Wising up on wireworm

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Wireworm

Potato tubers have always been an attractive food source for wireworm, the larvae of the click beetle. But problems appear to be getting worse, with major losses being reported by some potato growers who hadn't had problems previously. *CPM* finds out what's going on.

By Lucy de la Pasture

How to prevent wireworm damage without any effective control measures is causing many growers some sleepless nights, particularly as growing numbers of tubers are showing up with the tell-tale holes left by a satiated wireworm, making them worthless.

Problems seem to be getting worse and growers who haven't had problems before are now getting some major losses, explains Norfolk-based potato specialist Martyn Cox of Blackthorn Agronomy.

The gradual loss of persistent soil-applied insecticides from the carbamate, organochlorine and organophosphate groups of chemistry may, in part, account for the resurgence of wireworm. The most recent casualty being Mocap (ethoprophos) in 2019, which was the last chemical control left standing for use on all potato crops, including short-term ones.

But it's not the whole story, believes Martyn. "How many of the damaged crops would have been treated with Mocap is unknown, but it wouldn't have stopped all the problems that we see. We don't really have an effective in-crop control at the moment and it's unlikely we'll get anything good enough to stop a severe attack in longer duration crops in the near future."

Traditionally the risk of wireworm has been mainly associated with grassy weeds, and in particular, following long term grassland/fallows. And it's this narrow thinking that could be behind some of the problems the industry is now experiencing, believes Martyn.

Flawed thinking

"The idea that wireworm damage is related to grass or set aside alone is outdated and, although these remain powerful influences, they aren't the only ones. We've lagged behind European countries as far as integrated crop management (ICM) is concerned. Wireworm risk assessment in the UK is flawed and lags behind current thinking elsewhere."

And Martyn should know — he's studied the problem for over a decade and carried out basic research in recent years. Last year that expanded to a detailed literature review, on behalf of CUPGRA, in an effort to pull together the consensus of knowledge about wireworm.

"We've found risk assessment methodologies have gaps. There's a lack of knowledge of the basic biology of critical species; there's no idea how to manage the challenges of re-generative methods; crop managers are given poor guidance and there's little understanding of the effects of different crops in a rotation."

That's led to the situation the industry finds itself in today, he believes. "We've seen really severe problems leading to complete crop loss in regenerative situations but, importantly, also in others where it's harder to explain, even with a good knowledge of the pest."

Grass in the rotation is an established risk, says Martyn. "High populations have been established following two years of grass/clover followed by a wheat crop and this was also the experience in Canada, where the rapid escalation of the problem was linked with the adoption of under-sown barley followed by clover." ▸

Martyn Cox believes the best time to reduce wireworm numbers is in bare soil when larvae are small.

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Wireworm damage to tubers can effectively make the crop worthless.

▸ But work in a Link project published in the UK in 2010 (Lole, 2010) identified that populations remained similar to a grass-land level where non-inversion tillage was used, explains Martyn. He believes more research is required to help establish how much, or little, soil movement is needed to decrease populations.

"There's little recent research in the UK that directly answers the question of why wireworm is getting worse, and the recent research review has identified that there are many complex interactions."

There's evidence within the literature that there's a need to look wider than the preceding cropping when it comes to wireworm. "The last research at Plymouth by Blackshaw, with others such as Hicks or Benefer, indicated that invasion from field margins and other grassy habitats is a major influence in replenishing wireworm populations. This has also been highlighted in several European reviews — in particular by Furlan, Saussure and others such as Bob Vernon, and Christine Noronha in Canada."

Understanding these complexities is crucial to devising ways to keep wireworm populations in check. So what has Martyn established to date?

"When a source of adults exists, and the crop being grown is attractive for egg laying, then nature does what it does," he says. "Current agricultural systems tend to exert minimal disturbance following a cereal crop and green cover is increasingly established once the crop is harveste."

Species dependent

"This is very favourable for the survival of juvenile wireworms which would have been laid a few weeks earlier. Bare, cultivated soil is hostile to them and populations of small larvae can decline rapidly in this situation, although the effect of cultivations on larger larvae is most likely over-estimated."

Depending on the species, the larval stage has several instars which can take up to five years to complete. "Larvae live in the soil around four years for the species we consider to be the main crop pests, these all belong to the *Agriotes* genus — *A.lineatus*, *A.obscurus* and *A.sputator.* Other species are known to exist, and this is being investigated, but our knowledge of non-*Agriotes* species in the UK is minor, compared with *Agriotes* — which has been intensely studied in Europe and elsewhere."

It can take five years for the larva of a click beetle, or wireworm, to reach the stage where it's ready to pupate.

From what we already know Martyn says it's reasonable to assume that if high-risk crops, such as two years of cereals grown next to a source of adults, are grown 2-3 years ahead of potatoes without autumn cultivations, then a damaging wireworm population may well exist. So how do we find out whether this is the case?

"Our attempts to predict damage from the presence of larvae have met with little success, this is because their activity wasn't understood. To predict them we have to first understand them — this is the CUPGRA ethos," says Martyn.

"For wireworm, all you need are four things — a source of adults (nearby grass

Inaugural Enigma project looks at wireworm

The first Enigma project, a new R&D model launched by Fera in January, will be co-funded by industry partners and investigate wireworm. Martyn has been one of the drivers behind the instigation of the project, which will play a crucial role in bridging some the research gaps identified in the CUPGRA literature review.

"The pattern of wireworm damage is changing but the industry is yet to understand why and how these damage patterns are altering," explains Larissa Collins, principal scientist of the project and Fera entomology team leader.

"Click beetle lifecycles vary in duration and the number of larval stages, with different species preferring different conditions. Some are crop pests but by no means all."

Click beetle species in the UK number around 70 but the last UK survey on wireworm was carried out a considerable time ago, 1939-1942. At this time, the three main *Agriotes* species were identified, but some areas were found to have few or no *Agriotes*, just other species.

"We now know there are at least six members of the genus *Agriotes*, with *A.sordidus*, which has a shorter life cycle, rapidly increasing in southern France. There are also geographic differences between species in the UK with *A. obscurus* being particularly dominant in the north.

"The importance of other species has been ignored and we know very little about most species," says Martyn. Currently catches in the UK seem to support the presence of another genus, Athous, which appears to be widespread. Martyn confirms he finds quite a lot of these. "I've pulled them from within a potato tuber, so I know they can damage crops."

Losses due to wireworm damage are on the rise, even where the pest hasn't previously been a problem.

It's extremely difficult to visually identify wireworm species and molecular methods are only currently available in Austria. So a crucial part of the Enigma project will be to generate molecular methods for UK identification of species of wireworm and the aim is to produce a fast turnaround service for the industry.

or infested field); a suitable place to lay eggs in May-June (grass, cereals preferred); good conditions for eggs to hatch in June (not too dry); and food to sustain young larvae during June/July to autumn — this is the period neonates must eat to ensure survival."

Risk assessments should take all of these factors into account, says Martyn. "Consider the field surroundings as critical — such as grass margins, meadows, other sites with wireworm. Cereals are very attractive for egg laying and green cover after cereals is food for new larvae. When it comes to cultivations, remember that it's more the soil conditions afterwards that have an effect than direct mortality."

This has been evidenced by bait trapping before planting, which has long been the usual means for establishing whether wireworm is a risk, but it's been unreliable — with zero catches often followed by larvae in the crops a few weeks later.

"Wireworm in the soil is highly influenced by temperature and moisture but ignorance of this has limited our success with bait trapping. It's been established that once the soil is above 8ºC and not saturated, then results become much more reliable. For this reason, we've now moved bait trapping to the autumn before potato planting and have found good levels of detection in sites known to be infested.

"To prove the theory, we've also had negative catches in cold soil in 2021 where we knew wireworm were present. Temperature dataloggers giving hourly readings have proved invaluable to keep an eye on soil temperature and therefore the likely larval activity for successful trapping," he adds.

Wireworm activity is strongly influenced by soil temperature so trapping in the autumn, when soil temp. is > 8ºC, before the potato crop can be a more reliable indicator of numbers.

Pheromone trapping can give an idea of adult click beetle activity when assessing risk.

Adult trapping with pheromones has been used and, although there's no direct correlation between adult catches and the presence of larvae, it gives a better indication for the presence of some species than for others, explains Martyn.

"We've used these as a cheap, effective way of identifying when adult beetles are active. It can also highlight areas where invasion is taking place, but this is essentially a learning process on a farm. It's highly unlikely that a zero catch for all three species will be found during April-June, I have never seen this."

Monitoring damage

Once the potato crop is planted, crop monitoring for damage is an essential part in building the bigger picture. "Our monitoring work has shown a similar pattern of damage from the pest as would have happened 80 years ago (when the last national survey of the pest was conducted). The wireworms start early, and feeding patterns can fluctuate, but the severity of damage increases later in the season, particularly from September onwards."

Martyn highlights that damage from wireworm is often missed and put down to "dry core" — this is an effect of rhizoctonia infection in previous wireworm damage. In addition, early damage can result in severe symptoms as tubers distort and this can be confused with slugs, he says.

Even though some cover crops favour wireworm since they provide food for larvae, there's some hope that it may be possible to reduce wireworm populations by utilising plant species that are known to be less favourable for them. For instance, Faba beans were identified as antagonistic to the pest in research during World War II; buckwheat and brown mustard are used to reduce populations in Canada; and crops such as linseed and brassica crops generally provide poor food for larvae, explains Martyn.

All in all, the future for preventing wireworm damage lies in a more holistic approach. "We must manage the rotation to avoid favourable sequences for wireworm, which means thinking about them well ahead of the potato crop and identifying the risky parts of the rotation. But we're still at an early stage in learning how to achieve this, although studying older work gives good clues."

What does seem clear is that the best time to control a wireworm is when it's young. "Techniques, such as cultivating row crops during the egg hatch period; use of poor host crops; intensive cultivation when adults/larvae are vulnerable, after cereal harvest, all seem to indicate that the best strategy is to target the larvae in their first few months."

Varietal selection has an important role to play in integrated crop management strategies, so is this an option for potato growers where wireworm is concerned?

"As far as varieties are concerned, it's known that some are damaged much worse than others, and it appears to be linked to sugars and glycoalkaloids.

"We're trying to work with packers to identify potential leads here by looking at the data stored after intake quality control tests. So far some of the packers have helped, and this is greatly appreciated, but we need more," says Martyn. ■

What's known

- Usually a 5-year life cycle (some can be 1-2 years)
- Adults active April-June/July
- Eggs laid May – June, hatch in about 21 days
- Larvae must feed regularly while young
- Larvae will spend three years in the most damaging phase
- Pupate July-August and adults overwinter in soil
- Soil temperature and moisture are major factors in wireworm activity