5 lb/gal product), aminopyralid:2,4-D (1:8) or 2,4-D plus picloram. **For prairie gerardia control,** use 48 oz/acre of 2,4-D or the low rate of dicamba:2,4-D (1:3), dicamba plus 2,4-D; picloram:2,4-D (1:4), (3.8 lb/gal product), picloram:2,4-D (1:4), (2.5 lb/ gal product) or picloram plus 2,4-D when plants are 4–6 in. high. Use 20 oz/acre of picloram:2,4-D (1:4), (3.8 lb/gal product; Do not apply more than 80 oz/acre per year), 32 oz/acre of picloram:2,4-D (1:4), (2.5 lb/ gal product) or 8 oz of 2,4-D/acre when plants are 6–10 in. high before flowering.
	dicamba:2,4-D(1:3)	VH 16–32 oz (0.5–1 lb)	VH 1%			
	dicamba + 2,4-D amine or low volatile ester	VH 4–8 oz (0.125–0.75 lb) dicamba + 12–24 oz (0.375–0.75 lb) 2, 4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75 % 2,4-D (4 lb/gal product)			
	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 11–16 oz (0.3–0.5 lb)	VH 0.63%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 16–24 oz (0.3–0.5 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	VH 8–24 oz (0.0625–0.1875 lb) picloram + 8–24 oz (0.25–0.75 lb) 2,4-D 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	metsulfuron methyl dicamba:2,4-D(1:3)	VH Rate 1–Rate 2	—			Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:fluroxypyr (1:1)	VH 24–32 oz (0.25–0.33 lb)	VH 1%			Use high end of rate range for camphor-weed, marshelder, and smartweed.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Berlander lobelia, bitter sneezeweed, buffalobur, camphorweed, cocklebur, croton, horehound, marshelder (sumpweed, sulfaweed), prairie gerardia (see remarks), ragweed, smartweed, sunflower, thistles, western bitterweed (see remarks), western ragweed, others (continued from previous page)	triclopyr:fluroxypr (3:1)	H 16–24 oz (0.5–0.75 lb)	VH 0.5%	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, weeds 4–6 in. high, good moisture conditions. Spray thistles in rosette stage.	Use high end of rate range for camphorweed, marshelder, and smartweed. Triclopyr:fluroxypr (3:1) efficacy on smartweed is marginal.
	aminopyralid:2,4-D (1:8)	VH 24 oz (0.70 lb)	—			—
	aminopyralid:metsulfuron methyl (1:6.2)	VH 2.0–3.3 oz (0.078–0.127 lb)	—			Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
Broomweed (annual or common), plantain (tallowweed), wild carrot (continued on next page)	2,4-D amine or low volatile ester	VH** 16–32 oz (0.5–1 lb) 4 lb/gal product	VH 1% (4 lb/gal product)	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, weeds less than 4 in. tall, good moisture conditions	Use 2,4-D amine in areas with 25 in. of rainfall or more. Use 2,4-D low volatile ester in drier areas where no susceptible crops are nearby. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	aminopyralid:2,4-D (1:8)	VH 24 oz (0.70 lb)	—			
	aminopyralid:metsulfuron methyl (1:6.2)	VH 2.0-3.3 oz (0.078–0.127 lb)	—			
	dicamba:2,4-D(1:3)	VH 16–32 oz (0.5–1 lb)	VH 1%			
	dicamba + 2,4-D amine or low volatile ester	VH 4–8 oz (0.125–0.25 lb) dicamba + 12–24 oz (0.375–0.75 lb) 2, 4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75% 2,4-D (4 lb/gal product)			
	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 11–16 oz (0.3–0.5 lb)	VH 0.63%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 16–24 oz (0.3–0.5 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	VH 8–24 oz (0.0625–0.1875 lb) picloram + 8–24 oz (0.25–0.75 lb) 2,4-D 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 24–32 oz (0.25–0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	H 16–24 oz (0.5–0.75 lb)	VH 0.5%			
	metsulfuron methyl dicamba:2,4-D (1:3)	VH Rate 1–Rate 2	—			Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Broomweed (annual or common), plantain (tallowweed), wild carrot (continued from previous page)	metsulfuron methyl	VH 0.1 oz	—	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, weeds less than 4 in. tall, good moisture conditions	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron: chlorosulfuron (3:1)	VH 0.125 oz	—			
	metsulfuron: chlorosulfuron (1:1)	VH 0.2 oz	—			
Broom snakeweed (perennial broomweed)	picloram	VH 16–32 oz (0.25–0.5 lb)	VH 0.5%	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	During and after full flower stage in fall when growth conditions are good; or spring during peak plant growth when growth conditions are good	Add emulsifer to oil for proper emulsion when oil-in-water emulsion is used. Use 16 oz/ac picloram only in the fall. Use 32 oz/ac picloram in the spring. Poor control may be expected if dicamba:2,4-D(1:3) or dicamba:2,4-D mixture is used when growth conditions are less than ideal. Growth conditions should be optimum if picloram:2,4-D(1:4) or picloram:2,4-D mixture is used in the spring. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 43 oz (1.25 lb)	VH 0.63%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 64 oz (1.25 lb)	VH 1%			
	picloram:fluroxypyr (1:1)	VH 48–96 oz (0.5–1.0 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	VH 16 oz (0.25 lb) picloram + 16–32 oz (0.5–1 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	dicamba:2,4-D(1:3)	VH 32 oz (1 lb)	VH 1%			
	dicamba + 2,4-D amine or low volatile ester	VH 8 oz (0.25 lb) dicamba + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75% 2,4-D (4 lb/gal product)			
	metsulfuron methyl	VH 0.6 oz	—	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Add 32–64 oz surfactant or 2 gal crop oil/100 gal water.	Optimum time is in the fall, but it may be applied in spring	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron:chlorosulfuron (3:1)	VH 0.75 oz	—			
	metsulfuron:chlorosulfuron (1:1)	VH 1.2 oz	—			
	metsulfuron methyl dicamba:2,4-D(1:3)	H–VH Rate 1–Rate 2	—			
	tebuthiuron 20% pellets	VH 3.75 lb pellets (0.75 lb)	VH 0.167 oz of pellets (0.033 oz)/100 sq ft of ground area	—	Any time—optimum period is Oct 1–Apr 1 except in Trans-Pecos, where optimum period is May 1–Jul 1	Use only on sand, loamy sand, sandy loam, loam, silt loam, silt, or sandy clay loam soils.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Bullnettle, Carolina horsenettle, dogfennel, silverleaf nightshade, upright prairie-coneflower, western horsenettle (treadsalve), yankeeweed (rosin weed)	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 20–32 oz (0.6–0.9 lb)	VH 0.63%	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring (see remarks)	Spray bullnettle, Carolina horsenettle, silverleaf nightshade, and western horsenettle when plants begin to flower in the spring. Spray dogfennel and yankeeweed when plants are 8–10 in. tall. Spray upright prairie-coneflower when plants are 2–6 in. tall before flowering. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 32–48 oz (0.6–0.94 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester.	VH 8 to 12 oz (0.125–0.1875 lb) picloram + 16 to 24 oz (0.5–0.75 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.50% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 24 to 32 oz (0.25 to 0.33 lb)	VH 1%			
	metsulfuron methyl dicamba:2,4-D(1:3)	H–VH Rate 1–Rate 2	—			
	dicamba:2,4-D(1:3)	VH 32 oz (1 lb)	VH 1%			
	dicamba + 2,4-D amine or low volatile ester.	VH 8 oz (0.25 lb) dicamba + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75% 2,4-D (4 lb/gal product)			
Bullnettle, silverleaf nightshade, western horsenettle (treadsalve)	aminopyralid:metsulfuron methyl (1:6.2)	VH 2.0–3.3 oz (0.078–0.127 lb)	—	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz of surfactant/100 gal water	Spring (see remarks)	Spray bullnettle, silverleaf nightshade, and western horsenettle when plants begin to flower in the spring. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	aminopyralid:2,4-D (1:8)	VH 24 oz (0.70 lb)	—			
Common goldenweed, Drummond's goldenweed (continued on next page)	2,4-D low volatile ester	VH** 64 oz (2 lb) 4 lb/gal product	VH 2% (4 lb/gal product)	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, when growth conditions are good	Picloram:2,4-D(1:4), dicamba:2,4-D(1:3), and mixtures of dicamba:2,4-D and picloram:2,4-D are more effective than 2,4-D alone when growth conditions are less than optimal. When using oil-in-water emulsion, add emulsifier to oil for proper emulsion. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	dicamba:2,4-D(1:3)	VH 48 oz (1.5 lb)	VH 2%			
	picloram:fluroxypyr (1:1)	VH 32 oz (0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	H 32–48 oz (0.5–0.75 lb)	VH 1%			
	metsulfuron methyl dicamba:2,4-D(1:3)	VH Rate 3	—			
	dicamba + 2,4-D amine or low volatile ester	VH 12 oz (0.375 lb) dicamba + 36 oz (1.125 lb) 2,4-D, 4 lb/gal product	VH 0.5% dicamba + 1.5% 2,4-D (4 lb/gal product)			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Common goldenweed, Drummond's goldenweed (continued from previous page)	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 32 oz (0.95 lb)	VH 1.3%	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, when growth conditions are good	Picloram:2,4-D(1:4), dicamba:2,4-D(1:3), and mixtures of dicamba:2,4-D and picloram:2,4-D are more effective than 2,4-D alone when growth conditions are less than optimal. When using oil-in-water emulsion, add emulsifier to oil for proper emulsion. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 48 oz (0.94 lb)	VH 2%			
	picloram+2,4-D amine or low volatile ester	VH 12 oz (0.19 lb) picloram + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.50% picloram + 1% 2,4-D (4 lb/gal product)			
Flathead sedge	dicamba:2,4-D(1:3)	VH 64 oz (2 lb)	—	Ground broadcast 20–30 gal per acre. Add 32–64 oz surfactant/100 gal water.	Spring or fall	Control may be enhanced if the stand is burned and/or shredded and allowed to regrow to a height of 12–15 in. before spraying. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron methyl dicamba:2,4-D(1:3)	VH Rate 2	—			
Garboncillo, threadleaf groundsel, woolly locoweed	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 32 oz (0.95 lb)	VH 1.3%	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Fall, good moisture conditions	Herbicide application may increase palatability of these poisonous plants. Therefore, do not graze treated areas until the toxic plants dry up and lose their palatability. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 48 oz (0.94 lb)	VH 2%			
	picloram + 2,4-D amine or low volatile ester.	VH 12 oz (0.19 lb) picloram + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.5% picloram + 1% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 32 oz (0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	H 32–48 oz (0.5–0.75 lb)	VH 1%			
	metsulfuron methyl dicamba:2,4-D(1:3)	VH Rate 2	—			
	dicamba:2,4-D(1:3)	VH** 32 oz (1 lb)	VH 2%			
	dicamba + 2,4-D amine or low volatile ester	VH 12 oz (0.375 lb) dicamba + 36 oz (1.125 lb) 2,4-D, 4 lb/gal product	VH 0.5% dicamba + 1.5%, 2,4-D (4 lb/galproduct)			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Gray goldaster, narrowleaf goldaster	2,4-D low volatile ester	VH 32 oz (1 lb)	VH 1%	2–4 gal oil-in-water emulsion (64 oz diesel fuel oil and water to make 2–4 gal/ac) as aerial spray. 10–25 gal oil-in-water emulsion (1 gal diesel fuel oil and water to make 10–25 gal/ac) as ground broadcast. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant per 100 gal water or 5 gal diesel fuel oil/100 gal spray mix (1:19 oil-in-water emulsion). Oil-in-water emulsion requires the use of emulsifier.	Spring, during bud stage (pre-bloom)	Bud stage usually occurs mid-May–early June. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 34 oz (1 lb)	VH 0.63%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 51 oz (1 lb)	VH 1%			
	picloram + 2,4-D low volatile ester	VH 13 oz (0.2 lb) picloram + 26 oz (0.8 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.50% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 32 oz (0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	H 16–24 oz (0.5 to 0.75 lb)	VH 0.5%			
	metsulfuron methyl dicamba:2,4-D(1:3)	H–VH Rate –Rate 2	—			
	dicamba:2,4-D(1:3)	VH 32 oz (1 lb)	VH 1%			
	dicamba + 2,4-D low volatile ester	VH 8 oz (0.25 lb) dicamba + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75% 2,4-D (4 lb/gal product)			
Lespedeza	triclopyr	VH 16–32 oz (0.50–1 lb)	—	Ground broadcast 20–30 gal per acre with 32–64 oz surfactant/100 gal water.	June–Aug under good growing conditions	Plants need to be 12–18 in. tall before spraying. Use the higher rate if plants are large, approaching maturity, or if the infestation level is high.
	metsulfuron methyl	H 0.5 oz				Begin application at flower bud initiation through full bloom. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron:chlorosulfuron (3:1)	H 0.7 oz				
	metsulfuron:chlorosulfuron (1:1)	H 1.0 oz				
	metsulfuron methyl dicamba:2,4-D(1:3)	H Rate 2				
	picloram:fluroxypyr (1:1)	VH 24–32 oz (0.25–0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	VH 12–16 oz (0.38–0.5 lb)	VH 0.5%			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Rayless goldenrod (jimmyweed)	metsulfuron methyl	VH 0.75 oz	—	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Add 32 to 64 oz surfactant/100 gal water. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Fall	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron:chlorosulfuron (3:1)	VH 1.0 oz				
	metsulfuron:chlorosulfuron (1:1)	VH 1.5 oz				
	picloram:fluroxypyr (1:1)	VH 96 oz (1.0 lb)	VH 2%			
	picloram	VH 32 oz (0.50 lb)	VH 1%			
Spiny aster (wolfweed)	picloram:2,4-D (1:4), (3.8 lb/gal product)	VH 20 oz (0.6 lb)	VH 0.63%	10–25 gal water for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, during good moisture and growth conditions	Shred plants during winter. Regrowth will have leaves. Apply herbicide when regrowth is 10–12 in. tall. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (2.5 lb/gal product)	VH 32 oz (0.63 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	VH 8 oz (0.125 lb) picloram + 16 oz (0.5 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 24–32 oz (0.25–0.33 lb)	VH 1%			
	triclopyr:fluroxypr (3:1)	H 16–24 oz (0.5–0.75 lb)	VH 0.5%			
	dicamba:2,4-D(1:3)	VH 32 oz (1 lb)	VH 1%			
	dicamba + 2,4-D amine or low volatile ester	VH 8 oz (0.25 lb) dicamba + 24 oz (0.75 lb) 2,4-D, 4 lb/gal product	VH 0.25% dicamba + 0.75% 2,4-D (4 lb/gal product)			
Threadleaf groundsel	metsulfuron methyl	VH 0.4 oz	—	2–4 gal water for aerial spray; 10–25 gal water for ground broadcast application. Add 32–64 oz of surfactant/100 gal water.	Fall	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron:chlorosulfuron (3:1)	VH 0.5 oz				
	metsulfuron:chlorosulfuron (1:1)	VH 0.8 oz				
	metsulfuron methyl dicamba:2,4-D(1:3)	VH Rate 2				

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Weed controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant/spot treatment*			
Twinleaf senna (twoleaf senna)	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	VH 0.63%	Thoroughly wet foliage. Mix with water and add 32–64 oz surfactant/100 gal spray mix.	Late spring, good moisture and growth conditions	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (2.5 lb/gal product)		VH 1%			
	picloram:fluroxypyr (1:1)		VH 1%			
	dicamba:2,4-D(1:3)		VH 1%			
Upright prairie-coneflower	metsulfuron methyl	VH 0.2 oz	—	2–4 gal water for aerial spray. 10–25 gal water for ground broadcast application. Add 32–64 oz surfactant/100 gal water.	Spring, before flower stalk development	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron: chlorosulfuron (3:1)	VH 0.25 oz				
	metsulfuron: chlorosulfuron (1:1)	VH 0.4 oz				

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Table 6. Herbicides for controlling brush on rangeland

Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Ashe juniper (blueberry cedar)	hexazinone liquid	—	VH** 2 ml/3 ft height or canopy diameter, whichever is greater	—	Late winter through summer	Apply undiluted hexazinone liquid, picloram or hexazinone pellets between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid and picloram. If plant size requires more than a single 2 ml or 4 ml application of hexazinone liquid or picloram, or more than 1 hexazinone pellet, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone pellet		VH 1 pellet/3 ft height or canopy diameter, whichever is greater			
	picloram		VH 4 ml/3 ft height or canopy diameter, whichever is greater			
Ashe juniper (blueberry cedar), cholla, dog cactus, redberry juniper (redberry cedar), tasajillo	picloram	—	VH 1% H rating for cholla	Thoroughly wet foliage and stems or joints and stems for individual plant treatment. Mix with water and add 32–64 oz surfactant/100 gal spray mix.	Anytime	—
Baccharis (dryland willow, Roosevelt willow, seep willow or willow baccharis) (continued on next page)	2,4-D low volatile ester	H 48–96 oz (1.5–3 lb) 4 lb/gal product	H 1%	For aerial applications, minimum suggested total spray volume is 4 gal water for aerial spray; 15–20 gal water for ground broadcast. For individual plant treatment, thoroughly wet the entire foliage, stems, and trunks. Add 32–64 oz surfactant/100 gal water.	Spring, when leaves are fully expanded and dark green	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	H 0.63%	For individual plant treatment thoroughly wet the entire foliage, stems, and trunks. Add 32–64 oz surfactant/100 gal water.		
	picloram:2,4-D (1:4), (2.5 lb/gal product)	—	H 1%			
	dicamba:2,4-D(1:3)	—	H 1%			
	triclopyr ester	—	VH 1%			
	triclopyr:fluroxypr (3:1)	—	VH 0.5%			
	picloram:fluroxypyr (1:1)	—	VH 1%			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Baccharis (dryland willow, Roosevelt willow, seep willow or willow baccharis) (continued from previous page)	hexazinone liquid	—	VH** 2 ml/3 ft height or canopy diameter, whichever is greater	—	Late winter–summer	Apply undiluted hexazinone liquid, picloram or hexazinone pellets between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid and picloram. If plant size requires more than a single 2 ml or 4 ml application of hexazinone liquid or picloram, or more than 1 hexazinone pellet, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone pellet		VH** 1 pellet/3 ft height or canopy diameter, whichever is greater			
Baccharis (dryland willow, Roosevelt willow, seep willow or willow baccharis), blackbrush, bois d'arc, catclaw acacia, catclaw mimosa, Chinese tallowtree, elm, greenbriar, hackberry, pricklyash (Hercules club), Texas persimmon (see remarks), winged elm, yaupon	triclopyr ester	—	VH 25% in diesel fuel oil	Apply to lower 12–18 in. of trunk to wet the trunk; do not spray to point of runoff. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	This is a Brush Busters® low volume basal application method. A 5500-X1 adjustable cone nozzle is preferred. Use only on plants with smooth bark and a trunk diameter less than 4 in. For Texas persimmon, apply in spring after leaves mature but before June 15.
	triclopyr ester	—	VH 25% in diesel fuel oil 10% d,l-limonene (a penetrant) may be added to the mixture—see remarks	Apply to the trunk in a 3- to 4-in.-wide band near ground level or at line dividing smooth bark from corky bark. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	This is commonly called the streamline basal application method. Use a straight stream nozzle. Use only on plants with smooth bark and trunk diameter less than 4 in. Addition of a penetrant to the mixtures aids with coverage around the trunk and increases the control for most species. Trade names for d,l limonene are Quick Step II, AD 100, Cide-Kick II and Cide-Kick. Other penetrants may be effective but have not been tested on rangeland in Texas. For Texas persimmon, apply in spring after leaves mature but before June 15.
Bigelow shinoak (white shinoak)	tebuthiuron 20% pellets	VH 7.5 lb pellets (1.5 lb)	VH 0.5 oz pellets (0.1 oz)/100 sq ft of ground area	—	Anytime—optimum period is Oct 1–Apr 1	For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Blackberry	picloram:fluroxypyr (1:1)	VH** 48–64 oz (0.5–0.67 lb)	VH 1–2%	Use at least 10 gal water/ac, but increased volume up to 25 gal/ac will improve coverage, and subsequent herbicide penetration into the plant. Add 32–64 oz surfactant/100 gal spray mix.	Apply when leaves are fully expanded and the foliage is dark green, either before first flower or after fruit drop. Do not treat blackberries in the same year after shredding or burning.	—
	triclopyr:fluroxypyr (3:1)	H 24–32 oz (0.75 to 1.0 lb)	VH 0.5–1%			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Blackbrush	aminopyralid:metsulfuron methyl (1:6.2)	VH 3.3 oz (0.127 lb)	—	For aerial applications, suggested total spray volume is a minimum of 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil or methylated seed oil.	Fall applications	Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
Blackbrush, guajillo	tebuthiuron 20% pellets	H 10–15 lb pellets (2–3 lb)	VH 0.5 oz pellets (0.1 oz)/45 sq ft ground area or 2–4 in. stem diameter	—	Anytime—optimum period is Oct 1–Apr 1	Use higher rate on deep soils with higher clay content. For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge. Best results are expected on coarse-textured soils.
Blackjack oak, bois d'arc, elm, hackberry, lotebush, post oak, pricklyash (Hercules club), whitebrush (beebrush, beebush), willow, winged elm	hexazinone liquid	—	VH 4 ml/3 ft canopy diameter or height, whichever is greater	—	Late winter–summer	Apply undiluted hexazinone liquid or hexazinone pellets to soil surface between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid. If plant size requires more than a single 4 ml application of hexazinone liquid, or 2 hexazinone pellets, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone pellet		VH 2 pellets/3 ft canopy diameter or height, whichever is greater		Anytime—optimum period is Oct 1–Apr 1	
Blackjack oak, post oak, winged elm	tebuthiuron 20% pellets	VH 10 lb pellets (2 lb)	VH 0.5 oz pellets (0.1 oz)/45 sq ft of ground area or 2–4 in. of stem diameter	—	Anytime—optimum period is Oct 1–Apr 1	For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Blackgum, sweetgum and other hardwoods	triclopyr:2,4-D (1:2)	—	H 4% in diesel fuel oil	Apply to freshly cut surface of stump immediately after cutting.	Anytime—best results when soil is dry.	—
Burrobrush	picloram	—	VH 1%	Thoroughly wet foliage for individual plant treatment.	Apr–Jul	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	VH 1.3%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	—	VH 2%			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Catclaw mimosa	tebuthiuron 20% pellets	H** 3.75 lb pellets (0.75 lb)	VH 0.5 oz pellets (0.1 oz)/100 sq ft of ground area or 2–4 in. of stem diameter	—	Anytime—optimum period is May 1–Jul 1 in Trans-Pecos and Oct 1–Apr 1 in rest of state	Use only when brush is growing on sand, loamy sand or sandy loam soil. For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Cenizo	tebuthiuron 20% pellets	VH 3.75 lb pellets (0.75 lb)	VH 0.5 oz pellets (0.1 oz)/100 sq ft of ground area or 2–4 in. of stem diameter	—	Anytime—optimum period is Oct 1–Apr 1	For individual plant treatment, apply the pellets evenly on soil under the plant canopy and 1 ft beyond canopy edge.
Chinese tallowtree (continued on next page)	picloram:2,4-D (1:4) (3.8 lb/gal product)	VH 80 oz (2.4 lb)	VH 0.63%	5–15 gal as aerial spray or 10–25 gal for ground broadcast application. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring or fall	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4) (3.8 lb/gal product)	VH 1 gal (2.5 lb)	VH 1%			
	picloram + 2,4-D amine	VH 32 oz (0.5 lb) picloram + 64 oz (2 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	picloram:fluroxypyr (1:1)	VH 80 oz (0.84 lb)	VH 1%			
	picloram	VH 32 oz (0.5 lb)	VH 0.5%			
	picloram + triclopyr ester	VH 32 oz (0.5 lb) picloram + 16 oz (0.5 lb) triclopyr ester	VH 0.5% picloram + 0.25% triclopyr ester			
	hexazinone liquid	—	VH 4 ml/3 ft canopy diameter or height, whichever is greater	—	Late winter—summer	Apply undiluted Tebuthiuron 20% pellets, hexazinone liquid or hexazinone pellets to soil between stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid. If plant size requires more than a single 4 ml application of hexazinone liquid, or 2 hexazinone pellets, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone pellets	—	VH 2 pellets/3 ft canopy diameter or height, whichever is greater			
	tebuthiuron 20% pellets	—	VH 0.5 oz pellets (0.1 oz)/45 sq ft of ground area or 2–4 in. of stem diameter		Anytime—optimum period is Oct 1–Apr 1	
	triclopyr ester	—	VH** 15% in diesel fuel	Apply to lower 12–18 in. of trunk to wet the bark, but not to point of runoff. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	Use only on plants with a smooth bark and/or a trunk diameter less than 4 in. This is a Brush Busters® low volume basal application method. A 5500-X1 nozzle is preferred.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

Table 6. Herbicides for Controlling Brush on Rangeland

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Chinese tallowtree (continued from previous page)	triclopyr ester	—	VH 25% in diesel fuel	Apply to lower 12–18 in. of trunk to wet the bark, but not to point of runoff. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	Use on plants with rough, corky bark and/or a trunk diameter of 4 in. or greater. This is a Brush Busters® low volume basal application method. A 5500-X1 nozzle is preferred.
Christ thorn	triclopyr ester	—	VH 1%	Add 32–64 oz surfactant/100 gal water. Thoroughly wet foliage.	Early summer	—
	triclopyr ester + picloram	—	VH 0.5% triclopyr ester + 0.5% picloram			
Common or eastern persimmon	dicamba	L 64 oz (2 lb)	H 1%	Ground broadcast 15–20 gal water. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, when leaves are fully developed	—
	picloram:fluroxypyr (1:1)	—	VH 1 to 2%			
Creosotebush, tarbush, whitethorn acacia	tebuthiuron 20% pellets	H 3.75–5 lb of pellets (0.75–1 lb)	VH 0.5 oz pellets (0.1 oz)/100 sq ft of ground area	—	Anytime—optimum period is May 1–Jul 1	Use 5 lb pellets/ac when soil is a loam, silt loam, silt, sandy clay loam or clay loam. Use low rate when soil is a sand, loamy sand or sandy loam. Do not treat mountainside or gravelly ridges with slopes of 7% or more. Do not treat if soils have a cation exchange capacity greater than 30 meq/100 grams (commonly called "gyp" soils). For individual plant treatment, apply pellets evenly on soil under the plant canopy and 1 ft beyond the canopy edge.
Eastern redcedar	picloram	—	VH** 4 ml/3 ft height or canopy diameter, whichever is greater	—	Spring or fall	Apply undiluted hexazinone liquid, picloram or hexazinone pellets to soil surface between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid and picloram. If plant size requires more than one 4 ml application of hexazinone liquid or picloram, or more than 2 hexazinone pellets, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone liquid		VH 4 ml/3 ft height or canopy diameter, whichever is greater, or 1 in. trunk diameter		Late winter through summer	
	hexazinone pellet		VH 2 pellets/3 ft height or canopy diameter, whichever is greater, or 1 in. trunk diameter			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Elm, granjeno (spiny hackberry), hackberry, pricklyash, (Hercules club), yaupon	tebuthiuron 20% pellets	—	VH ½ oz pellets (1/10 oz) per 45 sq ft of ground area or 2–4 in. of stem diameter	—	Anytime during year-optimum period is Oct 1–Apr 1, except in Trans-Pecos, where optimum period is May 1–July 1	Apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Huisache, lotebush	tebuthiuron 20% pellets	—	L ½ oz pellets (1/10 oz) per 45 sq ft of ground area or 2–4 in. of stem diameter			
Flameleaf sumac	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	VH 0.63%	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (15 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring, when leaves mature	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (2.5 lb/gal product)	—	VH 1%			
	picloram:fluroxypyr (1:1)	H 48–96 oz (0.5–1.0 lb)	VH 0.75%			
	picloram	H 16–32 oz (0.25–0.5 lb)	VH 0.5%			
	picloram + triclopyr ester	H 16 oz (0.25 lb) picloram + 8 oz (0.25 lb) triclopyr ester	VH 0.25% picloram + 0.25% triclopyr ester			
	picloram + 2,4-D amine or low volatile ester	—	VH 0.25% picloram + 0.5%, 2,4-D 4 lb/gal product			
Giant reed	imazapyr	VH 64 oz (1 lb)	VH 0.5%	Use a minimum 20–30 gal/ac total volume of ground broadcast applications and a minimum 15 gal/ac for aerial. When using individual plant applications, spray plants to runoff. Add 1% MSO to individual plant treatments and 32 oz/ac for broadcast applications.	Spray when plants are actively growing during the summer or fall with a minimum 3 ft plant height	Do not mow plants for 3–4 mo. after treatment. When exposure to aquatic environments is possible, use an herbicide with aquatic label.
Greenbriar	dicamba + 2,4-D low volatile ester	—	H** 1.5% dicamba + 3% 2,4-D (4 lb/gal product) in diesel fuel oil	Thoroughly wet stems with diesel/herbicide mix.	Winter	Use as dormant stem treatment. Constant agitation is needed to maintain proper mixture.
Hardwoods with a diameter of >1 in. except mesquite and huisache	2,4-D amine	—	H Undiluted	Use tree injector or other injecting equipment. Apply in cuts spaced 2 in. apart at base of trees. Apply until 2,4-D runs from each end of cut.	Summer or winter	—

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

Table 6. Herbicides for Controlling Brush on Rangeland

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Honeylocust	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	VH 0.63%	For aerial applications, the minimum suggested total spray volume is 5 gal/acre. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water plus surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 20–25 gal/acre. Use oil-in-water emulsion (15 oil-to-water ratio is considered optimum), or water plus surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage, but not to the point of dripping, for individual plant treatments. Add 32–64 oz of surfactant per 100 gal.	Late spring after leaves mature through summer	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:2,4-D (1:4), (2.5 lb/gal product)	—	VH 1%			
	aminopyralid:clopyralid (1:4.6)	H 28 oz (0.61 lb)	—			
	aminopyralid:2,4-D (1:8)	H 33.6 oz (0.98 lb)				
	picloram:fluroxypyr (1:1)	M–H 48 oz (0.5 lb)				
	aminopyralid:metsulfuron Methyl (1:6.2)	M–H 3.3 oz (0.127 lb)				
Huisache (continued on next page)	aminopyralid:metsulfuron methyl (1:6.2)	L 3.3 oz (0.127 lb)	—	10–15 gal water as aerial spray; 10–20 gal water as ground broadcast. Add 32–64 oz surfactant/100 gal water.	Fall, under good moisture conditions	Because of metsulfuron methyl in the formulation, this herbicide is not recommended on bahiagrass pastures for weed and brush control.
	aminopyralid:metsulfuron methyl (1:6.2) + triclopyr ester	M–H 3.3 oz (0.127 lb) aminopyralid:metsulfuron methyl + 16 oz (0.5 lb) triclopyr ester	—			
	aminopyralid:2,4-D (1:8)	L 24–34 oz (0.70–0.98 lb)	—			
	aminopyralid:2,4-D (1:8) + triclopyr ester	L 24 oz aminopyralid:2,4-D (0.70 lb) + 16 oz (0.5 lb) triclopyr ester	—			
	triclopyr ester	—	H 15% in diesel fuel oil	Apply to lower 12–18 in. of trunk to wet the trunk; do not spray to point of runoff. Apply completely around the trunk.	Anytime—optimum time is growing season when plants have mature leaves.	This is a Brush Busters® low volume basal application method. A 5500-X1 adjustable cone nozzle is preferred. Use only on plants with smooth bark and a trunk diameter less than 4 in.
	triclopyr ester		VH 25% in diesel fuel oil			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Huisache (continued from previous page)	picloram:2,4-D (1:4), (3.8 lb/gal product)	—	VH 0.63%	Add 32–64 oz surfactant/100 gal water. Apply to the leaves. Thoroughly wet foliage, but not to the point of dripping.	Best results are generally obtained in the fall.	If plants are shredded, wait until regrowth is 3 ft tall or higher before treatment. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (2.5 lb/gal product)		VH 1%			
	aminopyralid:clopyralid (1:4.6)		VH 1%			
Huisache, retama	picloram + triclopyr ester	L–M 32 oz (0.5 lb) picloram + 16 oz (0.5 lb) triclopyr ester	H 0.5% picloram + 0.5% triclopyr ester	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 20–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Spring, with mature foliage or fall with good soil moisture and foliage	When using oil-in-water emulsion, add an emulsifier to oil for proper emulsion.
	picloram + clopyralid	L–M 32 oz (0.5 lb) picloram + 11 to 21 oz (0.25 to 0.5 lb) clopyralid	H 0.5% picloram + 0.5% clopyralid			
	picloram:fluroxypyr (1:1)	L–M 96 oz (1.0 lb)	H 1%			
	picloram	L–M 32 oz (½ lb)	H 1%			
Lotebush	triclopyr ester	—	VH 15% in diesel fuel	Apply to lower 12–18 in. of the trunk to wet the bark. Do not spray to point of runoff. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	This is a Brush Busters® low volume basal application method. Use a 5500X1 adjustable cone nozzle.
Macartney rose (mowed and other disturbed stands within 3 years of disturbance)	2,4-D amine	L** 64 oz (2 lb) 4 lb/gal product	L 1% 4 lb/gal product	5–15 gal water as aerial spray; 25–30 gal water as ground broadcast. Thoroughly wet foliage and stems for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring before Jun 1, good growth conditions	Avoid spraying earlier than 9–12 mo. after mowing or when plants have high percentage of new growth. Poor control may be expected if plants are <3 ft tall when sprayed. Repeat treatment when necessary. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	H 80 oz (2.4 lb)	VH 0.63%		Spring or fall, good growth conditions	
	picloram:2,4-D (1:4), (2.5 lb/gal product)	H 1 gal (2.5 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	H 32 oz (0.5 lb) picloram + 64 oz (2 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D 4 lb/gal product			
	2,4-D low volatile ester	L 64 oz (2 lb) 4 lb/gal product	L 1% 4 lb/gal product		Fall, under good moisture conditions, before Nov 1	

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Macartney rose (undisturbed stands)	2,4-D amine	L 1 gal (4 lb) 4 lb/gal product	L 1% (4 lb/gal product)	5–15 gal water as aerial spray; 25–30 gal water as ground broadcast. Thoroughly wet foliage and stems for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Spring, before June 1, good growth conditions	Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	H 80 oz (2.4 lb)	VH 0.63%		Spring or fall, good growth conditions	
	picloram:2,4-D (1:4), (2.5 lb/gal product)	H 1 gal (2.5 lb)	VH 1%			
	picloram + 2,4-D amine or low volatile ester	H 32 oz (0.5 lb) picloram + 64 oz (2 lb) 2,4-D, 4 lb/gal product	VH 0.25% picloram + 0.5% 2,4-D (4 lb/gal product)			
	2,4-D low volatile ester	L 96 oz (3 lb) 4 lb/gal product	L 1% (4 lb/gal product)	5–15 gal water as aerial spray; 25–30 gal water as ground broadcast. Thoroughly wet foliage and stems for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Fall, good moisture conditions, before Nov 1	—
Mesquite, huisache	hexazinone liquid	—	M–H** 4–8 ml/3 ft of canopy diameter or height, whichever is greater	—	Late winter–summer	Apply undiluted hexazinone liquid or hexazinone pellets to soil surface between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid. If plant size requires more than a single 4 ml application of hexazinone liquid, or 2 hexazinone pellets, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone pellet		M–H 2–4 pellets/3 ft of canopy diameter or height, whichever is greater			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite (basal stem diameter ≤1.5 in.)	triclopyr ester	—	VH 15% in diesel fuel oil or basal bark oil	Apply to lower 12–18 in. of trunk to wet the trunk; do not spray to point of runoff. Apply completely around the trunk.	Anytime—optimum time is during growing season when plants have mature leaves	This is a Brush Busters® low volume basal application method. Use a 5500X1 adjustable cone nozzle. Use only on plants with smooth bark and a trunk diameter <4 in.
Mesquite (basal stem diameter >1.5 in.)	triclopyr ester		VH 25% in diesel fuel oil or basal bark oil			
Mesquite (basal stem diameter ≤1.5 in.)	triclopyr ester	—	VH 15% in diesel fuel oil 10% d,l limonene (a penetrant) may be added to the mixture—see remarks		Anytime—optimum is in the growing season when the leaves are mature	This is commonly called the streamline basal application method. Use a straight stream nozzle. Use only on plants with smooth bark and a trunk diameter <4 in. Add a penetrant to the mixture to improve coverage around the trunk. Trade names for d,l limonene are Quick Step II, Cide-Kick, Cide-Kick II and AD 100. Other penetrants may be effective but have not been tested on rangelands in Texas.
Mesquite (basal stem diameter >1.5 in.)	triclopyr ester	—	VH 25% in diesel fuel oil 10% d,l limonene (a penetrant) may be added to the mixture—see remarks			
Mesquite (seedlings and saplings)	triclopyr ester	—	VH 5% in diesel fuel oil	Apply to the lower 12–18 in. of trunk to point of runoff but not to the point of puddling.	May–Aug	This is a Brush Busters® low volume basal application method. Use a 5500X1 adjustable cone nozzle.
Mesquite, huisache, twisted acacia	diesel fuel oil, kerosene	—	H	Apply to the base of the trunk from 12–18 in. above soil surface down to soil surface. Apply until the solution puddles on the soil surface.	Anytime the soil is dry and pulled away from the trunk	Apply sufficient oil to penetrate to the plant bud zone. Diesel fuel oil does not evaporate as fast as does kerosene.
	triclopyr ester		VH 2% in diesel fuel oil			
Mesquite, Christ thorn and other hardwoods (cut stumps)	triclopyr ester	—	VH** 15% in diesel fuel oil or basal bark oil	Thoroughly spray the cut surface as well as the bark from the cut to ground level but not to the point of runoff.	Anytime, except when snow or water prevents spraying to the ground line	This is a Brush Busters® cut-stump application method. Apply with a backpack or knapsack sprayer using low pressures and an adjustable cone nozzle (5500X1 to 5500X3). Hydraulic shears equipped with a large orifice nozzle such as a 5500X12 can also be used for this method.
	triclopyr:fluroxypr (3:1)		VH 10% in diesel fuel oil or basal bark oil			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite (continued on next page)	aminopyralid:clopyralid (1:4.6)	H 28 oz (0.61 lb)	VH 1%	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring–mid-summer with mature (dark green) leaves. Optimum period begins when soil temperature at a depth of 12 in. reaches 75°F and continues for 45 days thereafter. When clopyralid is used alone or in a tank mix, the period should continue for 60 days. For optimum root kill, do not spray if white flowers or bean elongation are observable, if >25% of the leaf canopy is damaged due to insects, disease or hail, if soil temperatures are less than 75°F 1 ft deep, or if new vegetative growth is present due to recent rains.	Use 16 oz/ac picloram + 8 oz/ac triclopyr, 8 oz/ac dicamba + 8 oz/ac triclopyr, 16 oz/ac picloram + 8 oz/ac dicamba, 16 oz/ac picloram + 11 oz/ac clopyralid and 11 oz/ac clopyralid only in West Texas. Dicamba and dicamba mixtures have been more effective in West Texas than in other parts of the state. Use mixtures that include 4 oz/ac triclopyr and 5 oz/ac clopyralid only in Bandera, Blanco, Bosque, Burnet, Coryell, Edwards, Hood, Kendall, Lampasas, Montague, Parker, Real, Somervell, Val Verde, and Wise Counties and the counties north and west of the named counties. Mixtures that include 8 oz triclopyr and 11 oz clopyralid will give better control than mixtures with 4 oz triclopyr and 5 oz clopyralid. When using oil-in-water emulsion, use emulsifier added to oil for proper emulsion. Use of a treatment with a low-control rating may result in a multi-stem growth form that may be more difficult to control in the future.
	clopyralid	M–H 11–21 oz (0.25–0.5 lb)	VH 1%			
	triclopyr ester + picloram	M 8–16 oz (0.25–0.5 lb) triclopyr + 16–32 oz (0.25–0.5 lb) picloram	M–H 0.5% triclopyr + 0.5% picloram			
	triclopyr ester + dicamba	L 8–16 oz (0.25–0.5 lb) triclopyr + 8–16 oz (0.25–0.5 lb) dicamba	M 0.5% triclopyr + 0.5% dicamba			
	triclopyr ester + clopyralid	M–H 4–16 oz (0.125–0.5 lb) triclopyr + 5–11 oz (0.125–0.25 lb) clopyralid	VH 0.5% triclopyr + 0.5% clopyralid			
	picloram + dicamba	M 16–32 oz (0.25–0.5 lb) picloram + 8–16 oz (0.25–0.5 lb) dicamba	H 0.5% picloram + 0.5% dicamba			
	picloram + clopyralid	M–H 16–32 oz (0.25–0.5 lb) picloram + 11–21 oz (0.25–0.5 lb) clopyralid	VH 0.5% picloram + 0.5% clopyralid			
	triclopyr ester + clopyralid + picloram	M–H** 4–8 oz (0.125–0.25 lb) triclopyr + 5–11 oz (0.125–0.25 lb) clopyralid + 32 oz (0.5 lb) picloram	—			Recommended for mixtures of mesquite and pricklypear or tasajillo cactus.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite (continued from previous page)	aminopyrlid:clopyralid + picloram	H 28 oz (0.61 lb) aminopyrlid: Clopyrlid + 16–32 oz (0.25–0.5 lb) picloram	—	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring–mid-summer with mature (dark green) leaves. Optimum period begins when soil temperature at a depth of 12 in. reaches 75°F and continues for 45 days thereafter. When clopyralid is used alone or in a tank mix, the period should continue for 60 days. For optimum root kill, do not spray if white flowers or bean elongation are observable, if >25% of the leaf canopy is damaged due to insects, disease or hail, if soil temperatures are less than 75°F 1 ft deep, or if new vegetative growth is present due to recent rains.	Recommended for mixtures of mesquite and pricklypear or tasajillo cactus. The tank mix of aminopyralid: clopyralid plus picloram also controls mesquite better in South Texas mixed brush habitat than does aminopyrlid: clopyralid alone.
	aminopyrlid:clopyralid + triclopyr ester	H 28 oz (0.61 lb) aminopyrlid: clopyrlid + 8–32 oz (0.25–0.75 lb) triclopyr ester	—			
	clopyralid (see remarks)	H 21 oz (0.5 lb)	VH 1%		Aug 1–Sep 30 with a soil temperature of 75°F or more at a depth of 12 in. Do not apply after a frost has occurred.	Use only in Bandera, Blanco, Burnet, Coryell, Edwards, Kendall, Lampasas, Montague, Real, Val Verde, and Wise Counties and the counties north and west of the named counties.
	picloram	—	VH 1 gal (2 lb)	Applied with a carpeted roller.	Late spring–Aug with mature (dark green) leaves. Best control during the period that begins when soil temperature at a depth of 12 in. reaches 75°F and continued for 45 days thereafter; when clopyralid is used alone or in a tank mix the period should continue for 60 days after soil temperature reaches 75°F.	Mesquite should be <6 ft tall and should pass under carpeted roller without breaking the main stem. Mix recommended quantity of herbicide with water to make 8 gal mixture. Add 3–6 oz surfactant for each 8 gal mixed.
	clopyralid	—	VH 84 oz (2 lb)			
	picloram + clopyralid	—	VH 64 oz (1 lb) picloram + 43 oz (1 lb) clopyralid			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite (suppression and weed control)	2,4-D amine or low volatile ester	L 32–28 oz (2–4 lb)	M 2% (4 lb/gal product)	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring–mid-summer with mature (dark green) leaves. Optimum period begins when soil temperature at a depth of 12 in. reaches 75°F and continues for 45 days thereafter. If treatment is applied before optimum soil temperatures, efficacy rates will be lower and multiple applications over a period of years may be necessary to maintain less than 10% canopy cover.	Treatments will control many weeds. When using oil-in-water emulsion, use emulsifier. Use of a treatment with a low control rating may result in multi-stem growth form that may be more difficult to control in the future. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	picloram:2,4-D (1:4), (3.8 lb/gal product)	L 20–32 oz (0.6–0.9 lb)	—			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	L 32–48 oz (0.6–0.9 lb)				
	dicamba:2,4-D(1:3)	L 32–48 oz (1–1.5 lb)				
	metsulfuron methyl dicamba:2,4-D(1:3)	L Rate 1–Rate 2				
	picloram + 2,4-D amine or low volatile ester	L 8–2 oz (0.125–0.1875 lb) picloram + 32–48 oz (1–1.5 lb) 2,4-D, 4 lb/gal product				
	dicamba + 2,4-D amine or low volatile ester	L 8–12 oz (0.25–0.375 lb) dicamba + 24–36 oz (0.75–1.125 lb) 2,4-D, 4 lb/gal product				
	triclopyr ester	L 16–32 oz (0.5–1 lb)	M 1%			
	dicamba	L 16–32 oz (0.5–1 lb)	M 1%			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite, western honey	triclopyr ester + clopyralid	—	VH 0.5% triclopyr ester + 0.5% clopyralid	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	The preferred application time is spring to early summer, 40–90 days after bud break. Spray with minimum soil temperature of 750F at 12–18 inch soil depth. Soil moisture should be adequate for plant growth. Not all years provide adequate conditions for spraying. In certain early season drought years with late summer rains, there is an opportunity for spraying in July and August. This occurs when summer rains provide sufficient soil moisture that allows mesquite foliage to recover from drought or other damage and develop healthy and robust leaf growth.	Western honey mesquite is most common in the western part of the Trans-Pecos region of Texas. Do not spray after major rain (usually at least 1 inch of rain) that causes light green leaves until all leaves have returned to uniform dark-green (approx. 2–3 weeks). Foliage should be robust, dark green, and undamaged. Do not spray foliage damaged by drought, frost, hail, wind, insects, and browsing.
	aminopyrlid:clopyralid + triclopyr ester	H-VH 28 oz (0.61 lb) aminopyrlid: clopyrlid + 8 oz triclopyr ester (0.25 lb)	—			
	aminopyralid:clopyralid	M-H 28 oz (0.61 lb) aminopyrlid: clopyrlid	—			Suggested for ground broadcast
Mixed brush—South Texas (includes several of the following: blackbrush, catclaw acacia, granjeno or spiny hackberry, guajillo, huisache, mesquite, pricklypear, retama, skunkbush, tasajillo, twisted acacia (continued on next page)	picloram + triclopyr ester	M** 32 oz (0.5 lb) picloram + 16 oz (0.5 lb) triclopyr ester	H 0.5% picloram + 0.5% triclopyr ester	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 20–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring–mid-summer with mature (dark green) leaves. Optimum period of application begins when soil temperature at a depth of 12 in. reaches 75°F and continues for 45 days thereafter; with the clopyralid tank mix the period should continue for 60 days after soil temperature reaches 75°F. If mesquite has 10% canopy cover or less, application may be made in spring or fall.	The mixture of 32 oz picloram + 21 oz clopyralid or 32 oz picloram + 28 oz aminopyrlid:clopyralid will usually provide better results than the 32 oz picloram + 11 oz clopyralid mixture. Mixtures will control most weeds. When using oil-in-water emulsion, use emulsifier added to oil for proper emulsion.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mixed brush—South Texas (includes several of the following: blackbrush, catclaw acacia, granjeno or spiny hackberry, guajillo, huisache, mesquite, pricklypear, retama, skunkbush, tasajillo, twisted acacia (continued from previous page)	picloram + clopyralid	M 32 oz (0.5 lb) picloram + 11–21 oz (0.25–0.5 lb) clopyralid	H 0.5% picloram + 0.5% clopyralid	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 20–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Late spring–mid-summer with mature (dark green) leaves. Optimum period of application begins when soil temperature at a depth of 12 in. reaches 75°F and continues for 45 days thereafter; with the clopyralid tank mix the period should continue for 60 days after soil temperature reaches 75°F. If mesquite has 10% canopy cover or less, application may be made in spring or fall.	The mixture of 32 oz picloram + 21 oz clopyralid or 32 oz picloram + 28 oz aminopyrlid:clopyralid will usually provide better results than the 32 oz picloram + 11 oz clopyralid mixture. Mixtures will control most weeds. When using oil-in-water emulsion, use emulsifier added to oil for proper emulsion.
	picloram + dicamba	M 32 oz (0.5 lb) picloram + 16 oz (0.5 lb) dicamba	H 0.5% picloram + 0.5% dicamba			
	aminopyralid:clopyralid + picloram	M 28 oz (0.61 lb) aminopyrlid:clopyralid + 16–32 oz (0.25–0.5 lb) picloram	—			
	aminopyralid:clopyralid + triclopyr ester	M 28 oz (0.61 lb) aminopyrlid:clopyralid + 8–32 oz (0.25–0.75 lb) triclopyr ester	—			
Mixed brush—Davis Mountains (includes catclaw acacia, catclaw mimosa and whitebrush)	tebuthiuron 20% pellets	M** 7.5–10 lb of pellets (1.5–2 lb)	H 0.5 oz of pellets (0.1 oz)/ 50–100 sq ft of ground area	—	Anytime—optimum period is May 1–Jul 1	Use 10 lb pellets/ac when soil is a loam, silt loam, silt, sandy clay loam or clay loam. Use low rate when soil is a sand, loamy sand or sandy loam. For individual plant treatment apply pellets evenly on soil under the plant canopy and 1 ft beyond the canopy edge.
Mohrs shinoak	tebuthiuron 20% pellets	VH 5 lb of pellets (1 lb)	VH 0.5 oz of pellets (0.1 oz)/ 100 sq ft of ground area	—	Anytime—optimum period is Oct 1–Apr 1	Use only when oak stand is predominantly Mohrs shinoak. These stands are generally found in Coke, Mitchell, Nolan, Sterling, and Taylor Counties. For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Pricklypear, tasajillo	picloram	H** 16–32 oz (0.25–0.5 lb)	VH 1%	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 10–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	Anytime—best results have been obtained with late summer through fall applications	Use emulsifier when adding diesel fuel oil-to-water. Use 1 pt/ac picloram only on High Plains where no brush overstory is present. Late summer or fall applications, especially with fluroxypyr, will provide best results, but aerially spray in the winter or early spring if heavy overstory of woody plants is present or if damage to live oak is a concern. Picloram:2,4-D (1:4), (3.8 lb/gal product): Do not apply more than 80 oz/acre per year.
	picloram:fluroxypyr (1:1)	H 64 oz (0.67 lb)	VH 1%			
	picloram:2,4-D (1:4), (3.8 lb/gal product)	H 80 oz (2.4 lb)	VH 1.3%			
	picloram:2,4-D (1:4), (2.5 lb/gal product)	H 1 gal (2.5 lb)	VH 2%			
	triclopyr: fluroxypyr (3:1)	—	VH 1%			
	fluroxypyr	—	VH 0.5%			
	prescribed burn + picloram	VH** 8–16 oz (0.125–0.25 lb)	VH 1%	For individual plant treatment, thoroughly wet all pads and crowns that survive the fire. Use a water carrier and add 32–64 oz surfactant/100 gal water.	After burn, when new pads are 3 in. tall. If new pads do not develop, spray by Apr 30.	Carry out prescribed burn Dec–Mar. Sufficient fine fuel with good fuel continuity should be present to provide a uniform burn with moderate to high intensity. Spray the burned area within 5 mo. of the burn but no later than Apr 30 (May 31 if new pads do not develop by Apr 30). Use 8 oz picloram when the prescribed burn is sufficiently intense to brown-out most pricklypear pads with <10% of the pricklypear green 2 wk after the burn. Use 16 oz picloram following moderate-intensity burn with more than 10% of the pricklypear green 2 wk after the burn. The prescribed burn + picloram treatment is not recommended for the Rio Grande Plains land resource area.
Redberry juniper (redberry cedar) (continued on next page)	hexazinone liquid (plants <6 ft tall)	—	VH 2 ml/3 ft height or canopy diameter (whichever is greater)	—	Late winter–summer	Apply undiluted hexazinone liquid or hexazinone pellets to soil surface between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid. If plant size requires more than a single 2 or 4 ml application of hexazinone liquid, or 1 hexazinone pellet, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

Table 6. Herbicides for Controlling Brush on Rangeland

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Redberry juniper (redberry cedar) (continued from previous page)	hexazinone pellet (plants <6 ft tall)	—	VH 1 pellet/3 ft height or canopy diameter (whichever is greater)	—	Late winter–summer	Apply undiluted hexazinone liquid or hexazinone pellets to soil surface between the stem base and the edge of the canopy. Use an exact delivery handgun applicator to apply hexazinone liquid. If plant size requires more than a single 2 or 4 ml application of hexazinone liquid, or 1 hexazinone pellet, apply subsequent applications or pellets equally spaced around the plant. Do not use these treatments on marshy or poorly drained sites nor on soils classified as clays. Best results are expected on coarse-textured soils.
	hexazinone liquid (plants >6 ft tall)		H 4 ml/3 ft height or canopy diameter (whichever is greater)			
	hexazinone pellet (plants >6 ft tall)		H 2 pellets/3 ft of height or canopy diameter (whichever is greater)			
	picloram	—	VH** 4 ml/3 ft of height or canopy diameter (whichever is greater)	—	Spring–fall, before expected rainfall	Apply undiluted picloram to the stem base at or near the ground line. Use an exact delivery handgun applicator to apply the 4 ml dose. If plant size requires more than a single 4 ml application, space subsequent applications equally around the plant. Do not use on marshy or poorly drained sites nor on soils classified as clays.
Redberry juniper (cut stumps)	picloram	—	VH 4% in water	Spray the sides of the stump and the cut surface, including the cambium, immediately after cutting, to thoroughly wet the stem and root collar area, but not to the point of runoff. Add 32–64 oz surfactant to 100 gal spray mix.	Anytime, except when snow or water prevent spraying to the ground line	This is commonly called the cut stump application method. Apply with a backpack or knapsack sprayer using low pressures and a solid cone or flat fan nozzle. Add 32–64 oz surfactant/100 gal water.
Running live oak	tebuthiuron 20% pellets	VH 5–10 lb pellets (1–2 lb)	VH 0.5 oz pellets (0.1 oz)/50–100 sq ft of ground area	—	Anytime—optimum period is Oct 1–Apr 1	Use low rate on brush 2–8 ft tall. Use 7.5 lb pellets/ac when brush is 2–8 ft tall on rolling or hummocking site and when live oak plants are 8 ft or taller without understory species such as yaupon. Use 10 lb pellets/ac when live oak plants are taller than 8 ft and an understory of yaupon and other species is present. For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Sacahuista	tebuthiuron 20% pellets	—	H 0.25 oz pellets (0.05 oz)/ plant	—	Anytime—optimum period is Oct 1–Apr 1 except in Trans-Pecos, where optimum period is May 1–Jul 1	Apply pellets evenly on the soil under the plant canopy near the stem base.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Saltcedar	imazapyr	VH** 64 oz (1 lb)	VH 1%	Minimum 10 gal/ac for aerial or ground broadcast sprays. Thoroughly wet foliage for individual plant treatment. Add 32–64 oz surfactant/100 gal water.	Jul–Sep, or until leaves begin to turn yellow	When exposure to aquatic environments is possible use aquatic labels of imazapyr and glyphosate (see Table 2). Imazapyr alone or in combination with glyphosate will cause damage to desirable plants if contacted by the spray mix.
	imazapyr + glyphosate	VH 32 oz (0.5 lb) imazapyr + 16 oz (0.5 lb) glyphosate	VH 0.5% imazapyr + 0.5% glyphosate			
	triclopyr ester	—	VH 25% in diesel fuel oil	Apply to lower 12–18 in. of trunk to wet the trunk; do not spray to point of runoff. Apply completely around the trunk.	Growing season when trees have mature leaves	This is a Brush Busters® low volume basal application method. Use a hollow cone nozzle with XI orifice.
Sand sagebrush	2,4-D low volatile ester	H 32 oz (1 lb) 4 lb/gal product {up to 64 oz (2 lb) for ground broadcast}	VH 1% (4 lb/gal product)	For aerial applications, the minimum suggested total spray volume is 4 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio considered optimum), or water + surfactant, crop oil, or methylated seed oil. For ground broadcast applications, the suggested total spray volume is 20–25 gal/ac. Use oil-in-water emulsion (1:5 oil-to-water ratio is considered optimum), or water + surfactant, crop oil, or methylated seed oil. Thoroughly wet foliage for individual plant treatments. Add 32–64 oz surfactant/100 gal water or an oil-in-water emulsion (5% diesel + 95% water).	May 1–Jun 15 under good growth conditions with plants fully leafed	Do not spray when plants are defoliated by late freeze, hail, or unfavorable growth conditions. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron methyl dicamba:2,4-D(1:3) + 2,4-D low volatile ester	H Rate 1 metsulfuron methyl dicamba:2,4-D(1:3) + 16 oz (0.5 lb) 2, 4-D 4 lb/gal product	—			
Sand shinnery oak	tebuthiuron 20% pellets	VH 3.75–5 lb of pellets (0.75–1 lb)	VH 0.5 oz of pellets (0.1 oz) per 100 sq ft of ground area	—	Anytime—optimum period is Oct 1–Apr 1 except in Trans-Pecos where optimum period is May 1–Jul 1	Use 3.75 lb pellets/ac in southern High Plains and Rolling Plains. Use 5 lb pellets/ac in eastern Panhandle north of Prairie Dog Town Fork of the Red River. For individual plant treatment, apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
	tebuthiuron 80DF	H–VH 1.25 lb (1.0 lb)	—	Apply by mixing with water and using ground equipment equipped with straight stream nozzles spaced 3–6 ft apart delivering a total spray volume of 20–30 gal/ac.	Anytime—optimum period is Oct 1–Apr 1 except in Trans-Pecos where optimum period is May 1–Jul 1	Use the closer spacing of nozzles when treating high densities of sand shinnery. Applications will result in damage to grass directly under each nozzle that can persist for 1–3 yr. Agitation is important to dissolve and maintain tebuthiuron 80DF in solution during application.

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

Table 6. Herbicides for Controlling Brush on Rangeland

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Saw palmetto	metsulfuron methyl dicamba:2,4-D(1:3)	H–VH Rate 2 or Rate 3 (see remarks)	—	For ground broadcast applications, the suggested total spray volume is 15–30 gal/ac. Use water + surfactant, crop oil or methylated seed oil.	Mid–late summer (August)	Rate 2 applications generally result in "high" control levels the first year after treatment, improving to "very high" by the second year after treatment. Rate 3 applications can be expected to produce "very high" control levels by the first year after treatment. Do not mow treated areas for at least 1 year. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
Whitebrush (beebrush, beebush)	tebuthiuron 20% pellets	VH** 5–7.5 lb of pellets (1–1.5 lb)	VH 0.5 oz of pellets (0.1 oz)/ 50–100 sq ft of ground area	—	Anytime—optimum period is Oct 1–Apr 1 except in Trans-Pecos, where optimum period is May 1–Jul 1	Use 5 lb pellets/ac on sand, loamy sand or sandy loam soils. Use 6.25 lb pellets/ac on soils with 20 to 30 percent clay. Use 7.5 lb pellets/ac on areas with grass production >1,500 lb/ac or on areas where mesquite, Texas persimmon or other woody plants have a canopy cover of 20% or more with whitebrush that is 6 ft tall or taller. For individual plant treatment apply pellets evenly on the soil under the plant canopy and 1 ft beyond canopy edge.
Yucca (continued on next page)	triclopyr ester	—	H 2% in diesel fuel oil	Spray the center of each individual whorl of leaves to the point of runoff.	Anytime	Complete coverage of leaves is not necessary. The crown of each plant must be thoroughly wet with the herbicide mixture.
			H 2% in 1:5 diesel fuel oil:water emulsion		May–Sep	Use emulsifier and agitate to maintain emulsion. Complete coverage of leaves is not necessary. The crown of each plant must be thoroughly wet with the herbicide mixture.
			VH 15% in diesel fuel oil	Use an adjustable cone nozzle (X1 orifice) and spray a 2-second burst into each whorl.	Spring–summer	Direct spray into the center of each whorl.
			H Undiluted 2–4 ml per plant whorl	Use an exact delivery handgun set at 2 or 4 ml/whorl dose.		
			VH Undiluted	Use an adjustable cone nozzle (XI orifice) and spray a 2-second burst into each whorl.		

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Yucca (continued from previous page)	metsulfuron methyl dicamba:2,4-D(1:3) + 2,4-D low volatile ester	H Rate 2 metsulfuron methyl dicamba:2,4-D(1:3) + 16–24 oz 2,4-D (4 lb a.i./gal product)	—	Crop oil concentrate, modified seed oil or modified seed oil/ organosilicone are the preferred adjuvants. For aerial applications, a minimum of 4 gal/ac total spray volume is recommended.	Spring–fall before frost	A second follow-up application of metsulfuron methyl dicamba:2,4-D (1:3) at Rate 1 or Rate 2 + 2,4-D low volatile ester at 0.5–0.75 lb a.i./ac within 2 yr of the initial application may be required to control yucca seedlings and regrowth from rootstocks. Because of metsulfuron methyl in the formulation, these herbicides are not recommended on bahiagrass pastures for weed control.
	metsulfuron: chlorosulfuron (3:1) + 2,4-D low volatile ester	H 0.675 oz metsulfuron: chlorosulfuron (3:1) + 32 oz 2,4-D (4 lb a.i./gal product)	—			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Section 2.

Chemical Brush Control Suggestions for Rangeland Brush Control Treatments

(Noncropland areas including fence lines, and wildlife habitat zones)
No livestock grazing in the foreseeable future when using aminocyclopyrachlor

Aminocyclopyrachlor maximum use-rate: 18 oz/acre

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Table 7. Individual plant treatment rates and ounces of herbicide per gallon of spray volume for aminocyclopychlor alone or combined with triclopyr amine or triclopyr ester

Herbicide common name	Product name/active ingredient or acid equivalent	Herbicide concentration (%) and ounces (oz)/gallon of spray volume					
aminocyclopyrachlor	Method 240 SL (2.0 lb/gal)	0.50%	0.66%	2.5%	5.0%	10%	15%
		0.64 oz	0.9 oz	3.2 oz	6.4 oz	12.8 oz	19 oz
triclopyr amine	Garlon 3A (3.0 lb/gal)	0.66%	0.88%				
		0.9 oz	1.1 oz				
triclopyr ester	Clear Pasture, Remedy Ultra, Triclopyr R&P, Triclopyr 4EC (4 lb/gal)	0.50%	0.66%				
		0.64 oz	0.9 oz				

No livestock grazing in the foreseeable future when using aminocyclopyrachlor

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Table 8. Brush control in fence lines and wildlife habitat zones using aminocyclopyrachlor

Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Agarito, Bumelia, Catclaw acacia, Catclaw mimosa, Coyotillo, Flameleaf sumac, Lotebush, Texas mountain laurel, Whitebrush	aminocyclopyrachlor + triclopyr ester	—	VH 0.5 % aminocyclopyrachlor + 0.5 % triclopyr ester	Thoroughly wet foliage to wet but not to point of runoff. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late spring through summer with mature (dark green) and healthy leaves.	
	aminocyclopyrachlor + triclopyr amine	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine			Recommended when herbicide volatilization is a concern
Huisache (broadcast spray)	aminocyclopyrachlor + triclopyr amine	VH 12 - 16 fl oz (3 - 4 oz ai) aminocyclopyrachlor + 16 – 21.3 fl oz (6 - 8 oz ai) triclopyr amine	—	For aerial applications use at least 4 gal/ac. total spray volume, for dense canopies carrier volume may be increased to 10 gal/ac. For ground broadcast applications, suggested total spray volume is 10-25 gal/ac. Use 4-5 fl oz/ac MSO or MSO-OS (organosilicone surfactant) spray adjuvant. For best results, use nozzles and pressure setting to deliver a mean spray droplet diameter within the range of 350 to 450 microns.	Best in Fall months (late September – November 1). Do not spray when soil temperature at a depth of 12 in. is below 75° F. For optimum root kill, do not spray when >25% of the leaf canopy is damaged due to insects, disease or hail. Apply with good soil moisture and a healthy leaf canopy	
Huisache (leaf spray)	aminocyclopyrachlor + triclopyr ester	—	VH 0.5 % aminocyclopyrachlor + 0.5 % triclopyr ester	Thoroughly wet foliage to wet but not dripping. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late September through October with intact, undamaged canopy. Optimum period when soil temperature at a depth of 12 in. is 75 deg. or higher. Apply with good soil moisture and a healthy leaf crop	
	aminocyclopyrachlor + triclopyr amine	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine			Recommended when herbicide volatilization is a concern
	aminocyclopyrachlor + triclopyr amine + picloram	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine +1.0% picloram			Recommended for mixtures of mesquite and pricklypear, tasajillo or small cedar
	aminocyclopyrachlor + triclopyr amine + picloram:fluroxypyr (1:1)	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine + 1.0% picloram:fluroxypyr (1:1)			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

No livestock grazing in the foreseeable future when using aminocyclopyrachlor

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Huisache (stem spray)	aminocyclopyrachlor	—	VH 10% to 15% aminocyclopyrachlor in water carrier	Apply to lower 12-18 in. of trunk to wet the trunk, but do not spray to point of runoff. Apply completely around each basal stem. Add 1% MSO adjuvant to spray mix.	Late spring through summer.	This is a Brush Busters low volume basal application method. Use a 5500X1 or X2 adjustable cone nozzle. Use only on plants with smooth bark and a trunk diameter less than 4 in.
Mesquite (broadcast spray)	aminocyclopyrachlor + triclopyr amine	VH 8 - 12 fl oz (2 - 3 oz ai) aminocyclopyrachlor + 10.67 - 16 fl oz (4 - 6 oz ai) triclopyr amine	—	For aerial applications use at least 4 gal/ac. total spray volume. For ground broadcast applications, the suggested total spray volume is 10-25 gal/ac. Use 4-5 fl oz/ac. MSO or MSO-OS (organosilicone surfactant) spray adjuvant. For best results, use nozzles and pressure setting to deliver a mean spray droplet diameter within the range of 350 to 450 microns.	Late spring through mid-summer with mature (dark green) leaves. Optimum period begins when soil temperature at a depth of 12 in. reaches 75° F and continues for 45 days thereafter. For optimum root kill, do not spray if white flowers or bean elongation are observable, if >25% of the leaf canopy is damaged due to insects, disease or hail, if soil temperatures are less than 75° F 12 in. deep, or if new vegetative growth is present due to recent rains.	
Mesquite (cut stump)	aminocyclopyrachlor	—	VH 2.5% to 5.0% aminocyclopyrachlor in water carrier	Thoroughly spray the cut surface as well as the bark from the cut to ground level but not to the point of runoff. Add 1% MSO adjuvant to spray mix.	Anytime, except when snow or water prevents spraying to the ground line.	This is a Brush Busters cut-stump application method. Apply with a backpack/ knapsack sprayer using low pressure and an adjustable cone nozzle (5500X1 to X3). Hydraulic shears equipped with a large orifice nozzle such as a 5500X12 can also be used for this method.
Mesquite (leaf spray)	aminocyclopyrachlor + triclopyr ester	—	VH 0.5 % aminocyclopyrachlor + 0.5 % triclopyr ester	Thoroughly wet foliage to wet but not dripping. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late spring through summer with mature (dark green) leaves. Optimum period begins when soil temperature at a depth of 12 in. reaches 75 deg.	
	aminocyclopyrachlor + triclopyr amine	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine			Recommended when herbicide volatilization is a concern
	aminocyclopyrachlor + triclopyr amine + picloram	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine +1.0% picloram			Recommended for mixtures of mesquite and pricklypear, tasajillo or small cedar
	aminocyclopyrachlor + triclopyr amine + picloram:fluroxypyr (1:1)	—	VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine + 1.0% picloram:fluroxypyr (1:1)			

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

No livestock grazing in the foreseeable future when using aminocyclopyrachlor

Table 8. Brush control in fence lines and wildlife habitat zones using aminocyclopyrachlor

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Brush controlled	Herbicide (common and chemical names, Table 2)	Herbicide quantity (active ingredient rate in parenthesis)		Spray volume (per acre for broadcast, as described for individual plant)	Time to apply	Remarks
		Broadcast rate per acre	Individual plant treatment*			
Mesquite (stem spray)			VH 10% to 15% aminocyclopyrachlor in water carrier	Apply to lower 12-18 in. of trunk to wet the trunk, but do not spray to point of runoff. Apply completely around each basal stem. Add 1% MSO adjuvant to spray mix.	Late spring through summer.	This is a Brush Busters low volume basal application method. Use a 5500X1 or X2 adjustable cone nozzle. Use only on plants with smooth bark and a trunk diameter less than 4 in.
Texas Persimmon	aminocyclopyrachlor + triclopyr ester	—	VH 0.66 % aminocyclopyrachlor + 0.66 % triclopyr ester	Thoroughly wet foliage to wet but not to the point of runoff. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late spring through summer with mature (dark green) and healthy leaves. Early work with other herbicides indicate applications before July 1st are the most effective.	
	aminocyclopyrachlor + triclopyr amine	—	VH 0.66 % aminocyclopyrachlor + 0.88 % triclopyr amine			Recommended when herbicide volatilization is a concern
Yaupon	aminocyclopyrachlor + triclopyr ester	—	H-VH 0.5 % aminocyclopyrachlor + 0.5 % triclopyr ester	Thoroughly wet foliage to wet but of runoff. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late spring through summer with mature (dark green) and healthy leaves.	
	aminocyclopyrachlor + triclopyr amine	—	H-VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine			Recommended when herbicide volatilization is a concern
Yucca (species)	aminocyclopyrachlor + triclopyr ester	—	H-VH 0.5 % aminocyclopyrachlor + 0.5 % triclopyr ester	Thoroughly wet the center whorl of each individual yucca. Add 32-64 oz (0.25-0.5%) nonionic surfactant/100 gal water.	Late spring through summer with mature (dark green) and healthy leaves.	
	aminocyclopyrachlor + triclopyr amine	—	H-VH 0.5 % aminocyclopyrachlor + 0.66 % triclopyr amine			Recommended when herbicide volatilization is a concern

*See Table 4 for mixing information.
**Treatment control ratings: VH – Very High; H – High; M – Moderate; L – Low

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Table 8. Brush control in fence lines and wildlife habitat zones using aminocyclopyrachlor

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