

## Organic Control of Canada Thistle in an Apple Orchard

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We raise organic apples on our farm in Lafayette County, southwest Wisconsin. Our trees are on dwarfing rootstocks and we rely on a thick, 4-6 inch, layer of hardwood bark mulch to control weeds in the tree row. Mulch works well for controlling annual weeds, but perennial weeds which spread underground can sometimes establish in the mulch and form dense patches. Of these weeds, Canada thistle has been the most troublesome in our orchard. It spreads via deep underground roots which are impossible to remove from the soil without uprooting nearby apple trees. As organic growers, we have no systemic herbicide which will kill Canada thistle with a single spray. For many years we chopped down thistle patches under our trees several times each growing season, but the weed persisted and patches expanded.

Research has showed that it's possible to eradicate thistle by repeatedly killing Canada thistle shoots on three week intervals. This gradually exhausts the plant's underground stored resources. We wondered if this would be true in our orchard, and if so, how we could fit this task into our busy farm schedules. In 2019-2020, we received funding from a USDA-SARE Farmer Rancher grant to evaluate organic methods for killing Canada thistle shoots. Our goals were to determine whether killing shoots every three weeks would actually eliminate the weed, and if so, to determine what was the most economical and effective method for killing the shoots.

We performed the project in an orchard block with trees at 6x10.5 foot spacing and a 5.5 foot wide strip of bark mulch under the tree row. We evaluated four different methods for killing the shoots: (1) hand-pulling, (2) slicing off the shoots at ground level with a diamond hoe, (3) cutting the shoots as low as possible with a gas-powered string-trimmer, and (4) spraying the shoots with Avenger Weed Killer, an OMRI-listed, non-systemic herbicide. Each of the four methods was performed in two ways: in our standard bark mulch and in areas where we applied a layer of recycled cardboard mulch underneath the bark, thus making eight treatments in total. We thought that the cardboard might reduce thistle emergence and lessen the time required to kill shoots. Each of the eight treatments was performed for two years on 14 different plots in our orchard. We counted the number of thistle shoots in each plot every three weeks, right before killing the shoots, and we measured the time and materials costs for applying the different treatments.

All the methods of killing shoots were extremely effective. Near the beginning of 2019 we counted 1329 thistle shoots in our plots; by the end of 2019 there were 5, and by the end of 2020 none remained. We had expected some decrease in the population, but the speed of the decrease was surprising – and gratifying! We observed several important differences between the treatments:

Thistle density declined to zero in all plots, under all treatments. However, the decline in June and early July of 2019 was much more rapid in plots with a layer of cardboard mulch underlying the bark. By August 2019, thistle counts were similar in all treatments. Accordingly, the time required to kill shoots was less in cardboard-mulched plots in early 2019.

Of the four shoot-killing methods, string-trimming and hoeing were least expensive, costing \$2.11 and \$2.64 per tree over the two years of the study. These costs include labor and operating expenses but not upfront costs to purchase tools. "Cost per tree" means the cost to perform the treatment in the 6' x 5.5' area under one tree, for two years. Hand-pulling was most time-consuming and treatment and was expensive (\$4.96 per tree) because of high labor costs. Spraying actually required the least time, but was the most expensive method (\$7.86 per tree) because of the high cost of the spray product. Although cardboard mulch reduced the time needed for killing shoots, it did not save money because the time required to lay the mulch was greater than the subsequent time savings.

It is possible to eradicate Canada thistle with a rigorous schedule of killing the growing shoots every three weeks. Of the methods we tried, we favor hoeing with a diamond hoe. String-trimming was somewhat faster and less expensive according to our data, but it does have several disadvantages which we did not quantify, including occasional damage to

trunk guards, noise, fumes, vibration, and annoying maintenance issues. In addition, we observed that string trimming was ineffective against low-growing weeds, such as dandelion and crabgrass, which sometimes occur in our orchard, whereas hoeing can be used to control most other weeds in addition to thistles.

A detailed report of our results is available online at [www.twoonionfarm.com/research/](http://www.twoonionfarm.com/research/) and I am happy to answer questions by email: [twoonionfarm@gmail.com](mailto:twoonionfarm@gmail.com).

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