Cultural method of controlling creeping thistle in an organic farming system

By Evans Basweti, Sheena Moore and William Bryan

Creeping thistle (*Cirsium arvense* L.) is a noxious weed in agricultural land in North America. It has been shown to cause herbage mass loss in perennial pasture of 2 kg ha^{-1} for each kilogram of standing thistle biomass and 4.3 kg ha^{-1} with each additional thistle stem per square meter (Grekul and Bork, 2004). Creeping thistle is a perennial plant in the composite family. It spreads by rhizomes and seeds. It can grow in most soil types, even up to 2% saline soils and most areas, including wetlands, pastures, roadsides, and forests. It prefers moist soils, with good aeration which are high in potassium and low in phosphate. Roots may grow as deep as 5 meters in well-aerated soils and horizontally as far as 6 meters per year if left unchecked. New shoots may be formed by root buds at 2-6 inch intervals, with most growth from the root system occurring in the upper 45-70 cm of soil (NPS 1999 and Gustavsoon 1997). Root fragments greater than 5mm in length are capable of forming new plants and in one study 100% of fragments 12mm and longer formed new plants (Hamdoun 1972).

On organic farms no effective herbicide is allowed so that some other means of control or eradication must be used. Organic methods for control and eradication include covering, cultivating every three weeks during the growing season, and using tall shade crops and use of insect herbivore (Friedli and Bacher, 2001). Methods can be combined and may need to be repeated for several consecutive years. Since this weed spreads mostly by rhizomes eradication is a possible solution.

The West Virginia University Horticulture Farm was placed under organic management in 1999. Areas in permanent grassland were plowed in early 2000 and put into a cropping systems experiment with a rotation of potatoes, soybeans, wheat, rape and 3 years of a temporary orchardgrass and red clover grassland. This experiment consists of 66 fields each 1254 to 1800 sq ft in size. Two of the treatments include sheep and permanent grassland fields each 9000 to 12186 sq ft in size. Problems with weeds were minimal the first few years. The first problem weeds were biennial thistles and docks and were controlled by hand. By 2006 several infestations of creeping thistle were noticed, almost all in the cropped fields. Some of the spread of these thistles came from seed along fence lines where they were allowed to seed. In 2006 creeping thistles in fence

lines were not allowed to seed and a variety of practices were initiated to control the spread and eradicate this plant from the cropped fields. In October 2007 these fields were surveyed and it was found that there were thistles present in 37 of the 66 fields. The purpose of this report is to provide information on experiences with eradication of this difficult weed.

Starting in 2006 and continuing in 2007 much more attention was given to control of creeping thistle on the cultivate fields and surrounding areas. Plants were not allowed to seed. Plants in fence lines and non cropped areas were allowed to flower and were either cut or pulled. If flowers had opened they were gathered and removed. Three approaches were initiated in 2006 to eradicate the creeping thistles. These were covering, pulling and digging.

Four areas within a dense patch of thistles were chosen for a trial with covering. This patch of thistles was growing on a disturbed area adjacent to the fields and there was very little vegetative competition to the thistle (Fig 1). The areas were mowed and covered with a black, white or green polyethylene sheet and one left uncovered. Areas were covered for 3 weeks form mid-June to early July. After the 3 weeks all the vegetation under the black and green sheets was dead. Under the white sheet plants were white and weak (Figure 2). No other management was applied to the areas until July 2007 when they were mowed. By October 2007 areas covered with green or black sheets had few or not thistles (Figures 3 and 4). Concentration of thistles in the area covered with the white sheet was similar to that in the uncovered area (Figure 5).

We chose four specific spots where thistle was highly concentrated (Figure 1) inside physical plant compound of Horticulture Farm. These spots were covered with black or white or green polythene sheet and one spot was not covered, a control, for 2 weeks in June and first one week of July. When we uncovered to monitor the progress at the end of three weeks, the spot with black and green polythene sheet had their thistle dead while the one that was covered with white and opaque polythene turned whitish because of lack of light (Figure 2). Whole plant of thistles under blue or black polythene sheet died (Figure 2b) but the spot covered with white did not die but were very weak (Figure 2a). Prior to covering thistles this area had been mowed in late May. The four spots were left without any activity except that this area was mowed in July of 2007.

In August 2006 a second trial was initiated. Two fields were chosen. Both were planted to winter wheat in Sept 2005 and soybeans in June 2007. Both had received applications of compost to supply 150 lb available N annually. Adjacent areas in permanent grassland were included because they were part of the patch of thistles. Thistles in the fields were dug and roots/rhizomes removed under each shoot. In the permanent grassland shoots were pulled. Fields were surveyed approximately every 4 weeks during the growing season and visible shoots dug or pulled. Time taken and number of shoots removed were noted. After one year the apparent infestation of thistles in permanent grassland areas was greatly reduced but the effect of digging in the cropped fields did not reduce the number of shoots (Table 1). This trial will continue to see if these measures will result in thistle eradication.

From the trial comparing covering materials it is concluded that light exclusion for 3 weeks in June and July will greatly reduce vigor of a thistle infestation but the most effective covering was a green or black polyethylene sheet. Thistles were about to flower when cut and covered and their root reserves would have been reduced. Covering kept them from recovering and the heat increased rhizome activity further reducing reserves. Pulling thistles in areas of permanent grassland reduced thistle shoots much more in a year than digging in a cropped area. In neither case was the infestation eradicated. Combining of covering in June/July and digging may be more effective for eradication in cultivated areas. Pulling appears to be effective in grassland areas. These trials will continue to establish how long it will take, and at what cost, to eradicate creeping thistle.

Table 1: Effects of digging and pulling on persistence of thistles.

Date	Dug		Pulled	
	# of shoots	time	# of shoots	time
	#	min	#	min
Sept 06	--[1]	60	--	--
Oct 06	48	14	124	15
Nov 06	47	14	--	--
May 07	--	--	90	15
June 07	--[2]	--	114	15
July 07	44	12	72	13
Aug 07	76	18	70	14
Sept 07	--[1]	--	16	7
Oct 07	--	--	10	2
Nov 07	74	20	10	5

Note: All shoots were pulled Aug 06. Data are averages of two fields (dug) and two adjacent grassland areas (pulled).

[1]Disked and rye and vetches seeded.

[2]Disked and soybeans seeded.

Figure 1: Creeping thistle area that was not covered for 2 weeks in June and a week in July 06.

a b

Figure 2: Creeping thistle area after being covered with (a) a white polythene sheet and (b) a blue polythene sheet for 3 weeks (2 weeks in June and a week in July) 2006.

Figure 3: Creeping thistle area in October 07 that was covered for 3 weeks in June/July of 2006 with a blue polythene sheet.

Figure 4: Creeping thistle area in October 07 that was covered for 3 weeks in June/July of 2006 with a black polythene sheet.

Figure 5: Creeping thistle area in October 07 that was covered with a white polythene sheet for 3 weeks in June/July of 2006

Literature Cited

Friedli, J., and S. Bacher. 2001. Direct and indirect effects of a shoot-base boring weevil and plant competition on performance of creeping thistle, *Cirsium arvense*. Biological Control 22: 219-226.

Grekul, C. W., and E. W. Bork. 2004. Herbage yield losses in perennial pasture due to Canada thistle (*Cirsium arvense*). Weed Technology 18: 784-794.

Gustavsson, A-M. D. 1997. Growth and regenerative capacity of plants of *Cirsium arvense*. Weed Research 37: 229-236

Hamdoun, A. M. 1972. Regenerative capacity of root fragments of *Cirsium arvense* (L.) Scop. Weed Research 12: 128-136.

HDRA Organic Weed Management. 2006. Creeping thistle. Retrieved December 2, 2007 from: http://www.gardenorganic.org.uk/organicweeds/weed_information/weed.php?id=5

HDRA Organic Weed Management
http://www.gardenorganic.org.uk/organicweeds/weed_information/weed.php?id=5
Accessed on 12/21/07

National Park Service. 1999. Appendix C: Species Abstract of Canada thistle at Pipestone National Monument, Minnesota.
http://www2.nature.nps.gov/pubs/ranking/ranking.htm#c
Accessed on 12/02/07