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MASTERS THESIS PRIZE 1980

The prize was awarded to Raymond Boffey for a thesis entitled 'An Integration of Ecological and Economic Criteria for Pest Control: A Dynamic Model Applied to Selected Apple Pests in Western Australia', submitted to the Faculty of Agriculture, the University of Western Australia, for the degree of Master of Science in Agriculture.

Thesis Abstract

Economic thresholds define the goal of pest control procedures: the profit maximising number of pests. The development of economic thresholds is necessary for optimal decision making in pest control. Existing definitions of economic threshold were reviewed and found to be deficient by not distinguishing among pests according to which part of the crop they attack, in the treatment of factors which determine the relation between pest numbers and revenue, and in not permitting biological and chemical inputs to be considered simultaneously when determining optimal procedures.

A definition of economic threshold which overcame these deficiencies was developed. The following factors, among others, were identified as influencing economic threshold:

(i) the sensitivity of crop yield and quality to the number of pests;
(ii) the prices of the various grades of the crop; and
(iii) the toxicity of the chemical inputs to the biological inputs.

The usefulness of this definition was evaluated by using it as a conceptual framework for analysing an issue in the control of pests in apple production. That issue was the relative contributions of natural enemies (biological inputs) and pesticides (chemical inputs) in the control of apple pests.

Currently, there is an almost total reliance on pesticides, with a minimal contribution by natural enemies. The analysis identified the following factors as causing this mix of control measures:

(i) the high sensitivity of apple quality to pest numbers, so that the quality distribution deteriorated quickly in response to higher pest numbers;
(ii) the relatively high prices obtained for apples undamaged by pests; and
(iii) the toxicity of the currently used pesticides to natural enemies.

The theory, based on the economic threshold concept, led to the prediction that pesticide use might decrease in future, due to likely changes in pest resistance, higher pesticide prices and rising pesticide toxicity to the natural enemies of the pest.

These predictions were tested empirically in relation to selected pests affecting apples in Western Australia. A dynamic model, based on the definition of economic threshold, was developed for the control of two pests. In this case, it was found that the current patterns of pesticide use were relatively insensitive to changes in both biological and economic parameters.