Wireworm Control using Fodder Rape and Mustard – evaluating the use of brassica green manures for the control of wireworm (*Agriotes spp*.) in organic crops

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Wireworms are a soil-inhabiting crop pest. Larvae attack many crops, particularly potatoes, and even low populations can cause an economic level of damage. In the UK, high wireworm populations are traditionally associated with long-term grass leys (Parker and Howard, 2001). In the case of organic production, potato crops frequently follow a long-term fertility-building grass ley. Organically grown potatoes, where soil treatment with insecticides is prohibited, are therefore particularly vulnerable to wireworm damage and there is a need to identify effective alternative methods of control.

Alternatives to pesticide control include cultural methods which discourage wireworm attack such as rotating a vulnerable crop with a resistant non-host crop and sowing crops of brassica green manures prior to planting. Mustard (*Brassica nigra* and *Sinapis alba*) is claimed in the organic literature as a soil conditioner that can control soil born pests in general and wireworms in particular.[i] These claims have not been scientifically tested though it is known that glucosinolates contained in cruciferous plant tissues are hydrolysed to a variety of biologically active products that can control soil-borne pests (Parker and Howard, *ibid.*; Lichtenstein *et al*., 1964)

In 2001, ADAS undertook a field experiment at Pwllpeiran in mid Wales to test the hypothesis that wireworm damage to potato crops can be controlled by the use of brassica green manures. This initial experiment was undertaken on non-organically certified land. The field was previously a long-term ley that was ploughed out in March 2001.

In May 2001 a randomised block design was established with two treatments and a control, with two replicates of each treatment. Each of the 6 blocks comprised a 10-metre row length. The treatments were, (1) mustard grown for six weeks then rotavated in prior to potato planting, (2) fodder rape grown for six weeks then rotavated in prior to potato planting, (3) No-treatment.

Potatoes were planted on a 0.75m row width with 14 inch spacing on June 18, variety King Edward. Plants emerged on 6 July, and tubers were harvested on 19 September.

Post harvest, all tubers were examined and the damage caused by wireworms and slugs was assessed. Overall it was found that the average number of tubers with wireworm holes was 32.17%, with an average of 29% tubers damaged for the mustard treatment, 32.0% for the fodder rape treatment, and 35.5% for the tubers from untreated plots. It was also found that an average of 10.83% of all

tubers had slug damage, with an average of 5.5% tubers damaged for the mustard treatment, 13.5% for the fodder rape treatment and 13.5% for the tubers from untreated plots.

Data from the experiment was analysed using Analysis of Variance (Genstat 5). Although it was found that there were significantly more tubers damaged by wireworms than by slugs, there was no significant statistical difference in levels of damage between the two treatments and the control group.

The variability in damage between individual experimental plots was high and therefore significant differences between treatments were not easily detected. There was however, a trend for lower levels of slug damage on the mustard treatments in comparison to the control and fodder rape treatment. This was also noted for wireworm damage. It is therefore suggested that further field experiments with longer periods of pre-planting treatment should be undertaken on certified organic land. Experiments on wireworm populations in controlled environments to investigate how far the breakdown products of brassica green manures are toxic to wireworms should also be undertaken.

References

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i. Mustard is claimed in the organic literature as a soil conditioner that can control weeds and soil-borne pests (Franck, 1983*)*. It is claimed as “a good remedy on soil which is infested by wireworm” by bio-dynamic growers (Soper, 1996) and the herbalist de Bairacli Levy claims that mustard, advocated in Victorian farming journals, kills the eggs of soil-borne insects (de Bairacli Levy, 1966). One suggestion is that mustard can control wireworm by accelerating the life cycle of the pest. Wireworms can spend several years in the immature stage during which they feed on grass and crop roots, and the founder of the HDRA suggests that when a mustard green manure is incorporated into the soil, wireworm gorge on the organic matter and rapidly move to the pupa stage. Subsequent potato plantings then avoid attack by wireworm larvae (Hills, 1971). This suggestion has not been scientifically tested and is counter to insect physiology. Insects are cold blooded and rate of development is strictly related to temperature. Food quality may affect eventual size, but not rate of growth (Parker, written communication; see also Parker & Howard, 2001). It has also been suggested that mustard has a root exudate toxic to wireworms that controls the pest.