

# Starthistle Control

By

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It has been estimated that a stand of starthistle can produce 50-200 million seeds per acre.

It only requires about 2 million seeds per acre to repopulate that stand the next year.

There is a difference of opinion on the viability of starthistle seed. Idaho researchers found that it persisted for 10 years, while others have found 99.5% germinate in three years. Microbial degradation of the seed by pathogens in a California study appears to account for 40% loss in the seedbank each year. Exposure to increased sunlight causes more germination. This is why disking an area can produce more starthistle seedlings and thatch and heavy litter decreases the number of plants observed. Starthistle's deep tap root allows it to be very effective at harvesting moisture. Research at Sierra Foothill and Extension Center has calculated that eight inches of the available 12 inches of moisture (66%) was used up by starthistle. This means that it will take more rainfall to saturate soils on rangeland site occupied by starthistle. Although the toxic constituent of starthistle for horses is unknown, the entire plant is apparently toxic, either fresh or dried. A large quantity (600 + pounds) must be eaten, typically over a period of 1-3 months before poisoning is evident.

## Review of Control Methods

### Tillage

Starthistle has a deep (3-6 ft) root. Poor control can occur from tilling too early. When the soil is moist, tillage can increase the sunlight that stimulates new starthistle germination and removes the other competing vegetation. Late and multiple tillage is the most successful.

### Mowing

Successful control of yellow starthistle by mowing depends on both proper timing and plant growth form. Branching habit of yellow starthistle is highly variable and is partly dependent upon the level of competition for light with other species. Tall grass or litter will force the branching to occur above the normal mower cutting height, increasing the successful control by mowing. Erect, high-branching plants are effectively controlled by a single mowing at early flowering (2-5% flower), while sprawling low branching plants were not satisfactorily controlled even by multiple mowing. Mowing too early stimulates starthistle growth. Mowing to be effective must cut below the lowest branch of the main stem. Check your starthistle plant to determine if a 4-inch height of the standard mower will cut below any branching. A weed eater can be used effectively in small sites to cut below the branching near the ground at the 2-5% flowering stage. Mowing fails frequently because of the narrow window of time that it can be used. Even under conditions where the effectiveness of mowing is optimal, expect some plants to recover. Retreatment will nearly always be necessary.

### Competition

Hardinggrass plantings have been observed to decrease starthistle populations in coastal areas, but this species is also a non-native and can be invasive. Siskiyou County Farm Advisor, Dan Drake, has observed that pubescent wheatgrass and rose clover plantings have decreased starthistle populations. Observation by Craig Thomsen and Fred Thomas at the Sierra Foothill Research & Educational Center in Browns Valley, also indicated that annual clover seedings have decreased starthistle. There was a question of what happened to remaining starthistle in the presence of clover nitrogen enrichment of the soil. Some researchers postulate that there may be fewer but larger plants?

### Fire

Researchers have been experimenting with fire to control starthistle at the early flowering stage. A single year (July 7) treatment was unsuccessful at decreasing starthistle. The fire is fueled by the dry annual grasses and girdles the green starthistle plant. After the second year of treatment there was an 85% reduction in starthistle plants coupled with an increase in native forbs. After the third year treatment there was a 96% control of starthistle. One year of absence of burning has allowed the starthistle to greatly rebound. This has illustrated the dynamics of the seed and repopulation by starthistle.

### Grazing

Grazing can be an effective way to manage starthistle. When green, starthistle can contain 11-28% crude protein depending on its stage of maturity. Goats are the best control grazers followed by sheep and then cattle. Grazing early (February /March) and allowing late season grazing rest (May -June) can favor starthistle production.

### Herbicides

#### **Roundup**

Once plants have reached the bolting stage, most effective control can be achieved with Roundup® (glyphosate). The best time to treat with glyphosate is after annual grasses or forbs have senesced but prior to yellow starthistle seed production. Glyphosate is also an important tool in a follow-up control strategy to prevent yellow starthistle escapes from producing seed. Glyphosate provides excellent control of yellow starthistle at all stages of development, even when plants are in the early flowering stage. The use of glyphosate is not recommended when desirable perennial grasses or broadleaf species are present.

Seedlings: Excellent control of seedlings can be achieved at 2/3 qt Roundup Pro per acre or spot application with 1% solution. No additional additives are necessary.

Mature plants: Plants in late rosette or bolting stage can be controlled with 1-1/3 to 2-2/3 qts per acre or complete coverage with 1% solution. No additional additives are necessary. Unlike seedlings, 2/3 qt Roundup Pro per acre will not effectively control large rosettes. Under optimum growing conditions, control of yellow starthistle in the spiny of early flowering (<5% of flower in bloom) stages can also be achieved at 2 qts per acre. All treatments should be made before plants exceed the 5% flowering stage. Beyond this stage, numerous viable seed will already have produced. Control is less effective when older plants show physical signs of drought stress.

Treatment Considerations: Roundup Pro is an ideal treatment for late season yellow starthistle control in annual grasslands. Its use is not advised when perennial grasses or desirable perennial broadleaf species are present, except when used as a spot application. When Transline® has been previously applied, Roundup Pro can be used in a broadcast or spot treatment follow-up program to control escapes before they produce seed, or to prevent the proliferation of potential Transline resistant plants. Early season application of Roundup Pro to seedlings will not provide control of later germinating seeds. Under these conditions, repeated treatments are necessary.

## **Transline**

Transline is a growth regulator herbicide registered for use in non-crop areas, including pastures and rangeland. It has been demonstrated to be very effective for the control of yellow starthistle, as well as other invasive composites (Sunflower family), but does not injure grasses. The increased efficacy of Transline on yellow starthistle can be partially attributed to its postemergence and preemergence activity. A few composites, such as spikeweed (*Hemizonia pungens*) are not injured by Transline. In addition to composites, Transline injures most legumes, particularly annuals such as burclovers and vetches. Some legumes, including lupines and rose clover are relatively tolerant to Transline. Injury can be avoided on perennial legumes when Transline is applied during their dormant phase. Other plant groups which may be susceptible to Transline include some members of the nightshade family (Solanaceae), the knotweed or smartweed family (Polygonaceae), and teasel (*Dipsacus* spp.). In contrast, many other broadleaf species, including crucifers and filarees, appear to be relatively tolerant to the herbicide. Transline can be applied both aerially (helicopter or plane) or by ground equipment. Under optimal conditions, 1/4 pt/acre (1.5 oz ae/A) of Transline can provide excellent control of yellow starthistle from December through April. However, under drought conditions, higher rates are necessary. Thus, for consistent control of yellow starthistle, rates between 1/4 and 1/2 pt/acre are preferable. For more information see conversion chart on page 8. Aerial applications should be made with the higher rates. Even when previous years skeletons are present, similar rates will effectively control seedlings. When the desired objective is to enhance rangeland forage quantity while reducing yellow starthistle, earlier applications dates (January to February) are ideal. Although Transline will provide effect control of starthistle to the bolting stage (April or later), the competitive effects of starthistle this late in the season will result in low quantities of grass forage.

## Surfactant Use

Use of a surfactant did not improve the control properties of Transline on starthistle until the foliage began to turn bluish, because of the heavy wax production and when the plant begins to produce more hairs or when the temperature increases.

## **Milestone**

Milestone® (aminopyralid) is a new herbicide for use in rangeland, pasture, wildlands, and rights-of way to control broadleaf plants, especially thistles. It controls some important Sacramento valley weeds such as yellow starthistle, Italian thistle, and artichoke thistle. The label rate for the control of most thistles with Milestone is 3 to 5 ounces per acre. The very low amount of material required per acre and the limited movement of the product from the application point has allowed it to be registered under the Reduced Risk Pesticide Initiative of the U.S. Environmental Protection Agency. Research trials conducted from 2000 to 2006 on rangeland sites in California by UC Weed Specialist Joe DiTomaso found that as low as 2

ounces per acre controlled yellow starthistle.

It is made by Dow Agrosiences, the same company that makes Transline. Milestone® is expected to replace Transline for starthistle control because of its lower costs (estimated \$9 to \$10 per acre for the product at the 3 ounce per acre rate and \$6 for the 2 ounce rate), and the fact that it has a broader control spectrum which includes fiddleneck.

Milestone® gives three to four months of preemergence control of starthistle in addition to postemergence control. Starthistle can germinate in the Sacramento valley from October to May. Thus, treatments of Milestone are best applied from December to March. March applications may require a higher rate to be effective. Applications should be made before starthistle bolts or before annual grasses exceed four to six inches in height. Research has shown that the earlier the application, the more grass that is produced on the site.

### **Long-term control**

Any control approach should be continued for at least three years to reduce the yellow starthistle seedbank. Whenever possible, every effort should be made to expose an infested site to high light during the germination period. This will increase the rate of germination and deplete the seedbank more rapidly. Fall or winter grazing, burning, or mowing will provide increased soil surface light during the germination period. By comparison, tillage will bury seeds and prolong the dormancy period. The presence of high populations of biological control agents (weevils and flies) does not appear to significantly impact yellow starthistle populations when used as the sole means of control. However, the presence of these organisms in combination with Transline applications may provide a more long-term or sustainable control. Although no evidence is yet available to support this integrated approach, landowners are encouraged to sustain high levels of the biocontrol organisms.

### **Precautions**

Continuous use of Transline will likely have a long-term detrimental effect on the legume population in a particular area (e.g., burning or mowing). Consequently, other control options should be rotated in the overall yellow starthistle management strategy. In addition, herbicide resistance developed in a Washington population of yellow starthistle exposed to several applications of picloram (Tordon). This population was cross-resistant to Transline. Although, the resistance plants have not spread, the potential exists for the development of resistance to Transline in California if the herbicide is used year after year, with no other method employed. Resistance can be minimized by incorporating other control strategies or by utilizing late season applications of Roundup Pro to control escapes from application skips or resistant plants.

**Transline (Clopyralid) Susceptibility Chart.**  
(N = no control, P = partial control, C = control).

Species or Plant Group	Susceptibility
Grasses (annual and perennial)	N
Chickweed ( <i>Stellaria media</i> )	P to C
Fiddleneck ( <i>Amsinckia menziesii</i> )	N
Mustards and other crucifers	N
Common lambsquarters ( <i>Chenopodium album</i> )	N
Russian thistle or tumbleweed ( <i>Salsola tragus</i> )	N
Filarees ( <i>Erodium</i> spp.)	N
Teasel ( <i>Dipsacus</i> spp.)	C
Puncturevine ( <i>Tribulus terrestris</i> )	N
Prostrate knotweed ( <i>Polygonum arenastrum</i> )	N
Smartweed or ladythumb ( <i>Polygonum</i> spp.)	P
Red sorrel ( <i>Rumex acetosella</i> )	C
Curly dock ( <i>Rumex crispus</i> )	P to C
Jimsonweed ( <i>Datura</i> spp.)	C
Nightshades ( <i>Solanum</i> spp.)	C
Annual clovers and other annual legumes	C
Perennial legumes	P or N during dormancy
Lupines ( <i>Lupinus</i> spp.)	C
Burclovers and medics ( <i>Medicago</i> spp.)	C
Alfalfa ( <i>Medicago sativa</i> )	P or N during dormancy
Vetch ( <i>Vicia</i> spp.)	C
Thistles	C
Knapweed (spotted, diffuse, Russian)	P to C
Tarweeds (except <i>Hemizonia pungens</i> )	C
Ragweed ( <i>Ambrosia</i> spp.)	C
Mayweed ( <i>Anthemis cotula</i> )	C
Sagebrush ( <i>Artemisia</i> spp.)	C
Pineappleweed ( <i>Chamomilla suaveolens</i> )	C
Oxeye daisy ( <i>Chrysanthemum leucanthemum</i> )	C
Chicory ( <i>Cichorium intybus</i> )	C
Horseweed and maretail ( <i>Conyza</i> spp.)	C
Sunflower ( <i>Helianthus</i> spp.)	C
Prickly lettuce ( <i>Lactuca serriola</i> )	P to C
Common groundsel ( <i>Senecio vulgaris</i> )	C
Dandelion ( <i>Taraxacum officinale</i> )	P to C
Salsify ( <i>Tragopogon</i> spp.)	C
Cocklebur ( <i>Xanthium strumarium</i> )	C

## **The Future of Biocontrol**

Many land owners want the same success with starthistle that occurred with the insect that controlled Klamath weed. Presently, there have been five seed head feeding insects released. Given that starthistle is estimated to produce 50 to 200 million seeds per acre and its populations has expanded in California for more than 100 years it may not be realistic to expect biocontrol agents released during the past five years to provide satisfactory control. There are five seed head feeding insects presently released in California. Biocontrol of starthistle should be considered a long term solution. This method may provide the only answer to control on rangelands where of herbicides cost may be too expensive.

### Insects

The USDA Ag Research Service conducts the foreign screening of insects that attack starthistle and Calif. Dept. of Food and Ag coordinates the release sites through the county Ag Commissioners. Nursery sites are established and once the starthistle pest increases it is redistribution to other areas. A committee of Ag commissioners decides on the location of the release sites.

#### **Bud Weevil (*Bangasternus orientalis*)**

Introduced in 1988, it has the widest distribution of any yellow starthistle pest. It has been released in 49 counties and has populated all of the sites. Siskiyou and Placer are the counties with the best collection sites. It lays its eggs on the starthistle bracts and the larvae eat the receptacle. They produce only one generation per season, which limits its ability to impact all the different flowering periods. They do not destroy all the seed heads on a plant or all seeds within a seedhead. A private company has been collecting them in Placer County and plans to market them. It is not recommended to purchase these pests, since they have a wide distribution and with time they will increase in number. In addition, the bud weevil is not considered an effective biocontrol agent.

#### **Gall Fly (*Urophora sirunaseva*)**

The gall fly was first released in Placer County in 1984. It is now established in 40 counties. It is a good flyer and can move up to 16 miles per year. Gall flies have increased their populations in Siskiyou and Placer counties. They lay eggs on the seed head, which creates a gall that causes an energy drain on the receptacles. This results in a lower production of viable starthistle seeds. Field surveys have indicated that it is having a limited impact on starthistle. Release sites are on the map below. Like the bud weevil, gall flies are not considered an effective biocontrol agent.

#### **Hairy Weevil (*Eustenopus villosus*)**

It has one generation per year, emerging in May, mating and ovipositing eggs inserted inside closed flowerhead buds in June. It does well in hot dry areas but does not do well in foggy areas. Unlike other yellow starthistle natural enemies, hairy weevil adults also cause extensive damage by feeding on young closed buds. It is now established in 47 counties in California. Thus far, the hairy weevil appears to be more effective in preventing seedhead production in yellow starthistle than both the gall fly or bud weevil.

#### **Peacock Fly (*Chaetorellia australis*)**

It deposits its eggs on the seed head and the larvae hatch it bores inside. They produce three generations per year. This is an added advantage to this pest. One problem is that it emerges early (April) before starthistle flowers. CDFA has had seven releases and seven recoveries. They have found them 100 miles away from the Trinity/Humboldt release site. This species needs cornflower for colonization and establishment and is unlikely to have much of an impact on yellow starthistle control in California.

#### Seedhead Fly (*Chaetorellia succinea*)

This fly was accidentally introduced with the Peacock fly in 1991. It has become widespread throughout northern and central California. *Chaetorellia succinea* produces more than one generation a year. Its larvae can destroy most of the seeds in a head, much like the hairy weevil. Along with the hairy weevil, this fly is the most promising of the natural enemies yet released for yellow starthistle control.

Some of these pests are produced commercially. Below are the names of retail outlets listed in Suppliers of Beneficial Organisms in North America by the Dept. of Pesticide Regulation (1994 edition).

#### *Bangasternus orientalis* & *Urophora sirunaseva*

Bio Collect  
5481 Crittenden Street  
Oakland, Ca. 94601  
Phone (501) 436-8052  
Fax (501) 532-0288

#### *Bangasternus orientalis* only

Biological Control of Weeds  
1418 Maple Drive  
Bozeman, Montana 59772  
Phone (406) 586-5111  
Fax (406) 586-5111  
email: [biocontrol@montana.campus.mci.net](mailto:biocontrol@montana.campus.mci.net)

Peaceful Valley Farm Supply  
P.O. Box 2209  
Grass Valley, Ca. 95945  
Phone (916) 272-4769  
Fax (916) 272-4794

#### *Bangasternus orientalis* and *Eustenopus villosus*

Caltec Agri Marketing Services  
P O Box 576155  
Modesto, CA. 95357  
Telephone: 1-800-491-BUGS  
Fax: 209-575-0366

# TRANSLINE RATE CONVERSION CHART

PRODUCT		ACTIVE INGREDIENT	
FLUID OUNCES	PINTS	OUNCES AE	LB AE
2.7	1/6	1.0	0.063
4.0	1/4	1.5	0.095
5.4	1/3	2.0	0.126
6.8	2/5	2.5	0.16
8.0	1/2	3.0	0.19
9.5	3/5	3.5	0.22
10.8	2/3	4.0	0.25

California high label rate

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