



UNIVERSITY OF  
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# VEGETABLE CULTIVAR AND CULTURAL TRIALS 2009

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Saskatchewan  
Agriculture  
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## Root Maggot Control Trial

Root maggots (*Delia radicum*) represent a major problem for growers of cole crops in Saskatchewan. Maggots damage to the roots renders them less capable of delivering the water and nutrients required for optimal growth. In vegetable crops grown for their roots (rutabaga and radish), the scars left by the feeding maggots make the roots unmarketable. Biological and cultural control practices may reduce problems with maggots but some form of chemical control is usually required. In Canada, the standard approach to controlling maggots is to apply the insecticide chlorpyrifos (Lorsban) as a root drench on several occasions through the growing season. The chlorpyrifos must be applied in enough water to carry the chemical deep into the soil profile to where the maggots are feeding. The timing of application is targeted to correspond to the development of the maggot population. Applications of chlorpyrifos must cease 30 days prior to harvest for rutabaga. As organophosphates like chlorpyrifos are relatively toxic to both the applicator and the environment this type of pesticide has been targeted for phase out as soon as effective reduced risk alternatives have been identified. The objective of this project was to test new reduced-risk products for potential use as a tool for root maggot management in vegetables.

The project was conducted in 2009 using a standard protocol at four sites across Canada (BC, SK, ON and QC). The Saskatchewan site was managed by the U of S in Saskatoon. Repeated cropping of this site to crucifer vegetables, coupled with the presence of commercial canola fields nearby has resulted in a large population of root maggots at this site. Production of vegetable cole crops is virtually impossible at this site – even with repeated applications of pesticides.

The trial was seeded in early June using cv. Laurentian rutabagas. Each treatment consisted of two adjacent rows of rutabaga (60 cm apart), with each treatment replicated four times in a randomized complete block design. The plants were hand thinned to a 10 cm spacing soon after emergence. The plot was kept weed free by hand weeding. Overhead irrigation was used to maintain optimum soil moisture levels throughout the growing season. No problems with crop development or health were observed, beyond the expected problems with root maggots. Cool weather throughout the 2009 growing season was near-ideal for the rutabaga crop.

The root maggot control treatments tested at the U of S site in 2009 are outlined in Table 1. All treatments except Trmt 8 were used at all sites. Except for Trmt 1, the control products were applied three times over the season, starting at the first true leaf stage and then repeated at two week intervals (June 27, July 10, July 24). In all cases except Trmt 9 the control product was applied using a small CO<sub>2</sub>-driven plot sprayer fitted with 80-08 flood nozzles to deliver the product in the equivalent of 1000 L/ha of water over a 15cm wide spray band. Trmt 9 was applied to the foliage in 100 L/ha of water using 8002 flat fan spray nozzles. Trmt 10 involved application of just water and served as the control. **Only Trmt 6 (Chlorpyrifos) is presently registered for root maggot control on rutabaga in Canada.**

The efficacy of each round of spraying was evaluated 2 weeks after treatment. For the first 3 rating dates 10 plants from each treatment replicate were evaluated for root damage using the semi-quantitative 0-5 rating scale outlined by Dossdall et al. (1994)(0=no damage : 5=severe damage). The 0-4 damage scale outlined by King and Forbes (1954) was used for the last evaluation on Aug 25<sup>th</sup>. This method of evaluation is based on the number of knife cuts required to remove the maggot damaged tissues from mature roots (maximum of 4).

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## Results

Some root damage was observed at the first evaluation (July 8) and the presence of large numbers of eggs suggested that the maggot problem would worsen. This was confirmed by the progressive increase in severity of maggot damage seen in subsequent evaluations.

Beginning at the first evaluation and continuing through to the final harvest, the chlorpyrifos treatment clearly provided the greatest degree of maggot control. The only other treatment that provided any degree of control was the high rate of the presently unregistered product CCCCC.

At the 4<sup>th</sup> and final evaluation conducted on Aug 25<sup>th</sup> most of the maggot damage observed was old healed-over scars that had expanded in size along with the roots. These scars rendered many roots unmarketable, even in the treatments that had provided some degree of maggot control. This suggests the importance of thorough maggot control early in the crop's development.

**Table 1. Influence of pesticides on root maggot damage rates in rutabaga (Saskatchewan 2009).**

Treatment	Application	Maggot Damage Ratings				
		Mean <sup>1</sup> (SEM)	Mean (SEM)	Mean (SEM)	Mean <sup>2</sup> (SEM)	% marketable <sup>3</sup>
		Jul-08	Jul-23	Aug-07	Aug-25	
1. AAAAAA	1 X Root drench	0.80 (0.16)	2.65 (0.35)	3.30 (0.37)	3.60 (0.14)	0
2. AAAAAA	3 X Root drench	0.80 (0.27)	2.10 (0.31)	2.80 (0.25)	3.25 (0.25)	0
3. BBBBBB	3 X Root drench	0.70 (0.24)	2.30 (0.17)	3.30 (0.13)	3.75 (0.13)	0
4. CCCCC (rate 1)	3 X Root drench	0.50 (0.37)	2.10 (0.31)	3.30 (0.33)	3.15 (0.53)	10
5. CCCCC (rate 2)	3 X Root drench	0.55 (0.43)	1.5 (0.25)	2.85 (0.34)	2.50 (0.44)	20
<b>6. Chlorpyrifos</b>	3 X Root drench	<b>0.05 (0.05)</b>	<b>0.25 (0.15)</b>	<b>0.75 (0.17)</b>	<b>0.85 (0.26)</b>	<b>75</b>
7. EEEEE	3 X Root drench	0.20 (0.14)	3.25 (0.39)	3.35 (0.29)	3.40 (0.16)	0
8. FFFFF	3 X Root drench	1.05 (0.28)	2.60 (0.36)	3.25 (0.09)	3.25 (0.13)	0
9. GGGGG	3 X Foliar	1.20 (0.41)	2.75 (0.24)	3.05 (0.48)	3.95 (0.20)	0
<b>10. Water (control)</b>	3 X Root drench	<b>1.10 (0.38)</b>	<b>3.25 (0.33)</b>	<b>3.45 (0.22)</b>	<b>3.85 (0.25)</b>	<b>0</b>

1. For Jul 8, Jul 23 and Aug 7 ... a damage rating of 0=no damage : 5 = severe damage.

2. For Aug 25 ... a damage rating of 0 = no damage : 1 = damage removed with one cut, 2 = two cuts, 4 = maximum.

3. Roots with a damage rating of 2 or less are considered to be marketable.

## Conclusion

This trial illustrates the severity of the maggot problem facing growers in Saskatchewan. Maggot damage increased as the season progressed, reflecting both a progressive accumulation of maggot damage as well as the expansion of the damaged areas as the roots grew. **By late August, in the untreated rows 100% of the roots had been rendered unmarketable due to maggot damage.** Chlorpyrifos, which presently represents the standard treatment for maggots across Canada, provided a level of maggot control that was far superior to all other treatments including the control. While three applications of chlorpyrifos kept the crop relatively well protected through late August it should be noted that rutabagas are not typically harvested in Saskatchewan until early October in order to allow the roots to accumulate the sugars required for peak quality. As this fall period also coincides with the development of large populations of 2<sup>nd</sup> or 3<sup>rd</sup> generation of maggots another application of insecticide may be required in mid-late August to keep the crop protected through until the final harvest. If chlorpyrifos is used this final treatment must be made at least 30 days prior to harvest.

**NB : OTHER THAN CHLORPYRIFOS, NONE OF THE PRODUCTS TESTED ARE APPROVED FOR USE FOR MAGGOT CONTROL IN CANADA.**