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Field Guide for Managing Malta Starthistle in the Southwest

Forest Service

Southwestern Region

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Cover Photos

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Malta starthistle (*Centaurea melitensis* L.)

Sunflower family (Asteraceae)

Malta starthistle is an invasive plant that has been listed as a noxious weed in Arizona and New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of Malta starthistle in forests, woodlands, 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 four national grasslands located in northeastern New Mexico, western Oklahoma and the Texas panhandle.

Description

Malta starthistle (synonyms: Napa starthistle, tocalote) is an annual invasive weed with foliage and winged stems that are grayish to green in color. Its thistle-like appearance is similar to yellow starthistle (*C. solstitialis*), but Malta starthistle is distinguished by smaller yellow flowers and longer seedpods that are armed with relatively short spines (less than 1/2 inch). Strategies for managing both species are similar.

Growth Characteristics

- Winter annual and occasional biennial.
- Grows erect to 1 to 2 feet tall.
- Deep, simple taproot.
- Thick leaves held in a basal rosette through winter and early spring until flower stems bolt; narrow leaves smooth-edged near the tip and lobed at the base; covered with thick, stiff "prickly" hairs and dot-like resinous glands that may be overlaid by fine white "cottony" hairs.
- Produces from 1 to over 100 solitary, spiny, yellow flower heads from April through September; flowers about 1/3- to 1/2-inch long; purple to brown-tinged flower base has fine hairs and a branched spine surrounding a central spine; insect pollinated.
- Reproduces by seed; 1 to over 60 seeds per flower head; seeds about 1/10 of an inch long with gray to tan stripes.

Ecology

Impacts/threats

Malta starthistle is highly competitive and often develops dense, impenetrable stands that displace desirable vegetation. The threat of injury from spines on the seed heads diminishes recreational opportunities, livestock grazing, and other resource values. Malta starthistle has also been implicated in producing an incurable neurological disorder in horses known as "chewing disease." A neurotoxic sesquiterpene lactone in starthistles called repin is believed to be the underlying cause of the disorder. However, animals in general typically avoid the weed because of the sharp spines and hairs.

Location

The invasive weed occurs on open disturbed sites such as grasslands, rangelands, open woodlands, fields, pastures, roadsides, waste places, and cultivated fields. However, it is uncommon in desert regions. Malta starthistle is found throughout most Western states and some states in the central, eastern, and southern parts of the United States as well. It ranges up to 7,200 feet in elevation.

Spread

Seeds adhere to surfaces and, thus, can be carried for long distances on undercarriages of vehicles and road maintenance equipment and for shorter distances on animals and humans. Birds can also transport seeds after eating them.

Invasive Features

Malta starthistle is a prolific seed producer. The starthistle grows rapidly and is highly adaptable to environmental variation. It typically out-competes native plant species for sunlight, space, water, and nutrients. Other features that facilitate invasiveness include a deep taproot that accesses available soil moisture, winged stems that dissipate heat, and formidable spines at maturity that deter grazing by livestock or wildlife.

Management

Early detection and eradication soon after discovery will increase the likelihood of controlling a Malta starthistle infestation. Malta starthistle grows rapidly as an invasive plant, and seeds may remain dormant in the soil up to 10 years. Therefore, the starthistle cannot be controlled within a single year or by using only one control method. The following actions should be considered when planning a management approach to control starthistle:

- Maintain healthy plant communities to suppress or limit the impact of a starthistle infestation.
- Incorporate sound grazing management with any control strategy.
- Map known infestations and keep annual records of reported infestations.
- Combine mechanical, cultural, biological, and chemical methods to control Malta starthistle populations whenever possible.
- Include monitoring and a followup treatment plan for missed plants and seedlings.

Table 1 summarizes management options for controlling Malta starthistle under various situations. Choice of individual control method(s) for starthistle depends on many local factors including degree of infestation, current land use, and site conditions (terrain, accessibility for treatment, microclimate, nontarget 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.

Table 1. Management options*

Site	Physical Methods	Cultural Methods	Biological Methods	Chemical Methods
Roadsides	Use machinery such as mowers or graders for mechanical clearing.	Implement reporting of infestations along roads and sanitary requirements for operation of vehicles.	Control with biological agents is little researched.	Use truck spraying equipment. Wash underneath vehicles to prevent spread.
Rangeland	Use tillage or prescribed fire if feasible. May need to use hand tools in difficult terrain.	Use certified seed. When moving livestock or vehicles through infested areas, inspect and remove any seeds from animals, clothing, and vehicles before entering uninfested areas.	Closely manage grazing to prevent overuse or toxicity to horses. For treatment of infested areas, consider prescribed grazing during spring with an intense, short-duration approach in combination with other control methods. Control with biological agents is little researched.	Use ground or aerial broadcast spraying; however, backpack spraying may be more practical in areas with difficult access.
Wilderness and other natural areas	Hand methods may be needed to protect other resources.	Post signs warning visitors to remove seeds. Use certified seed. When moving livestock or vehicles through infested areas, inspect and remove any seeds from animals, clothing, and vehicles before entering uninfested areas.	Closely manage grazing to prevent overuse or toxicity to horses. For treatment of infested areas, consider prescribed grazing during spring with an intense, short-duration approach in combination with other control methods. Control with biological agents is little researched.	Use backpack sprayers. Broadcast spraying by aerial or ground methods may be used on thicker stands if allowed.

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

Physical Control

Physical methods to control Malta starthistle should focus on removal of seed heads and the root system. These methods usually have to be repeated and must be timed properly to be most effective.

Manual Methods

Hand pulling and hoeing are effective for small infestations of Malta starthistle, but this must be done repeatedly. Plants should be removed in early bolt before flowers have opened and gone to seed. The taproot should be removed as much as possible.

Mechanical Methods

When feasible, frequent tillage with a plow or disc will control Malta starthistle. Tillage should be done when the surface soil is dry since fragmented plant segments can regrow in moist soil. Shallow cultivation (five or six times a year, 2 weeks apart) should be repeated while leaves are present but before plants have flowered. Regular cultivation for 2 or more years must be maintained for long-term effectiveness.

Mowing is a commonly used technique that can reduce seed production of starthistle; however, mowing during early plant growth can cause greater production of flowers and seed. Some vegetation management experts do not recommend mowing at all since mown plants often produce side branches that have more flowers, even with repeated mowing and proper timing. When appropriate, mowing should take place only when plants are in late bud or early bloom stage. Mowing should occur regularly (e.g., weekly or biweekly) at a level that will remove the lowest branches. Leaves should not be left below the level of the cut.

Prescribed Fire

Burning conducted from January to April can eliminate Malta starthistle during the rosette stage provided there is a source of fine fuels sufficient to carry an intense, uniform fire. Malta starthistle may also be burned in early to mid-summer (late June to early July) during the early flower stage. However, prescribed fire operations during this period may not be feasible in some areas due to the hazard of causing an uncontrolled fire. Burning at other times may increase seed production and enhance survival of established plants. Research currently underway is investigating the combination of fire with followup herbicide treatments for improved control, but results are unknown at this time.

Cultural Control

Early detection and plant removal are critical for preventing establishment of Malta starthistle. The local public should be educated to help prevent Malta starthistle from becoming established. Vehicles, humans, and livestock should be discouraged from traveling through infested areas; and a program to check and remove seeds from vehicles and livestock after going through infested areas should be implemented to help stop dispersal. Hay, straw mulch, planting seeds, and other related products should be certified to be weed free before use in areas undergoing treatment.

Biological Control

Grazing

Sheep, goats, and cattle may graze Malta starthistle in early spring when plants have developed flowering stems but before they have spiny heads. Excessive grazing favors growth of Malta starthistle over grass species. Although grazing can reduce the presence of starthistle, owners of horses and other livestock should ensure that suitable alternative forage is available. Owners should also look for signs of toxicity or so-called “chewing disease” in starthistle stands that have flowering heads.

In comparison to yellow starthistle, less is known about managing Malta starthistle with livestock grazing. Infested land may need to rest for a year and a half after treatment (herbicide, reseeding, disking, etc.) before grazing can be reintroduced. Grazing methods successfully used in controlling yellow starthistle will likely also control Malta starthistle to some degree. Therefore, prescribed grazing with an intensive, short-duration approach may be part of an effective control strategy to manage Malta starthistle, especially when combined with other control methods.

Classical Biological Control

Biological control agents for Malta starthistle have not been researched as well as yellow starthistle, although some biological control agents may affect both species. One beetle species (*Lasioderma haemmorrhoidale*) that feeds on starthistle seed heads was transplanted from the Mediterranean region into the United States, but it has little effect in controlling the invasive plant. The few agents known to affect Malta starthistle are shown in table 2.

Table 2. Classical biological control agents

Species	Type of Agent	Site of Attack	Impact on Host	Use/Considerations for Release
Bangasternus orientalis	weevil	Eats flowers and developing seed	Limited	Little researched
Puccinia juncea var. solstitialis	rust fungus	Undetermined	Unknown	Released in California

Agents used for biological control in southwestern states should be adaptable to arid environments and local conditions. Public, tribal, and private land managers may obtain biological control agents for release directly from local offices of the USDA Animal and Plant Health Inspection Service (APHIS) when the agents are available. Other sources for biocontrol agents include private companies or locally developed insectaries. A permit must be obtained from APHIS before biological control agents can be transported across state boundaries. Regulations and permit applications (PPQ 526 permit forms) pertaining to interstate shipment of biological control agents can be found at http://www.aphis.usda.gov/ppq/permits/. Although biological control agents may be collected and released within a given state without a permit from APHIS, the state's Department of Agriculture or Agricultural Extension Service should be consulted for any regulations relating to movement of these agents inside the state.

Chemical Control

The most effective period to spray Malta starthistle is from December through April during the seedling to early rosette stage since lower rates of herbicide can be applied. When in the late rosette or bolting stage, higher rates should be used. Herbicides should be applied before flowering when good growing conditions exist and there is 4 to 6 inches of growth. Since Malta starthistle is typically an annual, application of herbicide during or after flowering is ineffective.

Table 3. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example	Time of Application	Remarks
Clopyralid	Reclaim	2/3–1 pint	1–3%[2]	Early rosette stage; use higher rate at bolting to bud stage.	Wet foliage thoroughly. Do not spray when plants are defoliated by late freeze, hail, insects, or other unfavorable conditions. Effects are shown within 2 to 4 weeks.
Clopyralid + 2,4-D[3]	Curtail	0.25–1 pint	1–3%	After most rosettes have emerged, but before buds form.	Same as above.
Aminocyclopyrachlor + chlorsulfuron	Perspective	3–4.5 ounces	Consult label for spot applications.	Lower rate for rosette; higher rate at bolting. Fall or spring.	Selective herbicide used on noncrop sites; may cause temporary injury to some grass species.

Table 3. Herbicide recommendations (continued)

Common Chemical Name (active ingredient)	Product Example[1]	Product Example Rate per Acre (broadcast)	Backpack Sprayer Treatment Using Product Example	Time of Application	Remarks
Aminocyclopyrachlor + metsulfuron methyl	Streamline	4.75–9.5 ounces	Same as above.	Same as above.	Same as above.
Aminopyralid + 2,4-D[3]	GrazonNext	1.5–2 pints	1–3%	Same as above.	Same as above.
Picloram[4]	Tordon 22K	1–3 pints	1–3%	Same as above.	Same as above.
Picloram + 2,4-D[3, 4]	Grazon P+D	1–2 quarts	1–3%	Same as above.	Same as above.
Dicamba + diflufenzopyr	Overdrive	4–8 ounces	1–3%	Same as above.	Same as above.
Dicamba + 2,4-D[3]	Weedmaster	1 pint to 1 quart	3–5%	Same as above.	Same as above.
2,4-D[3]	several manufacturers	1–2 quarts	5–10%	Same as above.	Same as above.
Metsulfuron	Escort	1 ounce	NA	Same as above.	May take 2 to 3 months to show effects.
Metsulfuron + 2,4-D + dicamba[3]	Cimarron Max	Rate III: 1 ounce (Part A) 4 pint (Part B)	NA	Same as above.	May take 1 to 3 months to show effects.
Imazapyr	Arsenal	1 pint	1%	All stages	Spray to have total plant control (e.g., along roadsides). May take 2 to 3 months to show effects.

[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 Malta starthistle.

[2] Herbicide/water ratio - As an example, a gallon of spray water with a 3 percent mixture is made by adding a sufficient volume of water to 4 ounces of herbicide until a volume of 1 gallon is reached (4 oz/gal ÷ 128 oz/gal = 0.03 or 3 percent). For dry formulations, particulates should be added to sufficient water as specified by the label until the required concentration or volume of spray water is reached.

[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.

Malta starthistle is best controlled with postemergent broadleaf herbicides since these chemicals generally have little or no effect on grass species. The main herbicide entry into the plant is through the leaves with only minor entry through the roots. All herbicides listed in table 3 will effectively control Malta starthistle when properly applied. However, these herbicides will also impact other broad-leaved species that have emerged so caution should be taken if nontarget species need to be protected. This includes woody species that may also be impacted. Each herbicide product has specific requirements and restrictions; therefore, it is important to read the label carefully and follow all instructions when mixing and spraying.

Herbicides to control Malta starthistle may be applied by backpack sprayers, ATV or UTV sprayers, or conventional boom sprayers that are pulled or attached to a tractor or truck. Populations of Malta starthistle are rarely extensive enough to warrant aerial application of herbicide; however, spraying targeted areas by helicopter may be an option when large areas are infested by the starthistle.

Control Strategies

In nearly all cases involving management of Malta starthistle, a long-term commitment of greater than 3 years is usually necessary to deplete the seed bank. An approach that uses integrated weed management with different control methods is usually necessary for long-term success. Initial treatment should attempt to eliminate as much of the weed population as possible. Secondary treatment should include monitoring and additional control measures such as spot spraying with backpack sprayers or prescribed fire.

The following strategies are examples of combined methods that can be used to manage Malta starthistle infestations:

- **Herbicide–prescribed fire strategy** – An option for Malta starthistle management is to apply a clopyralid herbicide during the first year of treatment. The clopyralid herbicide will substantially reduce the starthistle population while allowing grasses to become established. Herbicide treatment can then be followed by burning in the next year (or possibly in 2 years). The sequence of herbicide-prescribed fire can greatly reduce starthistle infestations to insignificant or very low levels. This treatment sequence can benefit the range plant community by increasing species diversity and enhancing the quality and quantity of forage.
- **Herbicide–reseed strategy** – Areas infested with Malta starthistle are treated initially by intensive spraying to control the starthistle. In the second step, deep-rooted native perennial grasses are seeded to establish erosion control. Native broadleaf forbs such as lupines may be seeded at a later time to restore a more balanced mix of plants into the system. This strategy is potentially useful for roadways and may be adapted to other treatment situations depending on local circumstances.

References and Further Information

DiTomaso, J.M., W.T. Lanini, C.D. Thomsen, T.S. Prather, C.E. Turner, M.J. Smith, C.L. Elmore, M.P. Vayssieres, and W.A. Williams. 2007. Pest notes: yellow starthistle. Publ. No. 7402. Univ. Calif. Agric. Nat. Resources. Davis, CA.

DiTomaso, J. Yellow starthistle information. UC Weed Research Inform. Center. Available at http://wric.ucdavis.edu/yst/index.html.

DiTomaso, J., G.B. Kyser, and M.S. Hastings. 1999. Prescribed burning for control of yellow starthistle (Centaurea solstitialis) and enhanced native plant diversity. Weed Sci. 47:233-242.

Donaldson, S., and D. Rafferty. Identification and management of Malta Starthistle (Centaurea melitensis L.). Univ. of Nev. Coop. Exten. Serv. Fact Sheet-02-86. Reno, NV 89520. Available at http://www.unce.unr.edu/publications/files/nr/2002/FS0286.pdf

Turner, J.L., K. Duncan, and J. LeFevre. 2011. Russian knapweed and yellow starthistle poisoning of horses. Guide B-170. Cooperative Extension Service, College of Agriculture, Consumer, and Environmental Sciences. New Mexico State Univ. Las Cruces, NM. Available at http://aces.nmsu.edu/pubs/_b/b-710.pdf.

Suggested Web Sites

For information on invasive species:

http://www.invasivespeciesinfo.gov/

http://www.invasive.org/weedus/index.html

For information about calibrating spray equipment:

NMSU Cooperative Extension Service Guide
A-613 Sprayer Calibration at http://aces.nmsu.edu/pubs/_a/A-613.pdf

Herbicide labels online:

http://www.cdms.net/LabelsMsds/LMDefault.aspx

For more information or other field guides, contact:

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

Or visit:

http://www.fs.usda.gov/main/r3/forest-grasslandhealth/invasivespecies