An overview of the Alternate means of Controlling Insects

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Shortly after World War II pest control shifted largely from a biological discipline to a chemical one. This era of total dependence on insecticides provided spectacular insect control. However, there had also been a unilateral effort to develop crop varieties concentrating only on high yields with subsequent disregard for loss of, or incorporation of, characters for tolerance of, or resistance to insect pests. Both of these major "advances" have with time come up short of hopes. Neither rested on the broad ecological dictum that the whole interacting system must be considered, and neither rested on an appreciation of nature's two basic systems of containing excessive abundances- natural enemies and the plants' own factors for resisting pest attack. One reason for their failure to consider the whole system is that scientists are by nature specialists and individualists; they like to tinker with their own specific thing. To a regrettable degree, individuals, departments of research, and extension, have concerned themselves very little with what the others are doing.

In the era of nearly total reliance on pesticides, there was general disregard of the fact that even the simplest agroecosystem presents a complicated maze of delicately balanced ecological interactions.

The system ignored the enormous plasticity and potential of the insects to counteract man's intervention. Resistance to the pesticides became common place until now when some insect populations cannot be controlled by any insecticide. The target insects often resurged quickly, most of them eventually developed resistance, natural enemies were destroyed and previously innocuous or minor species became major pests. Increasing dosages and more kinds of, and more frequent pesticide treatments, led to a type of pesticide addiction from which it is difficult to disengage. The cost of pest control became a major threat to economic production. A basic need existed to revive an earlier era of research on agricultural pests that centred on the pests' biology and ecological, cultural and biological ways of handling them, but not to the abandonment of insecticides which, when used properly, remain our most reliable immediate solution to an economic problem.

Inherent to any attempt to provide good insect pest management is the recognition that most crop pests are tremendously adaptive, highly reproductive organisms, and that most of them in nature are not likely to be eradicated. Furthermore, these pests do not cause catasrophic damage to their host plants in natural systems. Thus, we seek to maximise their great natural control forces: the weather, host plant resistance and natural enemies. Containment

of their populations, rather than prevention or eradication is the logical strategy.

The objective of pest management is to optimise pest control in the long term economic, social and environmental spheres. While such a system may be found to be optimal for control of one pest or the whole complex of pests, may be associated with a resulting maximum crop yield on a given area of land to which it is applied, the goal of I.P.M. strategy is not specically to maximise yields. Pest control strategies that seek to effect maximum crop yields are not necessarily the most optimal form of pest control from the standpoint of both costs and benefits to the farmer or to society as a whole.

There are a number of direct pest control measure which can be used to pursue the objectives of an I.P.M. system.

Crop Plant Resistance

Over long periods of time plants, both natural and cultivated ones, have developed a great diversity of methods for warding off or tolerating atack by plant-feeding organisms. Our cultivated plants have been inadvertently selected for characters offering such resistance. An extensive pool of genetic factors for such resistance exists in our domestic and in wild plant varieties which can be used to develop crop varieties more resistant to pests. Use of plant resistance should be a first consideration in the long-term development of integrated pest management programs.

Plant pathologist have extensively used breeding for disease resistance as a primary method of plant disease control for many years. Entomologists, however, have lagged far behind in developing resistant cultivars despite there having been several noteable successes with the method for insect control. This lack of attention has been attributable in part to the originally effectiveness and simplicity of chemical insect control. The problems arising from the unilateral use of such insecticides however, have focused new and inceased attention on development of insect resistant cultivars.

Biological Control

For control of insects, in contrast to plant diseases, biological control has been the more central core tactic around which integated control has been based, rather than host plant resistance. Biological control occurs when the action of parasites, predators, or pathogens temporarily control or continually regulate a host population at densities below which they would be in the absence of these natural enemies. In practice, such control is not of importance to man unless the degee of control results in economic benefits. When man manipulates the natural enemies, the pest population, or other factors of the environment to achieve biological control, the system is referred to applied biological control. If biological control occurs without manipulation the term natural biological control is used. By far the greatst activity in biological control however, has been in the conduct of classical biological control, which involves the importation of natural enemies from

exotic regions, usually the native home of the pest, and their establishment and successful control of the target pest.

In some situations where detrimental pesticides are not used for controlling other pests on the crop, biological control alone has provided continuing, essentially permanent control. However, various manipulative procedures have been investigated for a number of pests to increase the effectiveness of natual enemies beyond what they can achieve in a self sufficient manner unaided. This has been termed augmentation and conservation. Various methods are used in such augmentation and conservation practices, including for examples, use of favourable cultural practices, strip cropping or cutting, addition of habitat resources, alternate hosts, refuges or subsidiary foods, or even the pest itself at critical times and, of course, protection by use of modified spray programmes.

Cultural Control

Cultural control methods are among the most economical of all methods of insect control and can be widely applicable. Cultural and physical methods have provided good control of many important insects pests for hundreds of years. Timing of planting and harvesting to escape infestation or infection or periods of intense exposure, rotation of crops or varieties, managing water, cultivation, sanitation and destruction of volunteer plants, are well known, widely practiced examples of cultural and physical control of insect pests. Their use interferes with pest development, commonly through exposure to rigours of the

environment, but also in fostering natural enemies or antagonist action or plant resistance. The development of synthetic broad-spectrum insecticides following Wold War II released growers from these rather unspectacular method, and many of them were largely abandoned.

Attactants

Insect repellants have been enormously useful in protecting people and domestic livestock from attacks from blood sucking insects, but no practical use of repellants to protect crops has been developed. Attractants however, have long been usd in insect control. The possibilities of using attractants and baits or trap crops for the purpose of concentrating pests where they will do little damage or can be destroyed, or for the purposes of attracting natural enemies into the habitat, have recently received some attention.

Opportunities have ben much expanded recently with discovery and characterisation of several powerful attractants, notably the sex pheromes. Potential uses of these products include the monitoring for insect presence and density so as to determine critical timing of events, as well as a direct controlling tactic.

Conventional Pesticides.

For I.P.M. we seek minimal use of pesticides, applied so as to give an optimal effect in controlling the specific target pest population while conserving natural enemies. Sometimes we do not need, or want, complete elimination of the taget pest, and

certainly not of all the pest and potential pests in the crop, for this would render indirectly the environment sterile for support of natural enemies, even if these natural enemies were not killed diectly by the materials applied.. A highly specific, environmentally sound microbial material that gives a lower initial kill may be better than a conventional insecticide that kills 100% of the taget population.

Support Tactics

In addition to the various direct pest control tactics discussed above, there is a number of supportive tactics required for making pest management decisions, and in assessing alernative strategies and tactics.

Establishing economic thresholds and the real need to use an insecticide, or to intervene in any way, is of foremost importance. The economical theshold, however, is not a fixed level, but a dynamic concept, the density level satisfying the concept depending upon a variety of circumstances which may vary markedly with the location and as the season progresses.

In summary, a critical review of the various methods of controlling insect populations reveals that each one of them, in specific circumstances, can provide a significant level of useful, and often gratis, pest control. The trend of practical pest control in recent times have failed to make use of these tactics. However, as the problems associated with the continued reliance on insecticide use become significant, and as the cost structure of

present pest control strategies are reviewed, the need to make most use of these tactics becomes self evident. However, with such a review, it will be paramount that, to maintain the ideals of pest management, the limitations of the alternative insect control procedures should be acknowledged. Without an acceptance of the potential and limitations of any particular tactic, the inevidable comparison to the speed of action and results of the conventional pesticides will make their implementation and acceptance most difficult.