CONTROL OF INSECTS

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The aim of insect control in commercial agriculture is to prevent financial loss by pest species. In general this means reducing the numbers of a pest below an economic injury level (where potential damage equals control cost) rather than attempting to eradicate it.

Since the aim is to maximise control with minimum expense, a knowledge of when and how to apply control measures is essential. This demands an understanding of the biology of the pests and environmental factors which lead to increases in pest populations to above the economic injury level. In this sense therefore, insect control is based on population ecology.

Pest populations in agroecosystems are usually highly unstable with rapid rises and falls. Such changes are brought about by conditions in the agroecosystem which attract large numbers of pests and favour their rapid multiplication and decline. The main factors which contribute to increases are the high density of a limited number of plant species which are available to the pest at a favourable time of year. Other favourable factors are the higher than normal level of nutrients (applied by the farmer) and often of supplementary water which ensure succulent growth, ideal for insect multiplication. Rapid falls may be correlated to sudden changes in the suitability of the plants (growth stage), to factors operating at high population densities such as biological factors which includes disease, inter and intra specific competition, and finally to the weather.

The value of the crop as a food source may be manipulated by the development of resistant varieties. Weather affects the insect in the form of the microclimate it produces around the plant and this may be altered by genetic manipulation of the plant or by cultural practices. The effects of parasite and predators are often limited in short-term agroecosystems by their transitory nature, their lack of suitable food for adults and the presence of pesticides. These factors may be altered to increase the effectiveness of existing biological control or further species may be introduced. Competition often does not occur until populations are well past the economic injury level and is rarely of major significance in pest management. Genetic manipulations within insect populations can change the fitness of the insect population and its ability to increase. Pesticides may be introduced into the crop to kill the pest species.

The stability of a population is usually related to the diversity of the factors which act on it. One or all of these manipulations may be combined with naturally occurring factors to give an acceptable type of population dynamic of pests in a crop. This combination is termed integrated control.

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Current pest control procedures in Australia are heavily dependent on the use of insecticides because they provide an effective, commercially attractive approach to insect control. Insecticides are used in most crops with little or no regard to the other elements of the ecosystem. This situation is likely to alter greatly only if the price of insecticides rises relative to the price of commodities, severe insecticide resistance problems occur or if some other method of control requiring no farmer intervention such as a resistant variety or a self-perpetuating biocontrol agent is introduced.

The future direction of agriculture is clouded by the question of energy costs. As the outcome is impossible to predict, research priorities should be set to achieve maximisation of long term effects on insect populations sufficient to maintain them below the economic injury level, minimisation of costs (and energy inputs) and minimisation of environmental hazards. In most crops this means that the aim is an integrated control program.

(Editor's Note: The initial invited speaker for the session on insect management withdrew at a late stage. Dr Turner kindly agreed to take over the presentation for this session and he has prepared the above abstract of his paper. The complete paper will be distributed at the Conference)