RES-224-25-0048
Biological Alternatives to Chemical Pesticide Inputs in the Food Chain: An Assessment of Sustainability (PI Professor W P Grant)

End of project summary

UK farmers and growers face the challenge of using more environmentally acceptable methods of crop protection while maintaining food quality, productivity and profitability. There are good opportunities to reduce chemical inputs using Integrated Pest Management (IPM) based on biological control agents such as naturally occurring fungi, bacteria, viruses or nematodes. The project focused particularly on microbial bio-insecticides, based on entomopathogens, for the control of insect pests which form part of a group of microbial biopesticides. They are applied in much the same way as chemical pesticides, but they offer a number of advantages such as low impact on non target organisms, compatibility with other natural enemies and limited toxic residue.

There has been a poor uptake of microbial pesticides in the UK. Relatively few products have been successfully registered and made available. This project focused on regulatory barriers to wider adoption. The regulatory system in the UK was developed in accordance with a chemical pesticides model which did not facilitate the registration of biopesticides.

The regulatory agency, the Pesticides Safety Directorate (PSD), introduced a Pilot Project to facilitate the registration of biopesticides in 2003 and converted this into a Biopesticides Scheme in 2006 offering features such as pre-submission meetings, reduced registration fees and a Biopesticides Champion within PSD. The project was able to study this process of regulatory innovation and work with PSD to provide training to facilitate the achievement of their objectives. It also enabled the development of a model specifying the conditions under which regulatory innovation was likely to occur.

The EU dimension of the system of regulation has been undergoing a process of change. The revision of the relevant directive, EC 91/414, was still under discussion when the project finished. However, the absence of a functioning system of mutual recognition between member states means that there is no effective internal market comparable with that of the USA which has had a much higher rate of biopesticide registration and adoption. This makes it difficult for the SMEs which are the typical developers and producers of biopesticides to secure economies of scale.

Major supermarket chains consider that they are under pressure from consumers to minimise pesticide residues. Consumer concerns about residues could undermine the achievement of the 'five a day' target in relation to the consumption of fruits and vegetables. Retailers stated in interviews that some of them sought to cultivate a greener image than competitors as part of a marketing strategy. This leads them to prohibit or control the use of pesticides that have been approved by the regulatory system. This could undermine confidence in the system, but it also means that growers are faced with differing demands from different retailers that go beyond the regulations and add considerably to management complexity on farm. Retailers are also with one or two exceptions reluctant to take a proactive role in recommending the wider use of

biopesticides. In academic terms, outputs from the project will explore the wider implications of this system of private retail governance.

A cross-national comparative element was introduced into the analysis by comparison with regulatory arrangements in Denmark, the Netherlands and the United States. The pesticides tax in Denmark was not considered to offer a way forward for the promotion of biopesticides. The Genoeg scheme in the Netherlands provides assistance with registration costs of new products. In the USA, the Environmental Protection Agency has a well resourced Biopesticides Division with a clear mission to facilitate biopesticide registration. This is helped by its links with the IR-4 programme. One lesson from these arrangements is that there may be scope for limited interventions to assist the development and registration of products.

Relatively little is still understood about the underlying ecology of bio-insecticides. However, research in Canada showed that two soil dwelling entomopathogenic fungi were adapted to local environmental conditions. This was a significant finding because it challenged a paradigm in insect pathology that the host insect is the predominant influence on population genetics. Local adaptation would have profound implications for the ability of natural entomopathogens communities to compete with bio-insecticide genotypes, and hence determine the efficacy and sustainability of bio-insecticide applications. The work undertaken in the project showed the existence of local adaptation in that particular strains represent an adaptation to both latitude and habitat such as woodland, ploughed field, permanent grassland etc. The results indicate that habitat type is likely to influence the environmental fate and behaviour of entomopathogenic fungal strains released as biocontrol agents. It would make sense to develop control agents for a particular habitat type using fungal strains from a genetic group adapted to the same habitat. Ecological niche theory suggests that such strains are likely to persist for longer (thereby giving more effective pest control) and there should be less of risk of the strain establishing in a heterologous habitat and causing unintended effects on nontarget organisms.

The project was characterised by effective engagement with a range of stakeholders. This was exemplified by two highly successful one day conferences organised by the project which attracted over one hundred participants to the first and seventy to the second from a range of stakeholders from growers through biopesticide manufacturers to regulators. Among the paper presenters at the conferences were an American biopesticides manufacturer, an environmental group, Marks and Spencers and the PSD.

The project team submitted a response to the draft National Pesticides Strategy and also took part in the informal and formal consultations run by Defra on the future of PSD. At a European level, the project was represented on the steering group of the European Commission policy action, REBECA (Regulation of Environmental Biological Control Agents). Project members took an active role in various workshops and played a key role in shaping the final report with Professor Grant serving as a member of the round table at the plenary session of the final conference in Brussels. The work undertaken in the project is consistent with Defra's Science and Innovation Strategy objective to develop alternative plant protection technologies to reduce reliance on conventional pesticides.