Envisioning an Integrated Approach to Wireworm Management
-Monitoring and Biological Control

Todd Kabaluk
Agriculture and Agri-Food Canada
Pacific Agri-Food Research Centre
Agassiz, British Columbia
Todd.Kabaluk@agr.gc.ca

Research over the past several years has advanced two areas of wireworm management: estimating field population levels to predict their risk to potatoes and corn, and reducing field population levels and crop damage through the granular application of the biocontrol Metarhizium strain LRC112. Most recently LRC112 was shown to provide 100% control of the adult click beetles, and targeting click beetles will be investigated further in the coming years.

Wireworm monitoring

Invented and developed at PARC, Agassiz, a new wireworm trap (aka 'probe trap') makes monitoring for wireworms an easy and efficient task. Using the trap to know if wireworms are present will i) inform conventional growers of potatoes and corn if pesticide applications are necessary for wireworm control; and ii) inform organic growers to plant crops not susceptible to wireworms. At this time, the method for using the probe trap is provisional i.e. its use has been shown to predict wireworm damage to potatoes and corn, but it is uncertain whether the prediction will be accurate on every occasion. For example, we can know that wireworms will be a problem and cause crop damage if the traps show that wireworms are present, but we *do not know for certain* if wireworms will be a problem if no wireworms are caught in the trap. If no wireworms are caught, then is it because they aren't there, or because environmental conditions were such that no wireworms were attracted to the trap, even though they are present in the field? We refer to this latter occurrence as a 'false zero', and are minimizing its occurrence through i) prescribing specific conditions for using the trap; and ii) identifying all possible conditions that would lead to a false zero.

At this time, we are predicting wireworm damage to potatoes and corn the following year by monitoring for wireworms in long-term grasses (e.g. set-aside land, forage, or any longer-term (3 years or greater) rotational perennial). We are doing this by i) rototilling an approximately 2m wide strip diagonally through the field in the spring; ii) keeping it lightly tilled throughout the summer; and iii) placing wireworm probe traps every 10m down the centre of the strip in early October, and collecting the wireworms from traps after 10 days. On-farm field trials have shown these catches to be predictive of wireworm damage to potato and corn (Figure 1).

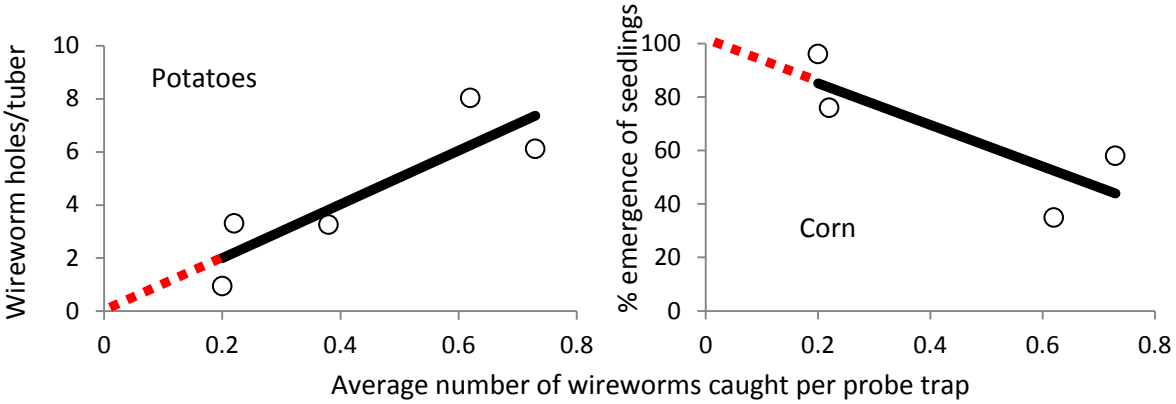

Figure 1. Damage to potato and corn the year after assessing wireworm levels using the probe trap. Red dashed lines show that if the relationship was extended to '0' wireworms caught, zero holes/potato tuber and 100% corn emergence are predicted, confirming the accuracy of the monitoring method.

Over the next few years, we will be verifying these findings, and then recommending a monitoring method to professional pest managers to implement as part of their pest monitoring activities for potato and corn growers.

<u>Biological control of wireworms and click beetles</u>

The insect fungal pathogen Metarhizium LRC112 was discovered in Agassiz and has been shown to be the most virulent biological control of wireworms compared to any other tested, worldwide. For several years, we used granular applications of LRC112 to reduce wireworm levels and the damage they cause to potato. While it reduced wireworm damage by an average of 33% (Figure 2), it was still not enough because wireworm levels in most farm fields are just too high. So, we changed our focus to targeting the click beetles with granular, dust, and spray applications of LRC112 spores. Controlling click beetles in the spring will reduce egg-laying and ultimately, the soil populations of the wireworms themselves. Both granular and dust applications reached or approached 100% control of the beetles under field conditions (Figure 3). While we do know that controlling beetles will ultimately reduce wireworms, we do not know exactly how this will happen e.g. how many years of application, and how many applications within a single year are necessary? That will be the subject of research in the years ahead.

We are aiming to increase the efficacy of LRC112 in targeting beetles by combining its use with pheromones. We believe this will reduce the number of applications required, and target a larger proportion of the population with each application.

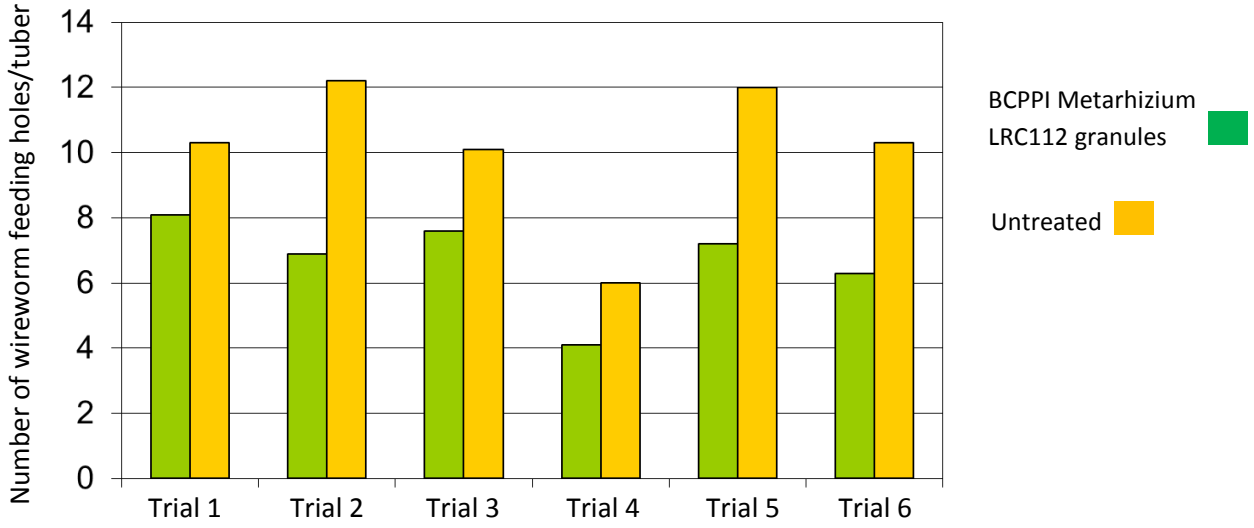

Figure 2. A 33% (average) reduction in wireworm feeding damage to potato tubers in six field trials after the application of broadcast preplant incorporated (BCPPI) Metarhizium LRC112 granules.

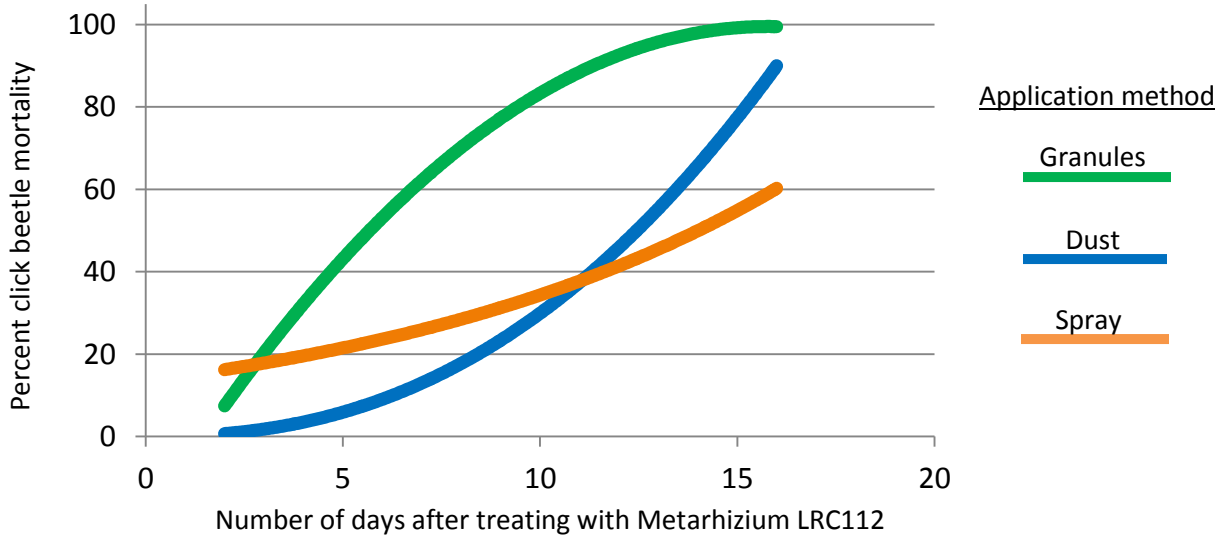

Figure 3. Click beetle mortality in response to three application methods of Metarhizium LRC 112.

<u>Envisioning an integrated approach to wireworm management</u>

By wireworm monitoring the year- or years before planting, we will be able to determine if control is necessary when we plant potatoes or corn. If we find that there will be a problem, we can apply Metarhizium LRC112 as a biological control. Even if we need a synthetic pesticide at planting, we might be able to provide long term control of wireworms by applications of LRC112 with pheromone within the field or around the field margins to target click beetles. Granular applications of LRC112 at the time of planting potatoes will reduce wireworm damage to acceptable levels in potato if the wireworm populations are not too high to begin with.