SUSTAINABLE WIREWORM IPM

WIREWORMS IN THE UK

A fera led collaborative R&D model

ENIGMA

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WIREWORMS ARE THE LARVAE OF CLICK BEETLES (ELATERIDAE). THEY DAMAGE ROOT CROPS SUCH AS POTATOES AND CARROTS AS WELL AS THE STEMS OF SOME CROP PLANTS, INCLUDING CEREALS, FIELD BEANS, LEEKS, LETTUCE, ONIONS, PEAS, MAIZE AND SUGAR BEET.

Wireworm damage is a barrier to implementing regenerative agriculture practices, particularly in cereal crops where tilling is recommended to reduce wireworm populations. Wireworm populations in minimum tillage systems are as high as wireworm populations on land previously under grass.

The pattern of wireworm damage has changed over the last few years. The amount of damage has increased and damage now occurs in crops on land which has never been under grass. It also occurs earlier in the season, making it impossible to avoid by lifting root crops early. In order to understand the changing dynamics of wireworm damage and to use Integrated Pest Management (IPM) to reduce and avoid wireworm damage, we must understand why and how damage patterns are changing. We need to monitor wireworm populations, understand how these translate into crop damage and design new strategies to minimise the commercial risk.

Monitoring is pivotal to IPM in any crop system. However, we currently do not have good wireworm sampling protocols or an easy way to identify the wireworm species which are present. Therefore, it is very difficult to monitor wireworm populations to allow predictions as to where and when they will cause damage to crops. We also have little understanding of the effects of climate change and changing crop rotation practices on populations of different wireworm species. There is evidence that some cover crops can reduce wireworm damage by releasing compounds which are detrimental to wireworms whereas others increase wireworm damage by providing a food source.

SOLVING THE WIREWORM IDENTIFICATION PROBLEM USING MOLECULAR TECHNOLOGY

Have different species become prevalent in recent years? Or were the species misidentified in the first place? Or have both happened?

We can now develop next generation molecular methods to quickly identify wireworm larvae. Some of this work has been done and we can use publicly available reference sequences to develop protocols to identify some species. Where there are gaps in the reference databases (i.e. species for which there are no reliable sequences) we can generate sequences from morphologically identified adult beetles that have been collected in the field or reared from larvae. Specimens from insect collections may also be used to generate missing reference sequences, depending on the condition of the specimens.

We will investigate options for developing this work into a fast turnaround service for wireworm identification.

MONITORING WIREWORMS

Which species are causing damage on which crops in which areas of the country?

Molecular identification will allow us to answer these questions much more effectively than has been possible in the past. We will also determine which species are causing the greatest amount of crop damage.

We will do this by collecting wireworms from crops, from land which is currently, or which has been, under a cover crop, and from soil sampling. We will also collect wireworms from processing lines. We will ascertain whether we can use frass in damaged crops to determine which species caused the damage and we will attempt to identify ingested plant material from wireworms found in samples.

The information gained from the surveying and monitoring will allow us to update our sampling strategies for the crops of concern and to understand the relationship between the wireworm populations of the species present and crop damage. We will also gain an understanding of the responses of different species of wireworms to cover cropping and min-till agriculture.

DECISION-SUPPORT AND PREDICTIVE MODELLING

We will review the available literature to ascertain the life histories of the species which emerge as being the greatest concern. Where this information is missing, we will carry out life history studies at different temperature regimes relevant to the UK to determine their life history parameters.

The results of the work described above, together with an understanding of the life histories of the different wireworm species, will allow us to develop guidelines to minimise wireworm damage across a range of crops. The implementation of these guidelines will be supported by reliable wireworm monitoring. It would also be possible to set up an email alert system and to map wireworm monitoring results and make these accessible via a webpage.

We will then produce predictive models for the species of greatest concern. These will take into account soil temperature and moisture. This will be used to predict current site suitability across the UK and assess the areas of the UK which are at greatest risk from increased wireworm damage with expected changes to temperatures and rainfall under climate change.

OUTPUTS

- NOVEL METHODS FOR THE ACCURATE IDENTIFICATION OF WIREWORMS
- INFORMATION ON THE EFFECTS OF COVER CROPS ON WIREWORM DAMAGE IN THE FOLLOWING CROP
- INFORMATION ON WHICH SPECIES OF WIREWORM ARE DAMAGING CROPS AND THE TIMING OF THIS (NOT SIMPLY DETECTION OF WIREWORM PRESENCE IN THE FIELD)
- AN IDENTIFICATION SERVICE FOR WIREWORM LARVAE AND, POTENTIALLY, TO IDENTIFY WHICH SPECIES CAUSED CROP DAMAGE EVEN IN THE ABSENCE OF THE INSECT
- RELIABLE WIREWORM MONITORING TO SUPPORT SUSTAINABLE IPM STRATEGIES
- PREDICTIONS FOR WHICH SPECIES WILL MOST LIKELY BE AN ISSUE OR WHICH WILL BECOME AN ISSUE IN DIFFERENT PARTS OF THE UK
- ACCESS TO THIS INFORMATION VIA A WEBSITE AND ALERTS SYSTEM

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FOR MORE INFORMATION CLICK HERE