Management information: *Cirisium arvense*

Physical:

C. arvense response to fire varies from positive to negative, depending on season of burn, soil moisture, and location. Dormant season burning stimulates growth of native herbaceous species that compete with the weed. Growing season fire damages native species as well as *C. arvense*. Covering *C. arvense* with boards, sheet metal or tar paper can kill the plants.

Chemical:

Picloram (Tordon), Dicamba (Banvel), Metsulfuron (Ally), 2,4-D, and Bentazon (Basagran) are not recommended. Clopyralid plus 2,4-D (sold under the trade name Curtail) provides the best and most consistent control in agricultural areas but may damage native forbs and shrubs. Fall application of clopyralid delayed shoot emergence by two weeks, and reduced shoot density the following summer. The impact of clopyralid increased with increased application rate, and application of 840 g/ha had the greatest impact. One fall application with clopyralid at 560 g/ha prevented almost all *C. arvense* shoot emergence the following spring.

Glyphosate is a non-selective systemic herbicide that kills all green vegetation at the time of application. It has little or no soil residual. Glyphosate impacts *C. arvense* by reducing the number of root buds and regrowth of secondary shoots more than by reducing root biomass. No root bud regrowth occurred when glyphosate was applied at 0.28 kg/ha. For optimal results, apply glyphosate under warm conditions prior to the first killing frost and when soil moisture is good, or after plants have adjusted to colder weather.

Chlorsulfuron is a post-emergent herbicide that primarily suppresses regrowth, and secondarily reduces the number of root buds and plant weight. Addition of growth regulators (chlorflurenol and dicamba) to chlorsulfuron enhanced control, but not under field conditions. Its density was reduced 2-5 years after spring application of chlorsulfuron.

Biological:

At least 7 insect species have been intentionally or unintentionally released for the control of *C. arvense* in North America and a few of them have caused conspicuous damage. The beetle *Cassida rubiginosa* was introduced accidentally in 1902 and defoliates plants. Larvae of the intentionally introduced biocontrol weevil *Ceutorhynchus litura* feed on the stems. The introduced stem-galling fly (*Urophora cardui*) attacks *C. arvense* shoots but has little impact. Larvae of the fly *Orellia ruficauda* (Diptera) damage seed heads. The beetles *Altica carduorum* and *Lema cyanella* feed on its leaves. The seed weevil *Rhinocyllus conicus* was introduced to control musk thistle and other related *Carduus* and Cirsium thistles and lays eggs in *C. arvense* flowerheads. The weevil *Larinus planus* is a seed head feeder but it has had little impact on *C. arvense* and attacks native thistles. Two pathogens have also been considered for use against this invasive. The rust *Puccinia punctiformis* and the fungus *Sclerotinia sclerotiorum* attack shoots and roots respectively. Of all these biocontrol organisms, *Orellia ruficauda* and *Puccinia punctiformis* appear to inflict the most significant damage, but even this is probably not sufficient to control its population.
A combination of biocontrol agents, or of biocontrol agents and herbicides, may provide better control than any single agent. It has been suggested that at least three biocontrol organisms may be needed for effective control. The chrysomelid beetle (*Altica carduorum*) weakens *C. arvense* by defoliating it and feeding on its flower heads. It was first regarded as a promising control agent because of its specificity and continuous feeding habit, but has proven unsatisfactory because of its own susceptibility to predation. *Cleonus piger* is a root-feeding weevil that can cause wilting and plant death, but plants usually regenerate from damaged vascular tissue. The leaf spot disease (*Septoria cirsii*) is host specific to *C. arvense* and causes severe damage to the plant in the field, inhibiting seed germination and root elongation, and causing leaf

chlorosis and necrosis. This disease has been proposed for consideration as a biological control organism.

Very young plants are eaten by goats or sheep in the spring, but grazing is the least effective method of control. Competition from tall fescue was more detrimental to *C. arvense* than competition from crownvetch (*Coronilla varia*), and damage increased when tall fescue was used in combination with *Cassida rubignosa*.

A study was undertaken to evaluate the potential of applying a rust fungus *Puccinia punctiformis* as a method of effective biological control of *C. arvense* at the University of Göttingen, Germany. The influence of a combination of cutting and pathogen treatments on this species was evaluated. The results of the trial indicate that whilst cutting is an effective method of reducing plant recruitment, additional application of the fungal pathogen further restricted sexual reproduction indicating that combined treatments are more effective at controlling creeping thistle.
For more details please see [ConservationEvidence.com, Case study 14:]() The influence of mechanical cutting and pathogen application on creeping thistle *Cirsium arvense* at Göttingen, Germany [extracted from: Kluth S., Kruess A. & Tscharntke T. (2003) Influence of mechanical cutting and pathogen application on the performance and nutrient storages of *Cirsium arvense*. Journal of Applied Ecology, 40, 334-343].

An experimental study was undertaken to investigate the use of biological control, to reduce densities of *C. arvense* in a successional fallow. Spores of two pathogens, the biotrophic rust *Puccinia punctiformis* and the perthotrophic *Phoma destructiva* was applied for three consecutive years individually, at different dates and combined. The authors conclude that "*Cirsium arvense* cover decreased from 60% to 5% within 3 years, while the cover of the co-occurring fallow vegetation increased. Under field conditions, with an already high degree of natural *P. punctiformis* infection, the effects of inoculations of the single pathogens were minor, but reductions in shoot density after combined inoculations indicate that this inoculation may have the potential to cause a decline of this weed." (Kluth *et al.* 2005)