



Purple starthistle



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Purple starthistle timing trial, Novato, 2011-2012

Product	Rate per acre	Application date					
		FALL – 12/14/11		WINTER – 2/1/12		SPRING – 4/5/12	
		cover %	count	cover %	count	cover %	count
<i>Milestone</i>	3 oz	0.1	0.5	0.3	8.0	0.6	0.8
<i>Milestone</i>	7 oz	0.6	14.3	0.0	0.3	0.2	2.5
<i>Capstone</i>	2 qt	--	--	--	--	0.0	0.8
<i>Capstone</i>	3 qt	--	--	--	--	0.1	1.0
<i>Transline</i>	2/3 pt	0.3	10.5	0.0	1.3	0.6	0.5
untreated	---	32.4	16.4	32.4	16.4	32.4	16.4

Purple starthistle timing trial, Lynch Canyon, 2012-2013

Product	Rate per acre	Application date					
				WINTER – 2/22/13		SPRING – 4/24/13	
				cover %	count	cover %	count
<i>Milestone</i>	3 oz					2.8	12.5
<i>Milestone</i>	7 oz			0	0	0.5	2.8
<i>Capstone</i>	2 qt			--	--	0.8	5.5
<i>Capstone</i>	3 qt			--	--	0.6	4.0
<i>Transline</i>	2/3 pt			0	0	0.6	2.5
untreated	---			20.6	35.5	20.6	35.5



**Woolly distaff
thistle**









Distaff thistle timing trial, Petaluma, 2011-2012

Product	Rate (per acre)	Application date			
		WINTER – 1/12/12		SPRING – 3/21/12	
		% cover	count	% cover	count
<i>Milestone</i>	3 oz	1.95	16.50	0.03	0.25
<i>Milestone</i>	7 oz	1.60	6.00	0.00	0.00
<i>Capstone</i>	2 qt	---	---	0.00	0.00
<i>Capstone</i>	3 qt	---	---	0.00	0.00
<i>Transline</i>	2/3 pt	3.00	31.00	0.03	0.25
untreated	---	18.83	74.88		

January and February were dry in 2012...



Distaff thistle timing trial, Petaluma, 2012-2013

Product	Rate (per acre)	Application date			
		WINTER – 1/15/13		SPRING – 4/30/13	
		% cover	count	% cover	count
<i>Milestone</i>	3 oz	0.025	0.5	3.38	25.00
<i>Milestone</i>	7 oz	0.025	0.25	0.03	0.25
<i>Capstone</i>	2 qt	---	---	1.13	10.50
<i>Capstone</i>	3 qt	---	---	0.03	0.25
<i>Transline</i>	2/3 pt	0.38	1.25	0	0
untreated	---	19.75	55.63		

May and June were dry in 2013...



Product	Residual	Good for	Best timing
<i>Milestone</i> (aminopyralid)	3-6 months	Most thistles	Mid to late winter
<i>Transline</i> (clopyralid)	2-3 months	Annual thistles (also good for purple starthistle)	Late winter to early spring
<i>Capstone</i> (aminopyralid + triclopyr)	1-2 months	Most thistles	Spring
<i>Perspective</i> (aminocyclopyrachlor + chlorsulfuron)	3-6 months	Most thistles	Mid to late winter



Product	Price / gal	Rate / acre	Grazing restrictions
<i>Milestone</i> (aminopyralid)	\$440	7 fluid oz	none
<i>Transline</i> (clopyralid)	\$230 \$160 generic	$\frac{2}{3}$ pt	none
<i>Capstone</i> (aminopyralid + triclopyr)	\$45	2 to 3 qt	none
<i>Perspective</i> (aminocyclopyrachlor + chlorsulfuron)	\$80 / lb	2.5 to 5 oz	do not graze



Product	Price / gal	Rate / acre	Cost / acre
<i>Milestone</i> (aminopyralid)	\$440	7 fluid oz	\$24
<i>Transline</i> (clopyralid)	\$230 \$160 generic	$\frac{2}{3}$ pt	\$18 \$13
<i>Capstone</i> (aminopyralid + triclopyr)	\$45	2 to 3 qt	\$22 to \$30

Late season control

- No soil residual
- Apply at end of rainy season
- Can be hard to control larger plants

Product	Activity	Price / gal	Rate / acre	Cost / acre
<i>Roundup</i> (glyphosate)	Nonselective	\$35 \$25 generic	3 qt	\$27 \$18
<i>Banvel</i> (dicamba)	Broadleaf plants	\$110 \$60 generic	1 to 2 qt	\$27 to \$55 \$15 to \$30
2,4-D LV ester	Broadleaf plants	\$28	1 to 2 qt	\$7 to \$14



Late season control

- No soil residual
- Apply at end of rainy season
- Can be hard to control larger plants

Product	Grazing restriction
<i>Roundup</i> (glyphosate)	none (but check label)
<i>Banvel</i> (dicamba)	none for non-lactating animals, 21 to 40 days for dairy
2,4-D LV ester	none for non-lactating animals, 7 days for dairy





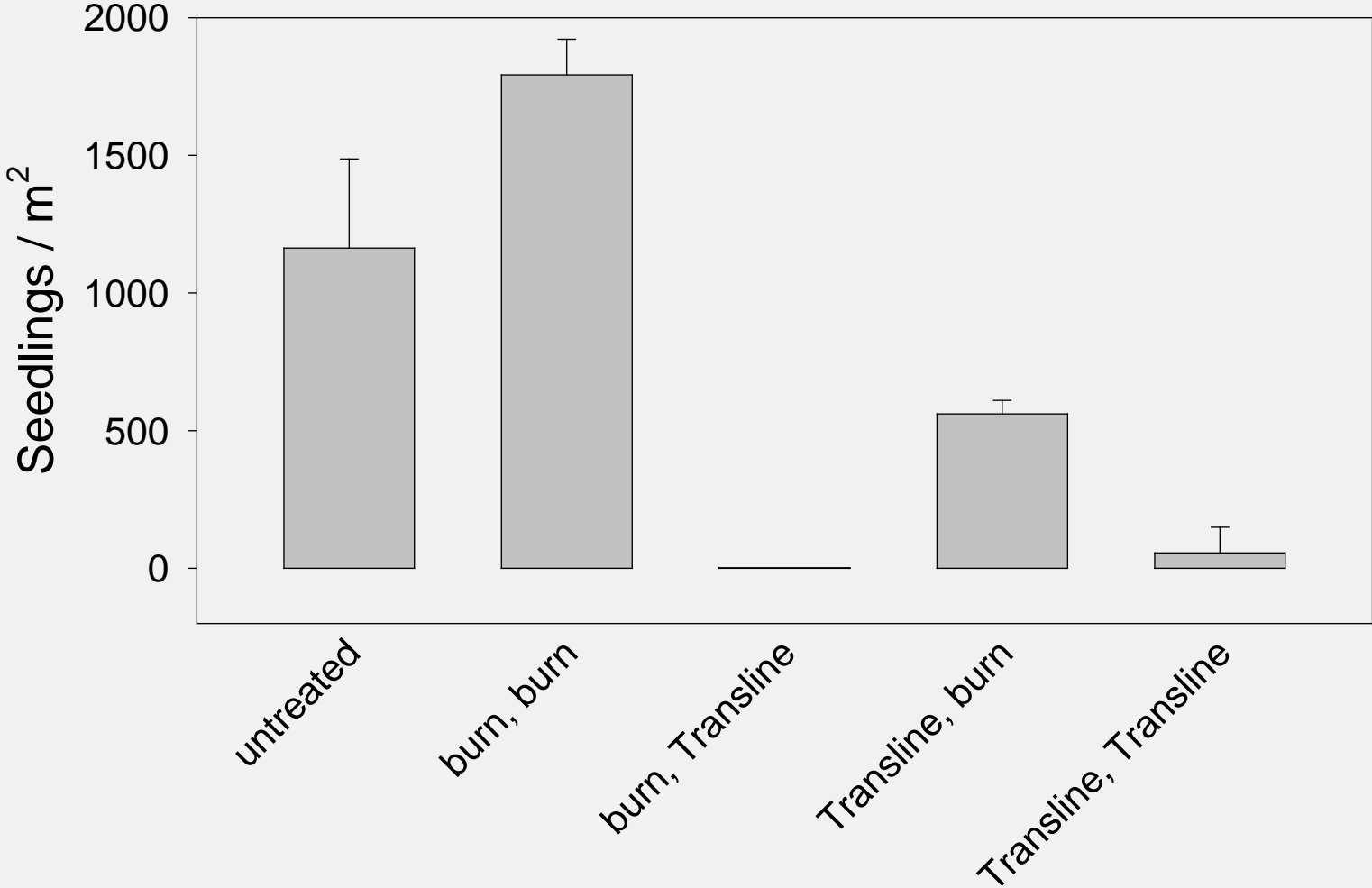
Many thistles can be controlled by mowing...

- Bud to early bloom stage
- Reduces seed production
- For perennials, must be repeated!





Yellow starthistle control with burning and *Transline*



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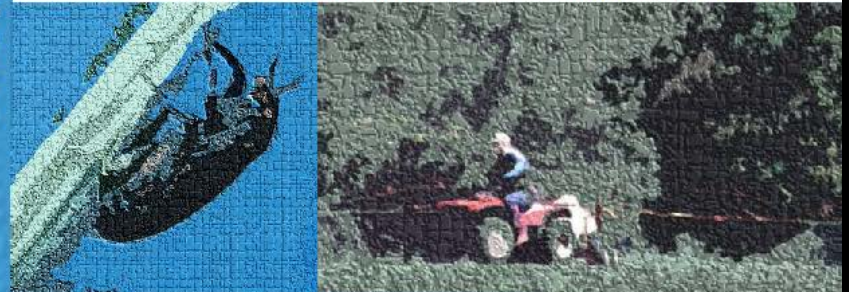
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Centaurea calcitrapa L.; purple starthistle
Centaurea iberica Spreng.; Iberian starthistle

Purple and Iberian starthistle

Family: Asteraceae

Range: Purple starthistle is found in Arizona, California, Oregon, Washington, Utah, and southeastern New Mexico. All of the Oregon and Washington populations have been controlled or are currently being treated for eradication.

Iberian starthistle is found in Oregon, Washington, Wyoming and California.

Habitat: Purple starthistle prefers fertile alluvial soils and forms dense stands in pasture, range, open forest, and riparian areas. Iberian starthistle often colonizes banks and watercourses and other moist areas.

Origin: Purple starthistle is native to southern Europe, whereas Iberian starthistle is native to southeastern Eurasia.

Impact: The rigid spines of purple and Iberian starthistle make the plant unpalatable and reduce the quality of infested hay. It restricts access and deters grazing by livestock and wildlife. Infestations can limit recreational opportunities, cause injuries, and degrade the quality of parks and natural areas. Purple starthistle can inhabit a wide range of environmental conditions and replace native species. Purple starthistle is known globally as an introduced weedy plant and is considered invasive or noxious in North and South America, New Zealand and Australia.

Western states listed as Noxious Weed: *Centaurea calcitrapa* and *Centaurea iberica* are listed as noxious weeds in Arizona, California, Nevada, Oregon. *Centaurea calcitrapa* is also listed as noxious in Washington.

California Invasive Plant Council (Cal-IPC) Inventory: *Centaurea calcitrapa* is listed as Moderate Invasiveness

Both species are annuals to perennials, to 3 ft tall. They exist as basal rosettes until they bolt. Bolting stems are erect, with highly branched flowering stems develop at maturity, usually in late spring and summer. The specific epithet name for purple starthistle, *calcitrapa*, was derived from *caltrap*, a spiked weapon from the Middle Ages that is dropped on the battlefield to injure advancing troops and horses. A long taproot provides a competitive advantage over annual and perennial grasses reducing available forage.

The flowers of Iberian starthistle closely resemble purple starthistle. While they are both spiny heads with purple flowers, the pappus on Iberian starthistle has white bristles ~1 mm long while purple starthistle usually lacks a pappus. Plants reproduce only by seed, which disperse with the seed head as a unit. Most fall just below the parent plant, but some can move longer distances when they attach to animals. Most seed germinates the first year, but buried seeds of both species can remain dormant for about 3 years.

NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disking) Hand pulling and digging of small infestations can be successful. Hand pulling must be repeated several times a year. Grubbing or digging can control small infestations. Purple starthistle populations were sharply reduced after 3 years of hand grubbing.

Mowing is not effective at killing plants but can reduce seed production if timed at full bloom. Regrowth occurs from root crowns when the tops are removed.

Cultural Conventional grazing by sheep or cattle will not control purple starthistle and in fact can promote it, because grazing animals usually avoid this plant and selectively feed on species that would otherwise compete with it.

Burning is not considered an effective tool for control.

In California where purple starthistle is a common pasture weed, fertility management is occasionally



	used as a management tool
Biological	While there are many biological control programs for purple starthistle, the most effective are currently being tested.

CHEMICAL CONTROL

The following specific use information is based on field trials conducted by weed managers. These are products known to be effective. Other products may have been omitted from the table. Other treatments may be effective on this weed. For foliar applications, use a low volume application. Use a low non-target species. Directions for use may vary by region. List the mode of action and then alphabetically. The preference.

GROWTH REGULATORS

2,4-D	Rate: 1 to 2 qt product/acre
Several names	Timing: Apply postemergence when plants are young and actively elongating. Treat rapidly before plants are well established. Remarks: Generally require a growth regulator herbicide for control. Apply ester formulations or ester forms at the smallest volume possible to minimize movement from volatilization.
Aminocyclopyrachlor + chlorsulfuron	Rate: 4.75 to 8 oz product/acre
Perspective	Timing: Applied both pre- and post-emergence. Effective when applied before plants are well established. Remarks: Aminocyclopyrachlor is a growth regulator herbicide for purple starthistle. Its ester formulations are effective on purple starthistle. Although generally effective on grass species. Do not use on wheatgrass. Not yet approved for use in California.
Aminopyralid	Rate: 4 to 7 oz product/acre
Milestone	Timing: Apply post-emergence when plants are young and actively elongating. Remarks: A non-ionic growth regulator herbicide. Effective on purple starthistle. Do not use on wheatgrass. Not yet approved for use in California.
Clpyralid	Rate: 0.67 to 1.33 pt product/acre
Transline	Timing: Apply post-emergence when plants are young and actively elongating. Remarks: Apply in 10 to 15 days after emergence.
Clpyralid + 2,4-D	Rate: 2 to 5 qt Curtail/acre
Curtail	Timing: Apply post-emergence when plants are young and actively elongating. Remarks: Use higher rates for control. Use in ester formulations. Add a non-ionic growth regulator herbicide for improved coverage.
Dicamba	Rate: 2 to 4 pt product/acre
Banvel, Clarity	Timing: Apply post-emergence when plants are young and actively elongating. Remarks: Dicamba is a

With postemergence application, optimally applied before plants are well established to prevent current year seed production, or fall

than aminopyralid, aminocyclopyrachlor, and chlorsulfuron. Most broadleaf plants are susceptible. It will kill many Centaurea species but is non-selective. It will not prevent seed production near trees. Tordon 22K is a restricted-use herbicide.

Apply at 3.375 lb a.e./acre. For

Apply when most plants are at bud stage.

Apply in the year of application, and will not kill seeds or seedlings. Kills many Centaurea species but is non-selective. Use for spot treatment to control current year's

Apply before or during the rainy season when weeds

to reduce the potential movement of the herbicide. Apply on dry soil or light, sandy soil when there is little risk of off-target movement when soil particle

Apply when weeds are actively germinating or growing.

Apply in cultivated non-agricultural areas (such as rights-of-way) which includes uses such as farmyards on coarse-textured soils (sand to sandy loam), in clay and on soils high in organic matter. At higher rates it will create bareground.

Carduus lanatus L.

Woolly distaff thistle

Family: Asteraceae

Range: Primarily a problem in the central coast regions of California, but is also found in Oregon, Arizona, Texas and Oklahoma.

Habitat: Disturbed open sites, roadsides, fields, grassland, rangeland, pastures, and sometimes agricultural land, especially grain fields.

Origin: Native to Mediterranean region.

Impacts: Highly competitive with cereal crops and desirable rangeland species, and dense populations can develop. In addition, the spiny foliage and flowerheads can injure the eyes and mouths of grazing livestock. Western states listed as Noxious Weed: California, Oregon. California Invasive Plant Council (Cal-IPC) Inventory: Moderate Invasiveness (Alert)

Erect winter annual, with rigid stems to 3 ft tall and spiny leaves. Plants exist as rosettes until flower stems develop in spring/summer. Stems usually covered with loose woolly or cobwebby hairs, as well as minute glandular hairs, especially in leaf axils and at bases of flowerheads. Stem leaves alternate, sessile, once-pinnate-lobed and prominently spine-tipped, also with glandular hairs.

Flowerheads are yellow, 1 to 2 inches long, solitary at stem tips, with spiny lobed phyllaries. Flowerheads consist of numerous disk flowers. Outer seeds (achenes) lack a pappus, whereas inner achenes have a persistent pappus, 10 to 13 mm long, of numerous narrow, unequal, brownish scales. Plants reproduce only by seed. Most achenes fall near the parent plant, but some remain in the persistent seedheads. Achenes and sometimes entire seedheads can disperse to greater distances with animals, humans, machinery such as tractors and agricultural implements, mud, and water. Most seeds germinate within the first couple of years after maturation, but some seeds can remain dormant and viable for up to 8 years under field conditions.



NON-CHEMICAL CONTROL

Mechanical (pulling, cutting, disk ing)	Hoeing can be effective for the control of small populations. This can be conducted in the rosette or bolting stage, but before flowering. Plants must be cut just below the soil surface to prevent resprouting. Mowing after bolting but just before the development of flower buds can prevent most seed production. This is generally in late spring. Mowing earlier can encourage the regrowth of flowering stems. In plants mowed after flowerheads have developed, seed can mature in cut flowerheads left on the ground. Control programs may have to be repeated two or more times throughout the season to prevent escaped plants from producing seeds.
Cultural	Heavy grazing can increase distaff thistle populations because livestock selectively graze more palatable and less spiny species, thereby reducing competition with other plants for light and nutrients.
Biological	Distaff thistle is closely related to commercial safflower (<i>Carthamus tinctorius</i> L.), which precludes the development and release of biological control agents.

CHEMICAL CONTROL

The following specific use information is based on published papers or reports by researchers and land managers. Other trade names may be available, and other compounds also are labeled for this weed. Directions for use may vary between brands; see label before use. Herbicides are listed by mode of action and then alphabetically. The order of herbicide listing is not reflective of the order of efficacy or preference.

GROWTH REGULATORS

2,4-D	Rate: 2 to 4 pt product/acre (0.95 to 1.9 lba.e./acre)
Several names	Timing: Postemergence when plants are at seedling or small rosette stage, which is generally in late winter

	or early spring. Remarks: 2,4-D gives good control, but aminopyralid is considered better. It will damage other broadleaf species, but is safe on grasses. 2,4-D is a restricted use herbicide in some areas.
aminopyralid	Rate: 3 to 7 oz product/acre (0.75 to 1.75 oz a.e./acre)
glyphosate	Timing: Preemergence and postemergence. For postemergence treatment it is best applied when plants are at seedling or early rosette stage, which is generally in late winter or early spring. Remarks: Aminopyralid gives excellent control. It is fairly selective primarily on members of the Asteraceae and Fabaceae, and is generally safe on grasses. Aminopyralid has soil residual activity which helps to control later-germinating seedlings. A premix of aminopyralid + metsulfuron (<i>Open Sight</i>) also provides excellent control at 1.5 to 2 oz product/acre.
glyphosate	Rate: 6 to 21 oz product/acre (2.25 to 8 oz a.e./acre) Timing: Preemergence and postemergence. For postemergence treatment, it is best applied when plants are at seedling or small rosette stage, which is generally in late winter or early spring. Remarks: Clopyralid gives good control, but aminopyralid is considered better. It is fairly selective primarily on members of the Asteraceae and Fabaceae, and is safe on grasses. Clopyralid has soil residual activity which helps to control later-germinating seedlings.
dicamba	Rate: 2 to 4 pt product/acre (1 to 2 lba.e./acre) Timing: Postemergence when plants are at seedling or small rosette stage, which is generally in late winter or early spring. Remarks: Dicamba gives good control, but aminopyralid is considered better. It is a broadleaf-selective herbicide and is safe on grasses.
picloram	Rate: 1 to 1.5 pt product/acre (4 to 6 oz a.e./acre) Timing: Postemergence in spring at the rosette stage before bolting. Remarks: Picloram has long soil residual activity. The label indicates picloram should be mixed with 1 lb a.e./acre 2,4-D. It will damage other broadleaf species, but is generally safe on grasses. Picloram is a restricted use herbicide. It is not registered for use in California.
trifluralin	Rate: 2 qt <i>Arion 3A</i> /acre (1.5 lba.e./acre) Timing: Postemergence when plants are at seedling or small rosette stage, which is generally in late winter or early spring. Remarks: Trifluralin gives good control, but aminopyralid is considered better. It is a broadleaf-selective herbicide and is safe on grasses.

GLYPHOSATE AND OTHERS

glyphosate	Rate: 1 to 2 pt product (<i>Roundup ProMax</i>)/acre (0.56 to 1.1 lba.e./acre) Timing: Postemergence in late spring or early summer, but before plants begin to flower. Rosette to early bolting stage is best. Remarks: Glyphosate is nonselective, and it is best to apply after desirable annual grasses have dried up. If perennial grasses are present, glyphosate can cause significant damage or death.
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Weed Control in Natural Areas in the Western United States

Useful websites

- WRIC.ucdavis.edu
- IPM.ucdavis.edu
- Cal-IPC.org