USDA
United States Department of Agriculture

Field Guide for Managing Malta Starthistle in the Southwest

Forest Service
Southwestern Region
TP-R3-16-01
Revised June 2017

Cover Photos

Top photos: Tonto National Forest

Bottom photo: Forest and Kim Starr, Starr Environmental, bugwood.org

Printed on recycled paper

Malta starthistle (*Centaurea melitensis* L.)

Sunflower family (Asteraceae)

Malta starthistle is listed as a noxious weed in 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 the Service's 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

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 has 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.

Site/Distribution

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

Malta starthistle grows rapidly as an invasive plant, and seeds may remain dormant in the soil up to 10 years. An integrated weed management approach with different control methods is usually necessary for long-term success. 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.
- Detect and eradicate infestations soon after discovery.
- Map known large 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 follow-up treatment plan for missed plants and seedlings.

Table 1 summarizes some management options for controlling Malta starthistle under various situations. Further details on these management options follow the table. Choice of individual control method(s) for starthistle depends on many local factors including extent of infestation, current land use, and site conditions such as

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides	Use machinery such as mowers or graders for mechanical clearing.	Use seed, mulch, and fill materials certified to be weed-free. Implement reporting of infestations along roads and sanitary requirements for operation of vehicles.	Control with biocontrol 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 seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. When moving livestock or vehicles through infested areas, inspect and remove any seeds from animals, clothing, and vehicles before entering un-infested areas.	Manage grazing closely to prevent overuse or toxicity to horses. Consider prescribed grazing during spring with an intense, short-duration approach in combination with other control methods.	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 certain resources.	Use seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. Post signs warning visitors to remove seeds. When moving livestock or vehicles through infested areas, inspect and remove seeds from animals, clothing, and vehicles before entering un-infested areas.	Manage grazing closely to prevent overuse or toxicity to horses. Consider prescribed grazing during spring with an intense, short-duration approach in combination with other control methods.	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 the land resource.

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 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

If using machinery to manage Malta starthistle, the equipment should be cleaned immediately after field operations to prevent movement of seeds into un-infested areas.

Tillage – 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 – Mowing is commonly used to reduce starthistle seed production; 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 with 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 follow-up 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. Seed and materials used for mulch, forage, or fill should be certified to be weed-free; pellets may be used for horses in backcountry areas.

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.

As compared to yellow starthistle, less is known about managing Malta starthistle with livestock grazing. Infested land may need to rest for 1½ years after treatment (herbicide, reseeding, disking, etc.) before grazing can

Table 2. Classical biocontrol agents approved for Malta starthistle

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

occur. Grazing methods successfully used in controlling yellow starthistle will likely also control Malta starthistle to some degree. Therefore, prescribed grazing applied in an intensive, short-duration approach may be effective for managing Malta starthistle, especially when combined with other control methods.

Classical Biological Control

Biocontrol agents for Malta starthistle have not been researched as well as for yellow starthistle, although some biocontrol agents may affect both species. The two approved biocontrol agents known to affect Malta starthistle are shown in table 2.

Organisms (insects, pathogens, etc.) used as biocontrol agents in southwestern States should be adaptable to arid environments and local conditions. Public, tribal, and private land managers may obtain biocontrol agents for release directly from local offices of the USDA Animal and Plant Health Inspection Service (APHIS) when these agents are available. Other sources for biocontrol agents include locally developed insectaries or private companies.

A permit must be obtained from APHIS before biocontrol agents can be transported across State lines. Regulations and permit applications (PPQ 526 permit forms) pertaining to interstate shipment of biocontrol agents can be found at *https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/regulated-organism-and-soil-permits/sa_apply/ct_plantpest_howtoapply*. Although biocontrol agents may be collected and released internally in a given State without an APHIS permit, the State's department of agriculture or agricultural extension service should be consulted for any regulations relating to movement of these agents within the State.

Chemical Control

Malta starthistle is best controlled with post-emergent broadleaf herbicides since these chemicals generally have little or no effect on grass species. The main entry for herbicide 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. 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. Aquatically approved herbicide formulations and surfactants must be used in or near water.

Herbicide Application

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.

Herbicides to control Malta starthistle may be applied by backpack or hand-held sprayers, ATV or UTV sprayers, or conventional boom sprayers that are pulled or attached to a tractor or truck. Any equipment used to spray herbicide should be calibrated. Precautionary measures should be taken to protect desirable plants. If Malta starthistle infestations are large enough, aerial application with herbicide on targeted areas may be warranted.

Table 3. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example[1]	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution)[2]	Time of Application	Remarks
Clopyralid	Reclaim	2/3–1 pint	1–3%	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	Same as above.	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 non-crop sites; may cause temporary injury to some grass species.
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	Same as above.	Same as above.	Same as above.
Picloram[4] + 2,4-D[3]	Grazon P+D	1–2 quarts	Same as above.	Same as above.	Same as above.
Dicamba + diflufenzopy	Overdrive	4–8 ounces	Same as above.	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[3] + dicamba	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. 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.

[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] 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.

Integrated Control Methods

An option for controlling Malta starthistle is to use a treatment combination of **herbicide-prescribed fire**. In this sequence, clopyralid herbicide is applied during the first year of treatment. The clopyralid will substantially reduce starthistle while allowing grasses to become established. Herbicide treatment can then be followed by burning in the following year (or possibly in 2 years). The treatment combination of herbicide-prescribed fire greatly reduces starthistle infestations to insignificant or very low levels. The combination also benefits range plant communities by increasing species diversity and enhancing the quality and quantity of forage.

Management Strategies

Initial treatment of Malta starthistle 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. More than one control method may be necessary over years of treatment.

Herbicide application may be necessary for restoration of areas infested with Malta starthistle. Infested areas can be treated initially by intensive spraying to control the starthistle. Deep-rooted native perennial grasses are then 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 reseeding strategy is potentially useful for roadways and may be adapted to other treatment situations depending on local circumstances.

In nearly all cases involving Malta starthistle management, a long-term commitment of greater than 3 years is usually necessary to deplete the seed bank. 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 monitored continuously to control recovering starthistle.

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. Coop. Ext. 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. Available 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 the Southwestern Region's website for invasive species:

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