

Field Guide for Managing Camelthorn in the Southwest



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Camelthorn (*Alhagi pesudalhagi* Bieb., synonym: *A. maurorum* Medik)

Pea family (Fabaceae)

Camelthorn is listed as a noxious weed in both Arizona and New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of camelthorn in rangelands and deserts associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also administers 4 national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

Camelthorn (synonyms: camels thorn, Caspian manna, Persian manna) is a deep-rooted, perennial shrub that is native to southeast Russia and the Mediterranean region. It was originally introduced into California in the early 1900s as a contaminant in alfalfa seed.

Growth Characteristics

- Perennial, long-lived shrub with rhizomatous roots that can reach up to 25 feet laterally.
- Grows 1.5 to 4 feet tall with spiny, intricate branches.
- Leaves are simple, entire, and alternately arranged on the branches. They are oval to wedge shaped with yellowish coloration above and bluish-green underneath.
- Pea-like flowers bloom mostly from May to July and are pinkish to maroon in color. Flowers are borne on short, spine-tipped branches arising from the leaf axils.
- Seedpods are jointed and reddish-brown to tan with a beak-like tip.
- Seeds are kidney shaped with a hard, thick coat that requires scarification for germination.
- Reproduction is primarily vegetative through rhizomes or re-sprouting root fragments. Seedlings are rare, and their growth rate is slow.

Ecology

Impacts/Threats

Camelthorn is a hardy shrub that can thrive on both dry and wet sites. It aggressively invades disturbed areas and is very difficult to manage once established. Roots of camelthorn can send shoots upward through asphalt, and the plant's sharp spines can puncture vehicle tires making it a hazard along roadsides. The spines also cause injury or discomfort to livestock and humans.

Site/Distribution

Camelthorn can be found along roadways, agricultural areas, river terraces, ditch banks, saline meadows, and disturbed pasture and rangeland. The species prefers deep, loamy soils where the water table is near the surface; but it can grow in many soil types ranging from sand to clay.

Camelthorn is widely scattered on dry, open rangeland areas across the western United States. It is not tolerant of flooding or cold temperatures and is usually found from 100 to 5,000 feet in elevation.

Spread

Although its seedpods may be transported by wind or water, camelthorn spreads mostly by underground rhizomes and sprouting from fragmented root crowns. New plants may form every 3 to 5 feet along lateral roots, and shoots have been noted to grow up to 25 feet away from the parent plant. Seeds scarified in the rumen of cattle have been noted to germinate successfully in manure.

Invasive Features

Camelthorn stores great amounts of energy reserves in its extensive root system. This makes it resistant to many control methods and very difficult to eradicate.

Management

Camelthorn is very persistent and difficult to eradicate. Any effort to contain and reduce established camelthorn must involve planning, integrated management, and a long-term commitment.

The following actions should be considered when planning a management approach for camelthorn:

- Maintain healthy plant communities to prevent or limit camelthorn infestations. Try to minimize soil disturbance when controlling the shrub and/or promptly revegetate disturbed areas with desirable perennial native species, especially grasses.
- Detect, report, and eradicate new populations of camelthorn as early as possible. Map known infestations and keep annual records of reported infestations.
- Anticipate that control methods may need to be combined together and repeated over several years for increased effectiveness.
- Implement monitoring and a follow-up treatment plan to control root sprouts and seedlings.

Table 1 summarizes management options for controlling camelthorn under various situations. Further details on these management options are explained below. Choice of individual control method(s) for camelthorn depends on many local factors including extent of infestation, current land use, and site conditions (terrain, accessibility for treatment, microclimate, non-target flora and fauna present, etc.). Other important considerations include treatment effectiveness, overall cost, and the number of years needed to achieve control. Typically, more than one control method may be needed for a particular site.

Physical Control

Physical methods for camelthorn control that do not completely remove the root system are not likely to be successful and may actually contribute to further spread when improperly applied. Follow-up monitoring and re-treatment of root sprouts or regrowth should always be anticipated after using a physical control approach.

Table 1. Management options*

| Site | Physical Control | Cultural Control | Biological Control | Chemical Control |
|--|--|---|--|--|
| Roadsides, fence lines, or non-vegetated areas | Hand pull or dig to remove as much of the root as possible. Anticipate regrowth. | Work closely with road crews and others to help identify and report infestations. Establish alternative ground cover by reseeding. | NA | Use an individual plant treatment (IPT) method to apply either a foliar or soil active herbicide on sparse populations. Apply herbicide using a broadcast method for extensive, dense infestations. |
| Rangeland, pasture, or riparian corridors | Mechanical methods are generally not recommended since disturbing the extensive root system may lead to an increase in population density. | Clean vehicles or equipment prior to leaving an infested area. Establish alternative ground cover by reseeding. | Encourage alternative ground cover through prescribed grazing. | Use an individual plant treatment (IPT) method to apply either a foliar or soil active herbicide on sparse populations. Apply herbicide using an aerial or ground broadcast method for extensive, dense infestations. |
| Wilderness, other natural areas, and/or small infestations | Same as above. | Place caution signs near trailheads; educate public to identify and report infestations; coordinate control efforts with other land managers. Establish alternative ground cover by reseeding. | Same as above. | Same as above. |

* Choice of a particular management option must be in compliance with existing regulations for the land resource.

Manual Methods

Hand-pulling or digging – Repetitive hand-pulling or digging on an annual basis can control camelthorn; but this approach is only practical for isolated, sparse populations. Extract plants when the soil is moist and remove as much of the root as possible. For young seedlings, it may be feasible to dig up the entire root.

Mechanical Methods

Tillage – As a single approach, tilling infested areas may be counterproductive since a great number of root fragments are left behind; re-sprouting from these root fragments can be prolific. Persistent and repeated tilling over a number of years can stress the root reserves, but this is costly and greatly disturbs the soil. Chemical control as a follow-up should be anticipated if tillage is used. To reduce spread, clean tillage equipment onsite following treatment.

Mowing or shredding – These management tools are usually not recommended for camelthorn as plants regrow rapidly after cutting.

Prescribed Fire

Prescribed fire is not recommended for controlling camelthorn.

Flooding

Where feasible, maintaining a water depth of 5 to 10 inches over a camelthorn-infested site for a period of several weeks can contribute to successful control. However, the option to use flooding to control camelthorn is usually limited to areas where natural basins are formed and an adequate water supply is available.

Cultural Control

Early detection and plant removal are critical for preventing camelthorn establishment. Land managers, the local public, road crews, etc., should be educated on identification of nonnative invasive species so they can help report suspected infestations. Vehicles, humans, and livestock should be discouraged from traveling through infested areas. A program to check and remove seed or root fragments from vehicles and equipment after going through infested areas should be encouraged to help stop

dispersal. If possible, use weed screens on irrigation water intakes inside infested areas to prevent seed from being transported by water systems.

Biological Control

Grazing

Despite the thorns, leaves and pods of camelthorn are palatable to livestock, especially after first frost. Monitor grazed areas to determine if seed germination of camelthorn is taking place.

Classical Biological Control

There are no classical biocontrol agents (insects, pathogens, etc.) approved for use on camelthorn.

Chemical Control

All herbicides listed in table 2 will effectively control camelthorn when properly applied. However, some may also impact non-target species or other resources such as groundwater when not used according to the label. Each herbicide product will have different requirements and restrictions. Thus, it is important to read the label carefully and follow all instructions and guidelines when mixing and applying chemical herbicides.

Herbicide Application

The key to chemical control of camelthorn is to apply the appropriate dosage at a time when carbohydrate reserves in the shrub's extensive root system can be depleted (see table 2 for time of application). Herbicide products listed in the table include some that are foliar sprayed and others that are applied to the soil surface. Equipment used to spray herbicide should be calibrated. Precautionary measures should be taken if non-target plants, including woody species, need to be protected.

Foliar applications - Herbicides commonly available for foliar application to camelthorn include picloram, aminocyclopyrachlor, dicamba, imazapyr, metsulfuron, and clopyralid. These herbicides may be used as single formulations or in tank mixes with 2,4-D. Active ingredients may also be combined as a product for foliar spot spraying such as Viewpoint® which combines aminocyclopyrachlor, imazapyr, and metsulfuron. Consult the label for mixing and application directions. Add a

Table 2. Herbicide recommendations

| Common Chemical Name (active ingredient) | Product Example¹ | Broadcast Treatment (rate per acre) | Spot Treatment (spray solution or pellets)² | Time of Application | Remarks |
|---|------------------------------------|--|--|--|--|
| Aminocyclopyrachlor + imazapyr + metsulfuron methyl | Viewpoint | 13–20 ounces | Consult label for spot spray applications. | Apply as high volume or broadcast foliar spray on actively growing plants. | Nonselective herbicide used on non-crop sites; may cause temporary injury to some grass species. |
| Aminocyclopyrachlor + metsulfuron methyl | Streamline | 7.5–11.5 ounces | Same as above. | Same as above. | Selective foliar application. Use a quality adjuvant. May cause temporary injury to some grass species. |
| Clopyralid | Reclaim | 1-1/3 pints | 3 quarts per 100 gallons water | On regrowth, after full leaf when buds begin to form. | Foliar application; mainly for individual plant treatment (IPT) and follow-up treatment of re-sprouts. |
| Dicamba + 2,4-D ³ | Weedmaster Veteran720 | 1–4 quarts | 1–3% | Late summer or fall before senescence but during active growth. | Foliar application; selective for broadleaf species. Used for IPT or broadcast spraying. Follow mixing instructions on label. |
| Metsulfuron methyl | Escort XP | 1–3 fluid ounces | High-volume: 1–3 fluid ounces per 100 gallons. Consult label directions. | Same as above. | Same as above. |
| Picloram ⁴ | Tordon 22K | 2 quarts | 1–3% | Same as above. | Same as above. |
| Imazapyr | Arsenal | 0.75–1.5 quarts | 0.5–2% | Same as above. | Foliar application; nonselective; apply only to foliage and stems you want to control. Higher rate is for heavier, denser infestations. In addition to spray drift, non-target plants may also be killed or injured by imazapyr through runoff, residue movement in soil, or root exudates from treated plants. |
| Tebuthiuron | Spike 80 DF | 1–1.25 pounds | Low volume: 1 pound per gallon of water High volume: 1 pound per 10 gallons of water. | Anytime; most effective if applied before rainfall season or in the fall. | Nonselective, soil-active herbicide applied to the ground surface. Use as an IPT or broadcast treatment. Leave treated plants in place for 2 years following application. For Spike 80 DF, agitate continuously; will be slurry-like. |
| Tebuthiuron | Spike 20P | ¼ oz. pellets per 3-foot canopy height | Hand scatter pellets near canopy drip line. | Same as above. | Nonselective, soil-active herbicide applied to the ground surface. Use as an IPT or broadcast treatment. Leave treated plants in place for 2 years following application. |

Table 2. Herbicide recommendations (cont.)

| Common Chemical Name (active ingredient) | Product Example ¹ | Broadcast Treatment (rate per acre) | Spot Treatment (spray solution or pellets) ² | Time of Application | Remarks |
|--|------------------------------|-------------------------------------|---|---------------------|---|
| Hexazinone | Velpar L | 3 ml/3 foot canopy height | Velpar L can be mixed w/ equal parts water (50:50) and applied by backpack sprayer. | Same as above. | Hexazinone is a nonselective, soil active herbicide applied to the soil surface. Apply as an IPT. |
| Hexazinone | Pronone Power Pellets | 1 pellet/2 foot canopy height | Hand scatter near canopy drip line | Same as above. | Same as above. |
| Fosamine | Krenite S | 1.5–6 gallons | Low volume: at least 1.5%; high volume: less than 30%. | Same as above. | Same as above. |

¹ Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific information and appropriate use with camelthorn.

² Spray solution is the herbicide/water ratio in a spray mix that may be used for spot treatment with backpack or hand-held sprayers. The amount of product applied during an annual growing season must not exceed the maximum application rate per acre as specified by the product label – refer to the product label for the site type and application.

³ 2,4-D is a restricted use pesticide in New Mexico only. A certified applicator's license is required for purchase and use.

⁴ Restricted use pesticide - A certified applicator's license is required for purchase and use.

quality nonionic surfactant (0.25 to 0.5 percent v/v) to the spray mixture to ensure even coverage and maximum leaf uptake.

To foliar spray camelthorn properly, all green leaves and shoots should be uniformly wet within the shrub's canopy. Camelthorn occurring in large continuous areas can be broadcast sprayed using a fixed-width boom or boom-less spray system, such as those attached to or towed by a truck, ATV, or tractor. Individual plant treatment (IPT) or spot spraying should be used wherever the camelthorn population is sparse or scattered. There are two basic techniques available for spraying camelthorn using the IPT method:

- The **low-volume technique** may be used for areas with sparse to moderate camelthorn densities. The technique involves applying a low quantity of concentrated herbicide, usually with a backpack or hand-held sprayer. The low volume approach is very flexible and can target specific plants. For success,

the operator must be able to spray the entire canopy in a light, uniform manner.

- The **high-volume technique** may be used for areas with moderate to high camelthorn densities. A high powered pressurized sprayer is used with this technique to apply herbicide until the foliage is visibly wet. The technique delivers a greater quantity of a less concentrated herbicide solution under high pressure, thereby allowing remote foliage to be sprayed at a greater distance.

Soil application - Tebuthiuron and hexazinone are the primary herbicides used in a soil-applied approach for camelthorn control. Tebuthiuron is formulated either as a dry pellet or as a dry flowable powder for liquid spraying. Either formulation can be used for IPT or broadcast treatment. Hexazinone is formulated as a liquid but is best suited only for application as an IPT. Although these soil active herbicides can be applied during any time of the year, the optimal time is just before the rainy season or

in the fall. Both herbicides are slow acting, and it may take 1 or more years before root reserves are depleted and the shrub is completely dead. These soil-applied herbicides may be inappropriate for some specific sites such as areas where the chemical can move through the soil profile into a shallow water table.

Management Strategies

Preventing establishment is critical to managing camelthorn, and it is very important to eliminate new plants or small infestations soon after they are discovered. Herbicide control of camelthorn is effective, but follow-up treatments will probably be necessary for at least 3 years. Since it is ordinarily useless to treat an area only one time without retreatment, sufficient resources must be allocated for the area where control is attempted. After initial treatment, it is especially important that resources are also available to respray or retreat the treated area as necessary. Previously treated areas should be continuously monitored to detect seedlings or recovering camelthorn plants. Failure to perform follow-up monitoring and adapt control methods as needed could result in a return of the camelthorn.

References and Further Information

- California Department of Food and Agriculture.
Encycloweedia Datasheet: Camelthorn. Available at <http://www.cdfa.ca.gov/phpps/ipc/weedinfo/alhagi.htm> (accessed May 2010)
- Donaldson, S. and D. Rafferty. 2003. Identification and Management of Camelthorn (*Alhagi pseudalhagi*). University of Nevada Cooperative Extension Fact Sheet 02-41. Available at <http://www.unce.unr.edu/publications/files/nr/2002/FS0241.pdf> (accessed May 2010)
- Gottfried, G.J., J.D. Shaw, and P.L. Ford, compilers. 2008. Ecology, Management, and Restoration of Piñon- Juniper and Ponderosa Pine Ecosystems: Combined Proceedings of the 2005 St. George, Utah, and 2006 Albuquerque, New Mexico, Workshops. Proceedings RMRS-P-51. Fort Collins, CO: USDA Forest Service, RMRS. 218 pp. Available at http://www.fs.fed.us/rm/pubs/rmrs_p051.pdf (accessed May 2010)
- Invasive Plant Atlas of the United States. Available at <http://www.invasive.org/weedus/index.html>.
- Kerr, H.D., W.C. Robocker, and T.J. Muzik. 1965. Characteristics and Control of Camelthorn. Weeds, Vol. 13, No. 2 (April 1965), pp. 156–163. Available at <http://www.jstor.org> (accessed May 2010)
- Lee, R.D. 1999. New Mexico's Invasive Weeds. New Mexico State University Cooperative Extension. Las Cruces, NM.
- Northam, E. and W. Meyer et al. 2009. Non-Native Invasive Plants of Arizona. pp. 8–9. Publ. AZ1482. Available at <http://cals.arizona.edu/pubs/natresources/az1482.pdf> (accessed May 2010)
- NPS: Grand Canyon National Park Information Booklet: Invasive Plants. pp. 2. Available at http://www.usbr.gov/uc/rm/amp/amwg/mtgs/08may22/Attach_04c.pdf (accessed May 2010)
- O'Connell, R. and M.C. Hoshovsky. 2000. Camelthorn (*Alhagi pseudalhagi*) in C.C. Bossard et al. (eds.) Invasive Plants of California's Wildlands. University of California Press. Berkley, CA. Available at <http://www.cal-ipc.org> (accessed May 2010)
- Parker, K.F. 1972. An Illustrated Guide to Arizona Weeds. University of Arizona Press. Tucson, AZ. Available at <http://www.uapress.arizona.edu/onlinebks/weeds/titlweed.htm> (accessed May 2010)
- Parsons, W.T. and E.G. Cuthbertson. 2001. Noxious Weeds of Australia (2nd Edition) CSIRO Publishing. Collingwood, Victoria. Australia. pp. 466. Available at <http://books.google.com> (accessed May 2010)

- Ramsey, S.R. and W. Kaufman. 2007. Invasive Plants: A Guide to Identification and the Impacts and Control of Common North American Species (1st ed) Stackpole Books. pp. 131–133. Available at <http://books.google.com> (accessed May 2010)
- Rashed Mohassel, M.H., M. Nassiri, and E. Poorkazem. 2003. Effect of Glyphosate and Herbicide Combinations on Pistachio Garden Weeds in Kerman (Iran). Available at <http://ressources.ciheam.org/om/pdf/c56/01600175.pdf> (accessed May 2010)
- Renz, M.J., C. Deuser, B. Hamilton, C. Nelson, and M. Ryan. 2008. Management of Camelthorn along the Virgin River (Clark County, NV). Available at http://www.weedcenter.org/funding/docs/FinalReports_8_08/2003%20Research%20Grant%20Reports/Renz_M_Final_Report.pdf (accessed May 2010)
- TexasInvasives.org. 2005. Factsheet: Camelthorn. Available at http://www.texasinvasives.org/invasives_database/detail.php?symbol=ALMA12 (accessed May 2010)
- USDA Plants Database. Available at <http://plants.usda.gov/index.html> (accessed May 2010)
- Washington State Noxious Weed Control Board. 2008. Factsheet: Camelthorn (*Alhagi maurorum*). Available at http://www.nwcb.wa.gov/weed_info/Alhagi_maurorum.html (accessed May 2010)

Suggested Web Sites

- For information about calibrating spray equipment: NMSU Cooperative Extension Service Guide A-613, *Sprayer Calibration*. Available at http://aces.nmsu.edu/pubs/_a/A613
- Herbicide labels online: Available at <http://www.cdms.net/>

**For more information or
other field guides, contact:**

USDA Forest Service
Southwestern Region
Forest Health
333 Broadway Blvd., SE
Albuquerque, NM 87102

**Or visit the Southwestern Region's
website for invasive species:**

<http://www.fs.usda.gov/goto/r3/invasivespecies>



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