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MANAGING INSECTICIDE RESISTANCE IN AUSTRALIAN *HELICOVERPA ARMIGERA*

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Abstract

Insecticide Resistance Management (IRM) strategies for Australian cotton were first developed in 1983/84 and have been evolving ever since. This paper aims to discuss some of the main components of the proposed 2000/2001 strategy, including chemical and non-chemical components. Australian field populations of *H. armigera* have developed high frequencies of resistance to the pyrethroids carbamates, endosulfan and organophosphates. Historically, new groups of insecticides or new technologies have become available one at a time. This has resulted in overuse of each sequential technology as it was released and selection for resistance. Once resistance is detected, we have attempted to manage it re-actively through the IRM strategies. The Australian IRM strategies are second to none and have successfully preserved older groups and bought time for the development of new technologies and new approaches. However, once resistance problems to any insecticide group or technology are detected they are established in the field and very difficult to slow down or reverse.

The 'history' of resistance and cross-resistance to older insecticide groups places increased selection pressure on new technologies (such as Ingard®) and new conventional chemistry and emphasises the need for a pro-active approach to resistance management. For the first time, we have a suite of concurrent new insecticides and technologies that are available for use in Australian cotton. None of these new technologies have an established resistance problem (yet), but none of them are resistance proof. The way that we implement these products now will have a tremendous bearing on how quickly our major cotton pests develop resistance to them. We have a tremendous opportunity to develop pro-active resistance management strategies to preserve these new tools for the longer term. Successful implementation of pro-active IRM will balance the risk of selection for resistance between different insecticide groups and prevent selection from being channelled towards any single group. This should result not only in preservation of the new technologies, but also a lifting in selection pressure and a benefit to the older groups with established resistance problems. Both chemical and non-chemical approaches need to be incorporated into integrated pest management guidelines, which will complement and support IRM.

Chemical approaches include the separation of the target pest species and insecticide selection pressure in time (alternations, rotations and window strategies) and separation of the target pest species and insecticide selection pressure in space (mosaic and refuge strategies). They include the use of synergists or mixtures where appropriate to overcome metabolic resistance and restrictions in the total number of applications of a particular insecticide group used. The success of these approaches will depend on the range (and cost) of chemical groups available, their impact on the major beneficial insects and their resistance status which needs to be thoroughly monitored. Once resistance is detected in the field, or preferably artificially selected for in the laboratory, then an understanding of the major resistance mechanisms and a thorough understanding of the ecology of the pest are vital for determining appropriate IRM tactics.

Complementary non-chemical approaches will have to emphasise a systems approach to help to reduce pest population pressure and reduce insecticide use. This will include; matching the variety and its agronomic management to the region, optimising planting windows, realistic early season thresholds, an understanding of the crops compensatory capacity for damage, classical or genetically modified host plant resistance, use of trap crops to concentrate pests for management, use of refuges for preservation of susceptible genes, physical destruction of over-wintering pupae and area-wide management. These components have been incorporated into Integrated Pest Management (IPM) guidelines designed to complement and support IRM.

Our understanding of many of these components is growing but far from complete. The challenges encountered in integrating these approaches into a coordinated strategy and regularly updating this strategy to cope with the dynamic nature of the resistance problem will be discussed using the Australian Cotton IRM Strategy as an example.