Linking Organic Knowledge
OACC
Organic Agriculture Centre of Canada
oacc.info
Le réseau du savoir biologique
CABC
Centre d'agriculture biologique du Canada
agbio.ca

MANAGING WILD RADISH IN FEED GRAINS

Final Research Report E2006-01

INTRODUCTION

Weed control problems are one of the main reasons many farmers don't switch to organic production. Farmers indicate that 'wild mustard' (*Synapis arvensis)* is one of the most problematic weeds in the Maritimes. Although wild mustard has been seen in the Maritimes, wild radish (*Raphanus raphanistrum)* is much more common and is often is misidentified as wild mustard (see adjacent text box). Wild radish is highly visible during their flowering period making farmers are concerned about both the appearance of poor weed management and the actual yield losses caused by the weed.

Wild radish can reduce yield and seed quality of the harvested crop[1]. Researchers have found that 7 wild radish plants m^{-2} reduced wheat yield by 10%, and at a density of 200 plants m^{-2}, yield was reduced by half[2]. Wild radish is not a seed limited weed. It produces many seeds per plant that may survive in the soil for decades. It is better to not allow a field to get weedy; as seed production is hard to control. To control wild radish, it is recommended that organic farmers use a systems approach that combines strategies such as crop rotations, cultivation, prevention systems, and planting methods[3] (see Table 1).

Flowering wild radish in a barley crop (K. Punnett)

Farmers in PEI requested an on-farm research and demonstration trials designed to identify successful weed control practices for wild radish in organic feed grains. For this study, we studied the literature and developed what we identified to be the theoretically ideal management system. We referred to this system as the **Best Organic Management Practice, or "BOMP".**

The objectives of this research were to:

- **Conduct on-farm research to test the effectiveness of (BOMPs) for controlling wild radish; and**
- **Estimate the yield loss caused by wild radish.**

Wild Radish or Mustard?

Both wild radish and wild mustard are highly visible when flowering. They can be taller than the crop, with bright yellow flowers and many branches. In PEI, wild radish is more prevalent than wild mustard. If in doubt, the following clues can be used to identify your weed.

Wild radish has:

- deeply divided lower leaves covered in stiff hairs[4]
- yellow or white flower petals with eye-catching dark veins[4]
- pods that hold a few large seeds
- pods constrict around and break between the seeds[4] (i.e. the pods do not open, making wild radish difficult to clean out of cereal seed because of their similar size and shape)
- a root with a spicy, peppery taste

Wild mustard has:

- less hairy leaves
- leaves are not deeply lobed
- stems are bristly[4]
- stems are purplish where they branch[4]
- seed pods that contain many small seeds and split open lengthwise[1]

WHAT WAS DONE?

The BOMP trial was conducted on two PEI farms. Both farms were interested in testing new weed management practices, and were in the early stages of adopting organic management. Early in the year, wild radish (not wild mustard) was identified as the problem weed in these fields.

The **BOMP** plots were managed with practices designed to control wild radish. Table 1 lists examples of BOMPs that may be useful for wild radish control, as determined through a literature review. For this project, the BOMPs chosen combine several techniques including **false seed bed** technique, **rolling** after tillage, **increasing seeding rate**, and **fingerweeding** (Table 2).

The **NORM** plots were managed with the farmers' normal practices.

The false seed bed technique is used early in the growing season to stimulate weed germination. The field is cultivated twice. The first cultivation encourages weed germination, and the second (7-10 days later) kills off any weeds that emerge. The crop is planted soon after into this "stale" seedbed. This operation is best done in the morning on a sunny day so uprooted weeds will dry out and not re-establish. Higher seeding rates will make the crop more competitive, and compensate for crop losses due to post-emergent fingerweeding.

Table 1. Best Management Practices for Wild Radish Control[2,3]

Prevention
• Use clean seed
• Scout your field and rogue at flowering in the first year weeds are spotted (Don't wait until next year!)
• Use a modified swather to reduce seed production by cutting the tops of weeds above the grain in July
Diversify Crop Rotations
• Longer term crops (pasture, forage)
• Crops that develop rapidly with full canopies
• Sturdy crops that allow aggressive mechanical weeding (potatoes and turnips)
• No-till seeding of fall seeded crops (winter rye, hairy vetch) to minimize seedbank disturbance
• Modify according to field history and future needs
Primary Cultivation
• In a clean field: Minimize inversion/vertical mixing
• In a weedy field:
- Maximize shallow tillage before or at the first true leaf stage (in top 5 cm)
- Mow green manures to form a mulch, then till into soil before sowing (use oats, barley, legumes, rye, hairy vetch, red clover)
- Use smother crops (oats, barley, rye, vetch)
- Include a period of fallow
Secondary Cultivation
• Tillage should be shallow, above 5 cm
• Promote germination of weed seeds by:
- Pack or roll after tillage to ensure good contact between the weed seed and soil
- Use shallow cultivation to alternate light/dark, which can trigger germination
• Create false seed bed then follow with a stale seed bed (repeated packing and shallow tillage):
- Create initial seedbed with 1 cm tillage
- Promote weed germination
- Cultivate/harrow to kill weeds 2–3 times
- Drill crop 4-7 days after first tillage (perhaps longer for fast germinating crop seeds)
• Blind harrowing at the pre-emergent or post-emergent (3-5 leaf) stage for cereals that are deeply drilled and robust
• After drilling the crop, control weeds with thermal/flame weeding, chain harrow
• Frequent mowing can prevent weed seed set
Sowing Crop
• Increase seeding rates by 10-20% and cross seed with 2 passes to increase crop competitiveness and compensate for mechanical weeding losses
• Accuracy with drilling is important to ensure no gaps occur between the runs
• If possible, use wide rows with twice the normal seeding rate in each row to allow aggressive interrow cultivation
Harvesting
• Capture weed seeds with a chaff collector on combine
Eliminating Autumn Flushes
• Seeding a winter cereal or a cover crop using cultivation practices described above where possible
• Underseeding a forage crop with the spring crop will eliminate tillage and will compete with weeds in the fall

Table 2.Treatment details of BOMP and NORM operations at two organic farms in PEI, 2005

Farm #1 (Oat- Barley)	
Both NORM and BOMP	Disc and S-tine
	Fingerweeding before seeding
	Post-emergent fingerweeding
BOMP	Roll after first cultivation
	Increased seeding rate
	Pre-emergent fingerweeding
Farm #2 (Barley)	
Both NORM and BOMP	Chisel plow and cultivate
	Roll after seeding
	High and low seeding rate
	Post-emergent fingerweeding
	Underseeding
BOMP	Use of false seedbed
	Increased seeding rate
	Pre-emergent fingerweeding

Rolling after tillage to pack the seed bed encourages weed seed germination. Fingerweeding cultivates the soil very shallowly, so can be used for pre-emergent and post-emergent operations without significant crop damage. Fingerweeding is most effective in killing small weed seedlings. Although there is some risk to the crop, a post-emergent fingerweeding can be done at the crop's 3-5 leaf stage to reduce competition from late-emerging weeds.

To compare the treatments, we measured crop establishment, wild radish and total weed density and biomass (fresh weight), and crop yield.

WHAT HAPPENED?

At **Farm #1,** an oat-barley (3:1) mixed crop was grown at a field scale with several strips each of the BOMP and NORM treatments (Table 2). The increase in seeding rate applied to the BOMP plots did not have a large effect on crop density, with an average of around 155 plants m^{-2} across all treatments.

The BOMP treatment reduced the biomass and density of wild radish compared with the NORM. This was most likely as a result of pre-emergent fingerweeding. August wild radish densities were reduced on average from 3.44 plants m^{-2} in the NORM to 0.48 plants m^{-2} in the BOMP. Wild radish fresh weight was 2.5% of the total weed weight in the BOMP, and 17% of the total weight in the NORM. Although wild radish was reduced, there was not a higher yield in the BOMP treatments. Other weeds were more problematic than wild radish, especially couchgrass (also known as quackgrass). Yield was reduced substantially by the couchgrass; the BOMP treatments did not help to control this weed. Although wild radish is a highly visible weed in the field, other weeds may be an even bigger problem. It is important to consider all of the weeds together when developing a management plan. A guide for couchgrass (quackgrass) control written by Jean Duval in Québec can be accessed on the OACC website[5].

At **Farm #2,** barley was seeded at two rates (130 and 160 lbs ac^{-1}) across both the BOMP and NORM treatments. Barley density was low overall at 60-75 plants m^{-2}, possibly due to losses from post-emergent fingerweeding. We didn't measure a big difference in the number of plants resulting from the different seeding rates. At harvest, there were slightly more heads m^{-2} (mainstems plus tillers) in the BOMP treatments, and at high seeding rates, but the difference wasn't large enough to be statistically significant.

Wild radish density ranged from 0-44 plants m^{-2}, averaging 3.3 plants m^{-2}. The BOMP treatments did reduce the density of radish plants in the crop; however, it did not reduce the biomass.

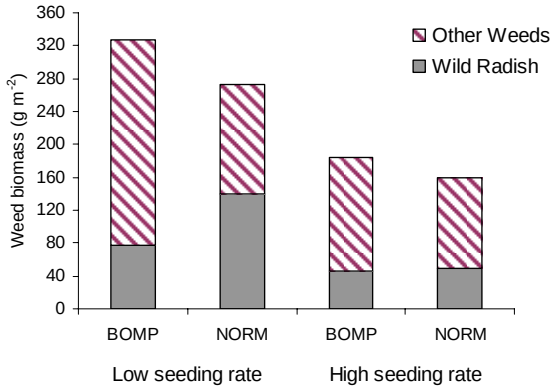

Figure 1. Total weed and wild radish biomass: Farm #2

The tillage operations appeared to reduce the wild radish population, but the smaller number of weeds compensated by increasing in size.

Despite a relatively small difference in the crop density between seeding rates, increasing seeding rate reduced the biomass of wild radish, in both the BOMP and NORM treatments (Figure 1). The higher seeding rate also made the crop more competitive with other weeds. Biomass of weeds other than wild radish was highest in the low seeding rate of the BOMP treatment.

SUMMARY

Overall, a combination of BOMP treatments and a high seeding rate proved to be the best way to reduce both density and biomass of wild radish. Although we did observe changes in weed competition, neither the increased seeding rates nor the BOMP practices increased crop yield. However, effective management of wild radish will reduce the number of seeds produced and lessen potential problems in future years. Our BOMP practices were not effective on all other weeds. Couchgrass is a very different weed from wild radish so this is not surprising. The effectiveness of the BOMP practices identified in this research for controlling other weeds needs to be studied further.

Post-emergent fingerweeding for weed control (K. Punnett)

CREDITS

Andy Hammermeister, Kate Punnett and Roxanne Beavers (ed.)

THE BOTTOM LINE...

A systems approach to wild radish control can reduce weed competition in organic feed grains.

Using a combination of stale seed bed techniques, increased seeding rate, and pre-emergent and post-emergent fingerweeding provides the most effective wild radish control.

REFERENCES

[1] Cheam, A. H. and Code, G. R. 1995. The biology of Australian weeds. 24. *Raphanus raphanistrum* L. Plant Prot. Quart. 10:1-13.

[2] Effects of Weeds on Wheat. 21 June 2001. Agriculture, Food and Rural Development. (http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/crop1280?opendocument)

[3] Bond, W. and Turner, R.J. 2004. The biology and non-chemical control of Wild Radish. HDRA: The Organic Association. (http://www.organicweeds.org.uk)

[4] Royer, F. and Dickinson R. 1999. Weeds of Canada and the Northern United States. Lone Pine Publishing.

[5] Duval, Jean. Quackgrass (*Elytrigia repens*) control methods in organic agriculture. (http://oacc.info/Docs/Quackgrass_final_rev_JD.pdf)

ACKNOWLEDGEMENTS

The participation and support of Carey Gillis (Belle River, PEI), Laura and Robert Robinson (Pisquid, PEI), Susan McKinnon (PEI Department of Agriculture, Fisheries and Aquaculture), and OACC technicians is greatly appreciated.

FUNDING

Prince Edward Island Department of Agriculture, Fisheries and Aquaculture

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

For more information:
Visit **oacc.info** or contact us at
P.O. Box 550 Truro, NS B2N 5E3
Tel: (902) 893-7256
Fax: (902) 896-7095
Email: oacc@nsac.ca

Nova Scotia Agricultural College