Seeds of change

Could dipping seeds in an acid make spraying pesticides in later life unnecessary. **Poppy Leeder** investigates.

To any gardener who has just discovered a whole row of precious plants destroyed by pests, the following story offers some hope. Researchers at Lancaster University have developed a remarkably simple way to treat seeds that means later in life the plants can fend off attacks from bugs.

Insect pests cost farmers and gardeners billions of pounds a year. Traditionally, a strict regime of pesticides keeps them at bay. But the economic and ecological costs can be huge. The global market for crop protection, seeds and other chemicals used in agriculture is valued at $60 billion, according to Edinburgh-based agrochemical consultants Phillips McDougall in June this year.

Genetically-modified crops are a solution. But, in the UK at least, this solution has encountered hostility from the press and the public. Lucky, then, that

It is now the subject of around 25 large-scale trials in North America over the summer.

scientists may have found a new approach.

Researchers at Lancaster University have discovered that dipping seeds in a chemical that plants naturally produce prevents or minimises attack from pests.

Jasmonic acid, or JA, is one of a plant's natural defences against being eaten. When a bug takes a bite of one of its leaves, a chemical signal warns other leaves. For many plant species, that signal is JA. Once made, it moves to other parts of the plant, triggering the production of other chemicals which in turn offer protection against pests by hampering their ability to digest food.

But what would happen if plants were treated with JA before coming under attack by pests? A group of enterprising researchers had the idea of trying this while the plants were still seeds.

They were rather surprised to find that the plants withstood attack for at least eight weeks after they germinated. The original work was carried out in a number of projects funded by the Horticultural Development Council and NERC.

'We were amazed to find tomato plants were protected for about two months after they germinated,' commented Jason Moore from Lancaster, who carried out some of the research. 'We decided to find out if this worked for other species too.'

Pest control without pesticide

There are two clear benefits: it reduces the numbers of pest insects on the plants and farmers need to administer far less pesticide and insecticide treatments while the plants are growing – good news for biodiversity and the natural environment.

But the funding ran out just as things were getting exciting. With the technique causing great interest and showing real potential, the team needed to find another route to do further technical work. The knowledge exchange team at NERC had just introduced a funding scheme to let researchers do proof-of-concept work on the outcomes of previous NERC research. The team secured funding, allowing them to refine the technique and protect the intellectual property behind it. This will let them sell licences to use the technology.

Seeds in a jasmonic acid bath.

Nigel Cattlin/FLPA (2)

Tomato plant with spider mite damage.

Typically the area eaten by caterpillars was 40-60 per cent less in the treated seeds.

Nigel Paul, also at Lancaster, led this stage of the work. The initial research had shown that a tomato seed soaked in jasmonic acid, dried and then sown was protected against red spider mite for eight weeks after it germinated. Protection of tomatoes is a small part of what could be a very large market. The proof-of-concept research was to investigate the technique further.

'It was important to see if other plant species could be protected against any other pests and also how long seeds could be stored once they had been treated,' said Nigel.

The aim was to apply for a patent and to show that the technique could be used on a broad range of different plant species, to protect against a wide range of different pest species and to better understand the best way to treat and store seeds.

The technology has now been used on tomato, sweet pepper, wheat and maize. The seeds are typically treated by soaking in JA for 24 hours. Once they have been planted they are 'challenged' with a range of pests such as caterpillars, aphids and red spider mites.

In some experiments the researchers measured the leaf area eaten by the caterpillars – typically this was 40-60 per cent less in the treated seeds than in the seeds of plants that had not been treated.

Red spider mites fed less on the treated plant, and a knock-on effect of this was that the overall pest population and reproductive rates were lower, which means the technique is beneficial to growing plants.

The technology has now been taken on by Plant Bioscience Limited (PBL) to possibly develop commercially. In summer 2008, PBL conducted around 25 large-scale trials in North America to assess its effectiveness for different crops and sites. Results are due by the end of the year. In the meantime, with new funding from Defra, the team at Lancaster (Nigel Paul, Mike Roberts and Jane Taylor) are developing new applications for the technology, including investigating its value in disease control. By the end of the year, we should know whether or not a commercial product will go into development.

My own hope is that having triumphed against mites and caterpillars, the team will now move on to a way of protecting plants against slugs – now that really would be fantastic. ❖

Follow-on funding

The Follow-on Fund allowed the Lancaster team to do all their development work towards a commercial outcome without putting their patent claims at risk. While the work was going on in the lab, the university, the Horticultural Development Council and Stockbridge Technology Centre (which was funding Jason Moore at the time) were working in the background to assign the intellectual property rights.

This means that all the parties who had funded the original work were able to benefit from likely future work (except NERC, which assigns intellectual property to the research organisation carrying out the work).

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