Biopesticides: The Way Ahead

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Introduction

Herbivorous insects and mites, plant diseases and weeds are major impediments to crop production and are becoming more difficult to control by conventional methods as a result of pesticide resistance and product withdrawals. New threats are occurring also from invasive pest species as a result of expanding global trade. At the same time, farmers and growers are trying to reduce the amounts of conventional chemical pesticides used in response to demands from retailers (e.g. the drive to zero detectable residues in fresh produce). The industry faces a serious challenge, therefore, to develop environmentally sustainable systems for controlling pests while maintaining crop quality, productivity and profitability. The best way to do this is through Integrated Pest Management (IPM), in which a range of complementary pest control methods are combined. These include chemical, biological, cultural and physical controls, host plant resistance, and decision support tools. Under IPM, chemical pesticides should be treated less as a blanket solution to crop protection and more as a precious resource, to be used in ways that reduce the chances of resistance occurring while still making important contributions to pest control. This is particularly the case for the new generation chemical products which have very good environmental and human safety characteristics. However IPM also provides the framework for the development of pesticide-free production should that be required.

Biopesticides in Integrated Pest Management

Biopesticides can make important contributions to IPM and help reduce reliance on chemical pesticides. Hence they have a major role to play in the development of sustainable farming. There are a range of definitions of what constitutes a biopesticide, and the terminologies used can be confusing at times. Essentially we are dealing with a broad group of agents. We define biopesticides as mass produced, biologically based agents used for the control of plant pests. This definition encompasses not only the active ingredient of a biopesticide but also how it is used. Biopesticides can be divided into three sub categories: (1) living organisms (a.k.a. natural enemies), which include invertebrates (e.g. predatory insects), nematodes and micro-organisms; (2) naturally occurring substances which includes plant extracts and semiochemicals (e.g. insect pheromones); (3) in some countries, genetically modified plants that express introduced genes that confer protection against pests or diseases (so called plant incorporated products) are also classified as biopesticides.

Biopesticides often have a narrow spectrum of pest activity, which means they have a relatively low direct impact on non targets, including humans. Their use is often compatible with other control agents, and they produce little or no residue. They are relatively inexpensive to develop. One significant advantage of biopesticides based on natural enemies

is that they can reproduce in the pest population. This means that the natural enemy population can respond to changes in the pest population, giving a flexible form of pest management.

How many biopesticide products are currently being sold? In the USA, there are over a thousand biopesticide products. Figures for the EU are harder to come by, but the available data suggests strongly that fewer products are being marketed. Data on microbial biopesticide agents from Agriculture and Agri-Food Canada and the US Environmental Protection Agency (EPA) indicates that, whereas more than 200 such products are being sold in the US, only 60 comparable products are available in the EU. In the UK, only 5 microbial products are currently sold, compared with 10 in Germany, and 15 each in France and the Netherlands.

Biopesticides have been criticised for their higher unit prices and lower efficacy compared to chemical pesticides. However such comparisons are overly simplistic and may well detract from the beneficial properties of biopesticides. In this context, it is worth noting that there are sometimes tensions between those who emphasise the biological nature of biopesticides and their use in ecologically based IPM strategies, and those who advocate a more technological approach to biopesticides, which follows closely a chemical-pesticide driven development model. The extent to which these two approaches will be used in farming in the future depends on a range of complex interacting factors based around the political and regulatory structure of the agricultural economy, debates about environmental sustainability, and the need for profitable agricultural industries.

Biopesticide regulation

The commercialisation of biopesticides is affected strongly by the regulatory system that governs their authorisation and use. In the EU, this is particularly the case for microbial agents and naturally occurring substances, which fall under Plant Protection Products (PPP) legislation. The PPP arrangements were originally designed for chemical pesticides, which are among the most strictly regulated of all compounds. In the UK, chemical pesticides and biopesticides classified as PPPs are regulated by the Pesticides Safety Directorate (PSD) and their use is governed by both national and EU level arrangements. The EU regulations are currently is a state of transition, as the arrangements of different member states are being harmonised. This should enable mutual recognition of authorisations between member states, which could expand significantly the market for biopesticides. However, it is widely accepted that the current mutual recognition arrangements are not working.

Biopesticides; the way ahead?

Given that (a) biopesticides can make an important contribution to the development of sustainable agriculture, and (b) relatively few biopesticide products have been commercialised in the UK / EU, there is a requirement for a system of regulation that will lead to more products reaching the market. In today's meeting, we will discuss ways forward for biopesticide regulation. Certainly, there is a role for government in helping new industries that bring positive public benefits related to policy goals. UK national authorisations have been addressed recently by PSD, which has brought in a new biopesticides scheme which contains a number of important innovations. The regulatory authority has a difficult job, because it is expected to ensure the quality and public safety of biopesticides while not inhibiting their commercialisation, and hence the costs of regulatory failure are high. Unfortunately, it has to operate in a general climate in which regulatory

innovation has been impeded by events such as BSE. It must be remembered too that the structure of institutions such as PSD matters, as it shapes how people in them act. In this regard we will be making some comparisons between the PSD and the US EPA, which has 20 staff working in a specialist microbial pesticides branch, and 23 in biochemical pesticides branch. Our research indicates also that regulatory innovation is not helped by the relatively weak policy network for biopesticides. The biopesticides industry is small, largely made up of SMEs, is still undergoing organisational development, and does not have the policy resources of the agrochemical industry. There is also little coalition building with environmental groups. Finally, there is a debate to be had over efficacy evaluation for biopesticide authorisations (which can be 50% of the registration cost) and the role of subsidies, which are used in the USA and the Netherlands. Perhaps the central question is whether there is a clear case of market failure for biopesticides than can be remedied by government intervention?

Our research

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For more details on the RELU programme, go to:
http://www.relu.ac.uk/

For more details on our biopesticides research, go to:
http://www2.warwick.ac.uk/fac/soc/pais/biopesticides/