2016 Wireworm Research & Extension Seminar

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For the third year in a row, there was a large turnout for the Wireworm Research and Extension Seminar. Almost 200 farmers and industry partners came to Red Shores Racetrack in Charlottetown on March 14th, 2016 to listen to a full day of presentations from researchers and industry representatives on the results of recent wireworm and click beetle research as well as new control methods.

Evaluation of Chemical Control Options:

For a number of years, researchers from Agriculture and Agri-Food Canada have been conducting trials on a number of chemical control options for wireworm control. Thimet (phorate) has been available for many years, but was recently scheduled for de-registration. Following a new submission based on a new formulation and a new method of application, Thimet 20G has been registered for use, and has been shown to have a significant effect on controlling wireworms when applied at planting. In addition, Capture (bifenthrin) has now been approved for the past two growing seasons and has also shown to be an effective control option for wireworm when applied as a liquid in-furrow spray at planting.

Both Dr. Christine Noronha and Dr. Bob Vernon of Agriculture and Agri-Food Canada presented the results of multiple years of research that has shown that both Thimet and Capture are effective at controlling wireworm. Laboratory conditions show that Thimet appears to kill wireworms, while Capture repels wireworms from the tuber zone but does not necessarily show the same lethal effect as Thimet. Nonetheless, both control methods appear to be equally effective at preventing tuber damage. Additionally, Mark MacMillan of FMC presented data from a couple of research trials conducted by Cavendish Farms and Technology Crops International that appear to confirm previously obtained results from AAFC regarding the equivalence of control for Thimet and Capture. Additionally, there appears to be a slight improvement in control when Capture is combined with a neonicitinoid such as Titan (clothiandin). This neonicitinoid is then also effective in controlling insects such as Colorado potato beetle.

Metarhizium spores attacking wireworms.
Photo courtesy Todd Kabuluk, AAFC

In addition, Delly Keen from the Pest Management Regulatory Agency (PMRA) of Health Canada spoke briefly about new conditions for use of Thimet 20G. She advised growers to pay close attention to the label, as there are some changes with the newly approved product. The largest change is that SmartBox systems are required to apply Thimet 20G at planting, along with pinch valves to prevent release of granules of product at the end of rows. In addition, there are some new precautionary regulations in effect when it comes to handling and applying the product, as well as new application rates for the product. Delly noted that PMRA has a new smartphone app that allows for quick access to labels for all approved agricultural pesticides.

Biological Control of Click Beetles and Wireworms:

A first time speaker at the Wireworm Seminar was Todd Kabuluk of AAFC in Agassiz, British Columbia. Todd has been researching biological control of click beetles and wireworms for a number of years, and is conducting research as part of the Canadian Horticultural Council National Cluster Project along with other AAFC researchers. Of particular interest is research into the use of a beneficial fungi to control click beetles and wireworms. The fungal species is Metarhizium, of which

two strains are being actively researched: one is a strain already registered with PMRA (called Met52), while another (called LR112) has been isolated and identified by Todd and his research partners. When click beetles or wireworms are exposed to Metarhizium spores, these spores attach to the insect and can quickly kill it.

Todd was able to show that using Metarhizium spores in combination with a pheromone attractant on granules spread in a field led to kill rates as high as 95 percent. The trick will be to find cost-effective methods to deploy the spores that are not compromised by weather conditions like rain. Todd indicated that he will be continuing his research this year, with improved bait-and-kill methods being investigated as well as exploring a method to apply the spores as a commercial spray for use on fields and headlands/buffer zones to kill click beetles. There is also work being done on how Metarhizium could be deployed to directly kill wireworms in the soil as well, though this may provide additional challenges.

The use of biopesticides, including this research into Metarhizium, is very exciting, as it represents a targeted insect control option that is also very environmentally friendly. Research into biopesticides for a number of crop diseases and pests is rapidly expanding, and new products are coming to market each year.

Trapping Click Beetles:

An exciting development unveiled at the seminar was a new trap designed and tested by Dr. Christine Noronha to catch click beetles, particularly females. Existing pheromone traps designed by Dr. Bob Vernon work very well at attracting and trapping male click beetles but do nothing to trap egg-laying females. This new trap simply features a solar-powered spotlight, a cup for the beetles to fall into, and chicken wire enclosure to keep out larger beneficial beetles and rodents. This trap, called the Noronha Elaterid Light Trap (NELT), is low-cost to put together and was shown in one year of testing to trap a substantial number of female beetles, hopefully preventing them from laying eggs in fields. Christine was able to show the math that collecting approximately 400 female click beetles per trap in her limited trial could theoretically prevent tens of thousands of eggs from being laid and creating new wireworms, just from one trap!

There is more work to be done to determine the ideal placement and number of traps necessary to make a difference in click beetle populations. Additionally,

Dr. Christine Noronha of Agriculture and Agri-Food Canada in Charlottetown, PEI with a 3D printed prototype of her newly designed "Noronha Elaterid Light Trap" (NELT).

Christine is reaching out to manufacturers who might be interested in making these traps available to growers on a larger scale.

Dr. Bob Vernon also shared results of research into click beetle trapping and spraying that was done in three PEI fields in 2015. Three fields with large click beetle populations had pheromone traps installed, and hundreds of thousands of click beetles were gathered in these traps. Click beetle numbers were high both in the headlands as well as in the field itself. These fields (in forage in 2015) were sprayed with an insecticide to assess its effectiveness at killing click beetles. Use of the high rate of insecticide killed only 50% of click beetles, so additional research will be required to identify ways to maximize click beetle mortality. Additionally, it was shown that following insecticide sprays in the field, there was a rapid migration of beetles from headlands and buffer zones back into the field, which presents challenges as well.

Joanne Driscoll from the PEI Horticultural Association presented on the second year of research that their group has been doing into the emergence and life cycle of adult click beetles in an effort to build a degree day model that will reliably predict when click beetles will emerge and

start to breed and lay eggs under PEI conditions. They were able to show that emergence seems to begin in late May, with the population reaching maximum size soon after (early June). From 2015 research, it appears that click beetles reach peak emergence at an average of 78 degree-days after April 15th.

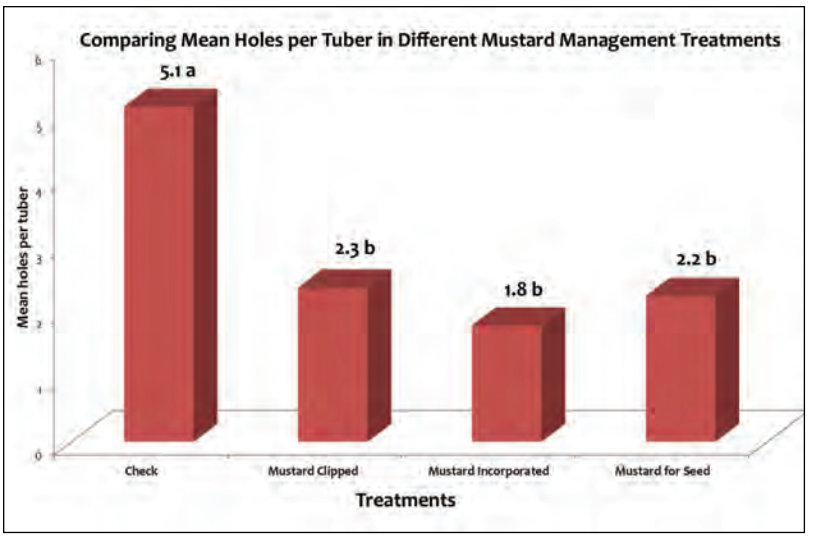
Use of Biofumigant Crops:

The last presentation of the day by Ryan Barrett, Research Coordinator of the PEI Potato Board, dealt with examining the use of biofumigant crops such as brown mustard or buckwheat to help control wireworm populations. Using research results from previous years by AAFC and Cavendish Farms, Ryan was able to show that both brown mustard and buckwheat have been shown to significantly decrease wireworm damage when grown in rotation before potatoes. There is still a lot to learn about how these crops are controlling wireworm, including the effect played by tillage versus the biological action of the plants and their biofumigant properties. Nonetheless, there is evidence that these crops can have some effect on reducing damage to potatoes. Additionally, Ryan presented some data that indicates that growing biofumigant crops can also have an impact on total and marketable yield. This may be due to beneficial effects of these crops on other soil-borne diseases and pests such as Verticillium, root lesion nematodes, and common scab. More research is needed under Prince Edward Island conditions, but studies from elsewhere appear to show positive effects on marketable yield and disease suppression, particularly with brown mustard.

Incorporating brown mustard as a biofumigant crop.

On-Farm Trials with Rotation Crops

Ryan was also able to present data from on-farm research into brown mustard that has been undertaken at two Island farms. At Klondike Farms in Wilmot Valley, the Hogg family has been working with Dr. Noronha of AAFC. One trial completed in 2015 looked at the effect of clipping mustard through the growing season rather than incorporating the mustard in a conventional manner. This trial has four treatments: control (barley), mustard clipped through the season and incorporated the next spring ahead of potato planting, mustard incorporated during the season, and mustard left to grow for seed with seed harvested in the fall. All three of the mustard treatments showed significantly fewer holes per tuber



Results from 2015 research at Klondike Farms indicates that damage in potatoes after clipping mustard through the growing season or growing mustard for seed purposes performs largely the same as mustard incorporation when compared to potatoes grown after a non-mustard check.

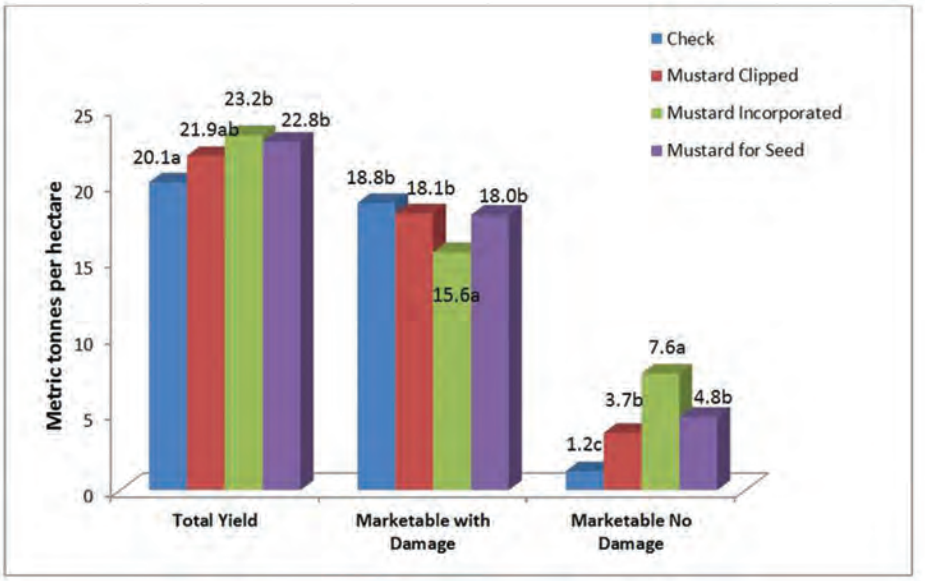
(between 1.8 and 2.3) compared to the control treatment (5.1). Additionally, all of the mustard treatments had significant increases in marketable yield compared to the control. The treatment where mustard was incorporated in the summer had the highest yield with no damage at all, but the other two mustard treatments also showed a significant improvement over the control. This indicates that not only does conventional incorporation of brown mustard for biofumigant purposes lead to marketable yield increases (approximately 27 cwt/ac in this trial) and reduced holes per tuber, but simply growing mustard and clipping multiple times during the year and leaving brown mustard as a winter cover also can significantly reduce damage. This might be a valuable tool for a number of farms where levels of damage due to wireworm is not at critical levels or where crops are not destined for a table market, which have a lower tolerance for wireworm damage to meet grade standards.

Experience working with mustard at Gerrit Visser and Sons was also presented, with William Visser on hand to relate their experiences and answer questions from those in attendance. They have been working with brown mustard and buckwheat for the past two seasons and have been working on a couple of different field trials. In one trial, potatoes grown following mustard that was incorporated in the summer showed a higher percentage of tubers with no holes than potatoes following winter wheat, a significant factor for their tablestock varieties. Buckwheat also showed a positive effect, but not quite as high as brown mustard. While there was no significant difference in total yield, there were higher crop values in the potatoes planted after mustard was grown. William noted that they have some additional trials that they are working on, but that as farmers, they would greatly appreciate assistance in helping set up trials and getting reliable data at the end of the trial.

Work planned for 2016 will include assessing the value of multiple years of biofumigant crops as well as the effect of summer fallow with tillage. William also noted that through working with brown mustard and learning from researchers, they have changed their mind about the timing of incorporation. Since there is a higher likelihood that incorporation of biofumigant crops will have an effect on newly laid eggs and neonate wireworms than on resident wireworms, they have moved their incorporation of mustard up to July rather than in the fall. This also allows for the planting of a cover crop following the mustard incorporation which provides winter cover and can be easily tilled before potato planting.

There was also a discussion about the cost of growing biofumigant crops. Estimates of variable costs from a number of Island potato growers ranged between $110 and $190 per acre, depending on the crop or variety grown and how the crop was managed. One of the key points raised was that while there is a cost to growing brown mustard or buckwheat, there is also a cost to growing other non-commercial crops like forages in rotation, and that this should be taken into account when comparing costs across crops. Even if there was a $200 cost per acre to grow brown mustard, it would only require about a 20 cwt per acre improvement in marketable yield to break even. In many trials already conducted, that level of improvement in marketable yield as well as the associated reduction in holes and scars per tuber has been surpassed.

The 2016 Wireworm Research and Extension Seminar was organized by the PEI Wireworm Research Working Group, with representatives from the industry, government, researchers and regulatory agencies all collaborating to foster research into wireworm and help provide answers for Prince Edward Island farmers on how to manage wireworm on their farms. While it was often repeated that there are no "silver bullets" for combatting this destructive pest, there are more tools in the toolbox than there was just a couple of years ago, and research is ongoing to provide more control options for growers.



Results from 2015 research at Klondike Farms shows that while potatoes grown after incorporated mustard had the highest total marketable yield (far left) and the highest marketable yield with no damage at all (far right), potatoes grown after mustard that was clipped during the growing season as well as potatoes grown after mustard grown for seed also show higher yields of unblemished tubers and total marketable tubers than the control treatment. This indicates that alternative forms of cultural management for brown mustard may have a beneficial impact at reducing wireworm damage. Yield units are in metric tonnes per hectare. Data analysis and graph provided by Dr. C. Noronha, AAFC.