

Yellow Starthistle Management for Small Acreages

Bob Callihan, Larry Smith,
Joe McCaffrey and Ed Michalson



THE SMALL ACREAGE PROBLEM

SMALL ACREAGES AND YELLOW STARTHISTLE

Small acreages range from less than 1 acre to 100 or more acres and are not usually income-generating properties. The landowner often has little motivation to provide consistent or intensive maintenance. Though small acreages may have substantial non-farm value, the landowner often does not possess equipment or knowledge to conduct efficient, farm-like management operations used in larger economic units. This results in serious management problems for owners of small acreages, and affects nearby communities.

Small acreages are particularly strategic to community and regional defenses against noxious weeds such as yellow starthistle. If owners of such properties are unaware of their role in such action, and are not motivated by economics to manage against noxious weeds, they are unlikely to be well equipped for management of those weeds. This bulletin provides the information to help establish priorities and formulate strategies.

EFFECTS ON SMALL ACREAGES

Small acreages are often pastures for horses or other grazing animals. Other properties are rarely used. Noxious weeds such as yellow starthistle can establish on such land, becoming sources of seed that can move to neighboring properties or be carried on vehicles, equipment, or animals to infest distant land. Yellow starthistle spines injure people and animals. This weed suppresses desirable vegetation, mars the appearance of ground cover, reduces wildlife habitat and ecosystem diversity, and suppresses production of nutritious, palatable forage for wildlife and livestock. Property values sometimes drop substantially when land is infested with yellow starthistle.

A particular concern for horse owners on small acreages is the toxicity of yellow starthistle to horses. On small acreages, horses have little choice of forage. If the pasture lacks good quality forage, horses must eat yellow starthistle. Horses will

sometimes develop a preference for the weed and eat it even though other forage is available. Horses that eat 5 to 10 pounds of yellow starthistle per day, or the equivalent of 60 percent to 200 percent of their body weight in yellow starthistle for 1 to 3 months may contract a permanent malady called "chewing disease." A neurotoxin in yellow starthistle produces irreversible brain lesions in horses, which leads to the loss of muscle coordination. The first symptom is often reduced activity and agility. Advanced symptoms of the cumulative effects of yellow starthistle are an unsteady gait, stumbling, tremors, and finally loss of use of the horse's mouth, lips, and tongue. The horse then cannot eat or drink, and eventually dies. The neurotoxin responsible for this poisoning has not yet been identified, and there is no treatment, so euthanasia of affected horses is generally recommended.

LEGAL CONSIDERATIONS

Yellow starthistle is a designated noxious weed in Idaho and other states. This requires it be destroyed to protect property not yet infested. Owners of land with yellow starthistle are subject to legal provi-

sions of that law unless the county commissioners obtain an exemption from the state department of agriculture.



HOW DID IT GET HERE?

Yellow starthistle, a native from Eurasia, apparently arrived in the Western hemisphere by way of California, where it is now a major weed. It is thought to have been transported to the Pacific Northwest in hay. It has spread into much of the semiarid northwestern United States where it has become a major weed, but is found to a lesser degree in other states. Its movement over long

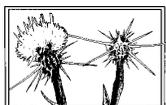
distances is largely a result of human activities. It is known to move in crop seed, in soil, on vehicles and various kinds of equipment used for farming, by road and right-of-way work, and by other industrial activities. Yellow starthistle is continuing to disperse within infested regions as well as to previously uninfested regions in both northern and southern Idaho.

BIOLOGY

Yellow starthistle (*Centaurea solstitialis* L.) is in the thistle family (*Asteraceae*), along with dandelion, sunflower, artichoke, and wild chicory. Yellow starthistle plants are forbs, that is, broadleaved herbaceous (non-woody) flowering plants. They are annuals; which means that any individual plant completes its life cycle in about one year, flowering only once and producing only one crop of seeds. The plants emerge from seeds in the fall and mature in late spring or summer of the following year. However, yellow starthistle seeds germinate whenever the soil conditions are favorable, so small plants may be found emerging after wet periods any time of year that the temperature is above 40 degrees F. Yellow starthistle produces up to 150,000 seeds per plant. Most germinate the first two or three years after they ripen, but a small fraction of the seeds produced can remain dormant in the soil

for 10 years before germinating. This enables it to reinvade after several years of apparent absence.

The weed grows in a variety of conditions, including dry and shallow soil. Its deep roots and tall growth enable it to overshadow most other plants in semiarid environments and continue to grow after shallow-rooted plants stop. Successful competition for light, water, and nutrients is the reason it forms dense populations, dominating the plant community where it infests. Aggressive and competitive by nature, yellow starthistle is established on more than 300,000 acres in north central Idaho, including lawns, vacant lots, alleys, small land holdings, and extensive acreages of marginal range land. Small colonies exist in southern Idaho and surrounding states. Authorities expect it to disperse and form large, new infestations there in the future.



CONTROL MEASURES FOR YELLOW STARThISTLE

HAND LABOR

Hand labor is the most important means of controlling yellow starthistle if only a very few plants are found on your property. Hand pulling or use of a shovel, hoe, or various weed digging devices are best for such circumstances. Hand removal by pulling is appropriate when the plants are large enough that they will not break and leave the crown and roots that will resprout. Inconsistent digging

and pulling are not useful if the soil contains seeds from the previous year's plants, for the disturbed soil will simply encourage growth of more seedlings. Regular, frequent removal of yellow starthistle (2 to 3 times per year) over a period of 10 years will eradicate the infestation unless more seeds come to the area.

MOWING

Mowing yellow starthistle is seldom fully effective, for mowed plants produce more side branches below mowing height and will produce seeds on low flowers. Mowing after its stems elongate above the cutting height of the mower may improve the

appearance of the infested area and will reduce but not eliminate the weed's seed production. That will not prevent its spread. Mowing will not comply with noxious weed law requirements to control yellow starthistle.

HERBICIDAL CONTROL

Short-term control of yellow starthistle for land renovation can be achieved by using herbicide products labeled for that use. Semiannual applications of 2,4-D are effective when begun in late winter or early spring when yellow starthistle is in the seedling or small rosette stage. This treatment only kills the current season's yellow starthistle plants for a year, but if there is a good stand of perennial grass, such treatment with 2,4-D, combined with other good grass management practices allows grass to recover its vigor and dominate the site. This eventually reduces yellow starthistle to the point where large areas within the property need treatment no more than every 5 or 10 years, or even less frequently when occasional surviving plants are removed by hand or spot spraying. Avoid treating more than once every two or three years to minimize selection for herbicide-resistant yellow starthistle plants.

Owners of small pastures that are not near herbicide-sensitive ornamental or garden plants should consider more potent, longer-lasting selective herbicides such as dicamba (Banvel), clopyralid (Curtail has clopyralid with 2,4-D), and picloram (Tordon 22K). These are particularly effective both because of the sensitivity of yellow starthistle to

them, and because they are effective through the soil and through the foliage of the weed. Special training and licensing is required to purchase or use picloram, which is a restricted-use product. For licensing, contact the nearest Idaho State Department of Agriculture field representative. Training and tests are administered by the Idaho State Department of Agriculture. If you do not want to obtain a license, consider hiring a commercial pesticide applicator.

Yellow starthistle growing along asphalt pavement, sidewalks, in cracks in concrete, parking lots, and waste areas may be treated with a herbicide when mechanical removal is difficult, ineffective or otherwise impractical.

The main limitation of herbicides is that those most effective on yellow starthistle are hazardous to certain other non-grass plant species. When used as directed by the label, herbicides useful for yellow starthistle are not hazardous to humans, but failure to observe label instructions can endanger valuable plants and water quality.

All pesticide products must be applied in accordance with product labels. Applicators are legally liable for improper use of any pesticide product.

BIOLOGICAL CONTROL

COMPETITION

A good stand of desirable vegetation is the basis of an effective, long-term yellow starthistle control program. Desirable vegetation is the best control agent because it is effective against all weeds—not just yellow starthistle—and because of its forage or other values. Grasses are normally better competitive vegetation than forbs, because they are well adapted to persist in environments that yellow starthistle can invade, and because they can be beneficially used by animals. Annual grasses such as downy brome or annual fescues, fail to adequately compete against yellow starthistle, but perennial grasses, whether bunchgrasses or creeping grasses, will do so once established and well cared for. For land infested by yellow starthistle or where

yellow starthistle is expected to invade, grasses are even more important than forbs, because grasses will tolerate the use of selective herbicides that occasionally must be used. But even when grasses are used in a yellow starthistle management program, excessive grazing and other stresses may reduce their vigor, allowing yellow starthistle to increase. When the weed begins to become prominent in a pasture, rehabilitative measures such as spraying and deferred grazing must be used to allow the grass to dominate again.

Vigorous competitive grass or other vegetation is *essential* to maintain a plant community's biological resistance to yellow starthistle invasion.

GRAZING

Almost all classes of grazing animals will consume yellow starthistle if other forage is unavailable or inadequate. Certain grazing animals utilize yellow starthistle better than others. Goats prefer broadleaved plants over grasses. If goats become accustomed to yellow starthistle, they seem to do well eating it, and grazing yellow starthistle favors development of the grass. Sheep will graze plants

such as yellow starthistle as much as grasses. Cattle and horses prefer grass, so grazing by these animals favors dominance by yellow starthistle, and fails to control spread of, or dominance by, the weed. It is more digestible than grass, but by midseason, its nutritive value is roughly equivalent to cured, low-quality timothy grass hay, so livestock do not gain well when grazing is limited to yellow starthistle.

INSECTS

University of Idaho and USDA researchers are evaluating several parasitic insect species and fungi to determine their ability to reduce yellow starthistle populations. These are specialized parasites, carefully selected to ensure that they do not affect organisms other than the weeds. Although these biological control organisms show promise, success has not yet been demonstrated, and many practical questions must be answered before they can be recommended as a reliable or standard control practice. Because biological control parasites will play a significant role in control efforts in the future, state and federal agencies continue to bring them into the region in anticipation of a time when they will actually help to control the weed.

Insects introduced to Idaho so far include three seedhead weevils: *Bangansternus orientalis*, *Eustenopus villosus* and *Larinus curtus*; and two seedhead flies: *Chaetorellia australis* and *Urophora sirunaseva*. These will be made available as UI evaluations indicate that they have become established and proven.

Although the UI does not yet recommend that landowners divert management efforts or resources to the use of these parasites, they are considered safe to release, and the public should collaborate with state and federal agencies to release them in the expectation that they will eventually become important to control of yellow starthistle.



CONTROL STRATEGIES

A long-term, cost-effective, environmentally-sound strategy for control of yellow starthistle on small acreages should generally include hand labor, herbicides, and various other cultural management practices that enhance competition by desirable vegetation. Each of these practices will suppress yellow starthistle but are expensive, complex, and time-consuming. When done individually or inconsistently they are neither economical nor practical. Although systematic management is also time-consuming and complex, it is successful and can be achieved by landowners who are willing to invest the necessary time and resources.

Community action is needed for the most successful program of protection against noxious weeds such as yellow starthistle. Each landowner ultimately

bears the burden for managing yellow starthistle. However, owners of neighboring properties should cooperate to prevent large-scale seed production and invasion of yellow starthistle from adjacent land. Cost-share programs are rarely available from county, state, or federal agencies. Community cooperation through compliance with county ordinances, state law, and the courtesy of responsible neighborliness can be effective when considerate, concerned citizens take action.

The key element is a dense ground cover of desirable vegetation. Well-adapted perennial grasses will, when well established, resist yellow starthistle while providing valued aesthetics and palatable forage for grazing animals.

REHABILITATION OF WEAKENED GRASS

If a reasonably dense stand of perennial grasses is still surviving, rehabilitation of those grasses is the best course of action. Where irrigation is available this can be done within one growing season. Application of nitrogen fertilizer aids grass recovery and productivity with good assurance of a return to the investment. Where irrigation is not available, the sole moisture source is rain, and the slow response of grass in this environment means that two or more years will be required to return the land to full productivity free of the weed's effects. The rate of fertilization must be lower, and the fertilizer must be applied in late winter or early spring to ensure that it is incorporated by rains in time for spring growth of grass to maximize its use.

Investments in yellow starthistle control in such circumstances are riskier and less profitable, but protection against weeds is often for the sake of maintaining income or the environment rather than realizing a return from the investment.

Where irrigation is available, the pasture should be treated with a herbicide in the late winter or early spring to remove yellow starthistle and other weeds. It should be fertilized with nitrogen, then irrigated whenever the soil moisture drops to 50 percent available soil moisture or less. The grass should respond quickly enough that by late summer or autumn, grazing can begin. If yellow starthistle seedlings reappear the following fall or winter, a herbicide should be applied the following late winter or early spring.

RENOVATION OF INFESTED PASTURE

Replant where there is not enough grass to rehabilitate the land. To ensure grass seedling establishment, seedbeds must be prepared properly. Use certified seed, because it assures varietal purity, high quality, high germination, and freedom from noxious weed seeds.

A firm, weed-free seedbed is necessary for successful establishment of small-seeded grasses. A firm seedbed holds moisture near the surface, helps control the depth of seeding, and provides ready

anchorage for the tiny seedling roots. The soil surrounding the seeds after seeding should be moist to promote rapid germination, emergence, and successful establishment of the forage species.

Weeds provide severe competition for forage crops of all kinds. Prepare a clean seedbed free of growing weeds; never plant into growing weeds or where dense populations of weeds are nearly ready to germinate, because there are few weed control options for such cases.

PLANTING ON NONIRRIGATED LAND

Plant grass seed with a drill, or with grass seeding equipment that places the seed beneath the soil surface. Where a drill cannot be used, broadcast seed by hand, from an airplane, or with a seed broadcast spreader. Regardless of the broadcast method, it is critical to harrow or rake the soil surface to cover as much seed as possible. Without a covering of soil, the likelihood of a seeding failure or a poor stand, along with reinfestation by yellow starthistle, is very high.

Depth of seeding of most pasture species on dry, loose soil should not exceed 1/2 inch on fine-textured soils, 1 inch on loam soils, and 1 1/2 inch on sandy soils. Half this depth is sufficient where the soil is moist. Small-seeded species should be planted shallower than large-seeded species. Follow UI or SCS recommendations for the particular species. When mixtures are sown, the depth of seeding should be regulated to favor the small-seeded species.

Fall seedings work best when the ground is moist before seeding to promote germination, and the seed is planted in September, to allow time for seedlings to become large enough to tolerate winter freezing. Fall or winter seedings are generally more successful than spring seedlings because seed can be planted in soil that stays moist and is not excessively hot while the seeds germinate. Late winter or spring plantings should be as early as possible to take advantage of early season rains. Seed should be planted at the recommended rate. However, if the seed is to be broadcast and raked or harrowed in, the planting rate should be doubled to compensate for uneven seed distribution and uneven depths of planting, and lack of covering of much of the seed. If no covering procedure is done, even more seed is needed for broadcast seeding to compensate for seeding failure.

If a dense weed population emerges along with the grass, the weeds can weaken or destroy the grass by

shading and robbing soil moisture. To prevent this, plant into a “stale seedbed.” Do not plant until the fall flush of weeds has emerged after fall rains, then apply glyphosate (Roundup) to kill the weedy grasses and yellow starthistle. Allow a few days for the glyphosate to be absorbed by the weeds to ensure that equipment does not damage the plants and thus prevent the herbicide to be fully effective. Grasses should then be planted without further soil tillage, to minimize stimulation of further weed seed germination. This procedure can also be used for late winter or early spring planting.

Two years will likely be needed to establish grass that is vigorous enough to survive carefully managed grazing in semiarid conditions. In hot, arid

conditions, 3 years will likely be needed for successful establishment of grasses unless irrigation is available.

Planting is generally not possible where the slope exceeds 40 percent, or where the ground is too rocky or timbered. Seeds can be broadcast by ground or aircraft, which is sometimes feasible after a dense litter layer has burned. However, most broadcast seedings fail due to lack of sufficient seed covering. Unless seeds can be covered with soil afterwards with a harrow, intense livestock trampling, or other means, broadcast seeding is very risky. The risk can be reduced by increasing the rate of seed per acre, but this is a costly method, and does not assure success.

FERTILIZATION ON NONIRRIGATED LAND

Nitrogen fertilizer should be applied sparingly if at all under semiarid nonirrigated conditions. The nitrogen rate normally ranges from 25 to 50 pounds

per year in semiarid conditions, depending on precipitation.

PLANTING ON YELLOW STARHISTLE-INFESTED IRRIGATED LAND

The pasture should first be irrigated to fill the soil profile with moisture in preparation for seeding. As soon as the soil dries to about 65 percent available soil moisture, it should be tilled to provide a good seedbed, and the seed can be planted. A single application of a selective herbicide to yellow starthistle and other weeds after the grass and weeds have emerged, often releases enough competition to enable the stand to become well-established.

When grass is seeded immediately after seedbed preparation, a dense weed population normally emerges along with the grass, and the weeds can ruin the grass stand. To prevent this, plant into a “stale seedbed” as described for nonirrigated land. Prepare the seedbed, wait until the new flush of weeds has emerged, then apply glyphosate (Roundup) to kill the weeds. Delay planting for a few days to ensure that equipment does not damage the plants and thus prevent the absorption of the herbicide by the weeds. Grasses should then be planted without further soil tillage, to minimize stimulation of further germination of weed seeds.

Sprinkler irrigation can be used successfully by homeowners and owners of small acreages. The best way to tell when to irrigate is to watch soil moisture. Dig one-third of the way into the zone of main root activity to check moisture. Apply water

when moisture levels fall below 50 percent of the soil’s water-holding capacity. Be sure to start early enough to be over the field by the time the last set needs irrigating. On a deep silt loam soil a 2-inch application of water on pasture will wet the effective root zone. Use an auger or probe to determine the wetting front. The wet soil will be less resistant to probe penetration than the deeper dry soil.

Maintain adequate moisture in the top two inches of soil during emergence of newly planted seedlings. *This is critical.* The root zone of newly emerged seedlings is only a few inches deep (4 to 12 inches). Light, frequent irrigations are required to avoid continuously saturated soil, while keeping the soil-moisture level above 50 percent in the upper 2 feet.

Planting in dry soil usually results in poor seedling emergence. Irrigating before seedlings emerge normally causes soil crusting. Irrigate after the plants emerge. Failure to provide moisture to deep soil prevents deep root development, so you should monitor deep soil moisture and periodically irrigate enough to supply water to the deeper soil.

Herbicide applications, if necessary for weed control, can begin as soon as most of the grass seedlings have developed a 2-inch secondary root system. This usually occurs when seedlings are 2 to

3 inches tall and have side tillers. Destroying weeds at this time gives a competitive edge to young grass seedlings as they vie for dominance. Follow-up herbicidal applications may be needed, depending on the competitive ability of the grass and the growth of yellow starthistle and other weeds. As

many as two post-emergence herbicide applications may be necessary the first year if the stale seedbed procedure is not used.

Correct irrigation and grazing management ensures that an adequate grass stand can be achieved in one growing season.

FERTILIZATION ON IRRIGATED LAND

Irrigated pastures for livestock must be fertilized with nitrogen periodically, to enable the grass to take full advantage of the water and to produce enough forage to pay for the investment. New and established grass seedings should be fertilized on a regular basis to keep grass vigorous enough to withstand grazing and resist weed invasion. Thirty pounds of nitrogen per acre should be added after

each cutting or grazing period, or once in March and again in September. Nitrogen can be applied in various forms, such as 100 pounds of a 33 percent nitrogen fertilizer or 65 pounds of a 46 percent nitrogen fertilizer. New grass stands should be fertilized in the spring as soon as a 2-inch root system has developed, then after each cutting or grazing period.



GRAZING MANAGEMENT

Once yellow starthistle has become established in a pasture, even the most vigorous of grasses will not withstand reinvasion by the weed without protection by excellent management. On nonirrigated land, this includes deferred and rotation grazing, applying a selective herbicide when the weed population exceeds the owner's tolerance, and possibly range renovation by destroying all weed growth and reseeding. On irrigated land, this includes avoidance of grazing on wet soil.

Unless grazing is controlled to prevent excessive grass removal, yellow starthistle will soon reappear in great numbers. One acre of irrigated pasture normally can support one horse or cow under proper management. Pastures should be divided so that animals can be moved among four or more pasture subdivisions to allow grasses time to recover

between grazing periods, before grazing and other factors contribute to irreversible damage to the grass stand. Pastures can be divided with electric wire or other fencing that can be purchased at farm supply stores.

Regrowth of grazed plants and regeneration of stand density is vital to long-term survival of grass stands. University studies show that rotation grazing is more cost-effective and provides more high-quality, palatable grass than continuous grazing. The length of time before rotating should be determined by the rate of grass regrowth, fertility of the pasture soil, adequacy of soil moisture, and number of animals per acre for the grazing period. Animals should be moved to a fresh pasture subdivision before grass is grazed below a 4-inch height.

DIFFICULT TERRAIN

On productive, accessible ground, control is cost-effective when carefully managed, but on some properties yellow starthistle cannot be economically controlled. Where yellow starthistle is widespread and established in rimrock, steep canyonland, or rock outcrops, it may be best to omit any action against yellow starthistle because of the low probability of successful control and economic return on the investment. Economically, control in such circumstances is only justified when it protects

other land from reinfestation or if horses are endangered. Sociologically, yellow starthistle control may be justified by other values such as aesthetics, good neighborliness, or a sense of responsible land management even when the return on investment is not monetary. When yellow starthistle is designated noxious the landowner must control it to be in compliance with the noxious weed law, regardless of the cost, if the infestation is not in a designated special management zone.



ECONOMICS OF YELLOW STARHISTLE CONTROL

Strategies described in this bulletin are effective but require significant out-of-pocket costs and labor. Herbicides can be purchased at farm supply stores or farm chemical dealers. Correct application is done with a regular field sprayer that in some cases can be rented from fertilizer dealers for \$5 to \$15 per acre. A hand pump sprayer for spot spraying can be purchased for between \$25 and \$50 depending upon the quality desired. A typical hand pump sprayer should last from 5 to 10 years so the average annual cost will vary from \$3 to \$6 per year. Annual cost of herbicide application for yellow starthistle control on a typical small acreage will likely vary between \$25 and \$55 per acre annually. These costs include application and labor and materials. Labor and materials for spot spraying to control occasional isolated plants or colonies are included in these costs. The cost of renovating or rehabilitating infested irrigated land in an integrated program for sustainable land management varies

with the specific site, but is normally between \$60 and \$80 the first year. Under appropriate management thereafter, costs are only those associated with maintaining vigorous, productive grass.

If horses are pastured on infested lands, additional care should be taken to prevent yellow starthistle from becoming a significant part of the horses' diet. Horses can be excluded from yellow starthistle areas with electric fencing, costing approximately \$.30 to \$.60 per linear foot of fence for 1,000 feet or more, depending on number of wires, distance between posts, length, terrain, labor cost, kind of materials used, and other factors.

Benefits of yellow starthistle control may include control of other weeds that are susceptible to the same practices that control yellow starthistle; the landowner must take such other benefits into account when comparing costs and benefits.

THE AUTHORS

Bob Callihan is Extension weed specialist, Joe McCaffrey is professor of entomology, and Ed Michalson is professor of agricultural economics. All three are at the University of Idaho in Moscow. Larry Smith is Nez Perce County Agricultural Extension educator, UI at Lewiston.

FOR ADDITIONAL INFORMATION

on yellow starthistle, see *Yellow Starthistle Biology and Management in Pasture and Rangeland*, University of Idaho Current Information Series No. 634; and *Yellow Starthistle Management for Homeowners*, University of Idaho Current Information Series No. 1020. For additional information on control of this and other weeds, contact your county University of Idaho Extension educator, or see the current issue of the *Pacific Northwest Weed Control Handbook*.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, LeRoy D. Luft, Director of Cooperative Extension System, University of Idaho, Moscow, Idaho 83844. The University of Idaho provides equal opportunity in education and employment on the basis of race, color, religion, gender, national origin, age, disability, or status as a Vietnam-era veteran, as required by state and federal laws.