Grower Summary

SF158

Application and Management of Biopesticides for Efficacy and Reliability (AMBER)

Annual report, January 2018

Project title:	Application and Management of Biopesticides for Efficacy and Reliability (AMBER)
Project number:	CP 158
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Date project completed	31st December 2020

DISCLAIMER

The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

The use of Trichoderma-based biopesticides for management of soil-borne diseases was evaluated on Choisya and Dianthus. Within the constraints of the experiment, the biopesticide programme was found to perform as well as a standard fungicide programme. In research to evaluate the effect of different application configurations on spray deposition to poinsettia, it was found that lower water volumes were the most efficient at depositing spray liquid on the plant.

Background

Pests and diseases (P&D) are a major constraint on the production of protected edible, and protected and outdoor ornamental crops. Chemical pesticides can no longer be relied upon as the sole method of P&D control, as significant losses of pesticide actives are occurring as a result of government legislation and the evolution of pesticide resistance in target P&D populations. Many growers already use Integrated Pest and Disease Management (IPDM), in which different crop protection tools are combined, including chemical, biological and cultural methods. IPM is now a required practice under the EU Sustainable Use Directive on pesticides. In order to make IPM successful, it is vital that growers have access to a full range of control agents that can be used as part of an integrated approach.

Biopesticides are plant protection products based on living microorganisms, plant or microbial extracts, or semiochemicals (behavior–modifying substances). A small number of biopesticides have been available to UK growers for some time, and an increasing number will be entering the market in the next few years. Within 10 – 20 years, the number of biopesticide products available is likely to exceed the number of conventional chemical pesticides. Biopesticides have a range of attractive properties, in particular they are low risk products for human and environmental safety and many are residue-exempt, meaning they are not required to be routinely monitored by regulatory authorities or retailers. While some biopesticides work well in IPM, UK growers have found others to give inconsistent or poor results, and the reasons for this are often not immediately obvious. Clearly, growers need to get the best out of biopesticide products in order to support their IPM programmes.

AMBER (Application and Management of Biopesticides for Efficacy and Reliability) is a 5-year project with the aim of identifying management practices that growers can use to improve the performance of biopesticide products within IPM. The project has three main parts: (i) to understand the reasons why some biopesticides are giving sub-optimal results in current commercial practice; (ii) to develop and demonstrate new management practices that can improve biopesticide performance; (iii) to exchange information and ideas between growers, biopesticide companies and others in order to provide improved best-practice guidelines for biopesticides.

Summary

This year of the project saw the last of a series of "benchmarking' trials completed. The aim of this work was to observe how a number of different biopesticides perform when used in commercial practice. Previous trials had included work on cucumber, pepper, chrysanthemum and cyclamen crops. The benchmarking trial in this year was the final part on a long-term experiment to evaluate the performance of Trichoderma-based biopesticides for managing soil borne diseases on Choisya and Dianthus. The biopesticide T34 Biocontrol (based on the fungal antagonist *Trichoderma asperellum*) was drenched onto Choisya and Dianthus growing in pots on either two or three occasions over the autumn and spring. This was compared to a chemical fungicide programme of one drench application each of Previcur Energy followed by Horti-Phyte. All the pots had been treated with a granular mix of Trianum G (*Trichoderma harzianum*) at the time the plants were potted up in September. Within the constraints of the trial (which included using natural disease infestation rather than artificially inoculating with soil-borne diseases), we found that the biopesticide programme used by the grower performed as well as a standard chemical fungicide system. All of the drench treatments were based on applying large volumes of water to the crop as per label guidance (application volumes equivalent to 10% of pot volume were used); this takes a lot of time to apply and can also increase waste, and there is a need to determine whether smaller volumes can be used that would still deliver the product to the root zone, but which would give savings in terms of the reduced time needed to treat the crop.

Research was also done to investigate biopesticide spray application to crop foliage. Because most biopesticides currently on the market work by contact action, achieving optimum activity depends on delivering an effective dose directly to the target pest or disease. However, there is little information available to growers on how different spray configurations affect biopesticide spray deposition on a crop. In this part of the project, research was done at the track sprayer facility at Silsoe Spray Applications Unit to quantify how different spray configuration affected the deposition of spray liquid onto poinsettia foliage, using a spray tracker dye. The work started with an observational trial done at a commercial nursery to observe application with a boom sprayer of a fungal biopesticide to a poinsettia crop, and which is used as part of a whitefly management programme. Following this, six different spray configurations were tested back in the laboratory at Silsoe that are typically available to

growers using boom sprayers with ornamental crops. The variables tested were nozzle type, forward speed, pressure, nozzle flow rate, applied volume, boom height, nozzle angle and nozzle configuration. The spray volumes applied covered the typical range of water volumes recommended for a biopesticide product, from 500 to > 1000 litres per ha. It was found that although (i) the lowest applied volume resulted in lower doses on the plant than the higher volumes (ii) the lowest volume was the most efficient at depositing spray liquid on the plant, as it resulted in a greater proportion of the spray volume adhering to the plant foliage. The data suggest that the most efficient application strategy is to apply a higher concentration of biopesticide product in a lower volume of water. As part of the same study, the application of the fungal biopesticide to the commercial poinsettia crop was studied to help develop a method for measuring the numbers of fungal spores per unit leaf adhering to the crop foliage. The plan is to be able to use this method to directly compare the deposition of fungal spores with the deposition of spray liquid on the crop.

Work was also started to improve our understanding of the relationship between arthropod pest population dynamics and microbial biopesticide efficacy. Microbial biopesticides are slower acting than conventional synthetic chemical pesticides, and, in some cases, it takes 5 – 7 days for the biopesticide to cause mortality. If the target pest has a short life cycle, and pests reach the adult life stage before they are killed by the biopesticide, then the slow mortality rate of a biopesticide may not be sufficient to stop the pest population from growing. The effect of the biopesticide will also be influenced by the susceptibility of different pest life stages, by environmental conditions, and by crop type. However, the details of how these factors affect the performance of biopesticides are not well understood. This is partly because it is difficult to study the effects of multiple combinations of factors using conventional experiments. An alternative is to put existing data sets from individual factors into a mathematical model of pest population dynamics. Modelling allows predictions to be made about the effects of particular combinations of treatments, a subset of which can then be investigated experimentally. For the Amber project, Dr Dave Skirvin at ADAS has started to develop a so-called “boxcar train” model to describe how pest populations increase over time, and which can be used to investigate mathematically the influence of pest life stage factors, environmental conditions and plant variety on the efficacy of biopesticides applied at different times during the development of a pest infestation. The model is based on a mathematical simulation of a pest transitioning from one life stage to the next until it reaches adulthood and reproduces. The rate of population growth depends on the number of life stages, the development time of each life stage, the natural mortality occurring in each life stage, and the number of offspring produced per adult. The model has been developed initially for glasshouse whitefly, although the basic ideas behind the model allow it to be used for any pest for which there is adequate data about its life history and susceptibility of different life stages to biopesticides. At the time of writing, the model ran successfully with dummy data, and in the next stage of the project it will be tested using real world data for glasshouse whitefly taken from the scientific literature and from laboratory tests of fungal biopesticides against whitefly nymphs and adults.

Financial Benefits

It is difficult to comment on the financial benefits given the early nature of results. However any improvements to the performance of biopesticides - including issues such as improved efficiency of spray applications, and improved efficacy and reliability - would allow growers to use biopesticides more cost effectively and to reduce over reliance on synthetic chemical pesticides at a time when their availability is declining, and when growers generally are under increasing pressure to produce crops with zero detectable pesticide residues.

Action Points

Growers should ensure that spray applications are done according to best practice guidelines in order to get the best out of biopesticides. No other specific actions are being recommended at this stage until more research has been done.