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CONCEPTS IN PEST MANAGEMENT

Growers have always used some of the pest control practices recommended in pest management but only rarely all of them. In most cases, only chemical pesticides have been used because they were the most economical and the most effective. However, in many cases use of pesticides has given rise to the development of resistant strains of the pest. Further, we have come to realize that pesticidal chemicals in many cases are sufficiently dangerous to humans and non-target organisms in the environment that we should minimize the use of all chemicals. Other means of control must be added. Such programs are usefully described by the term "pest management."

Since the problems of pesticidal resistance and toxic chemicals in the environment arose first in insect control, we find pest management more widely used and more intensively developed in entomology than in the plant pathology or weed control sciences. Resistance to pesticides has only recently been encountered from the use of bactericides and systemic-type fungicides, and it has not yet evolved into significant insoluble problems with herbicides nor with nematicides. Anti-viral chemicals have never been available, so the control of plant virus diseases has always employed "pest management" programs emphasizing prevention through use of virus-free seed or propagation parts, varietal resistance or tolerance, and virus-vector control.

Pest management in insect control places heavy emphasis on providing a small non-economic population of a pest in order to maintain natural populations of parasites and predators. However, the pest and parasite/predator populations are closely monitored so that populations of the pest do not increase beyond the point where economic damage to the crop occurs. In the most effective pest management programs, it is only at this point that selective chemical control is used and then only as many applications as are needed to protect the crop until it is harvested. Although often labor intensive, especially in the early years of use, this program does minimize reliance on the use of chemicals and maximize natural control. It is successful only if monitoring is consistently and accurately done, and if conditions are right for the maintenance of effective parasite/predator populations.

Pest management requires as complete a knowledge of the biology of the pest and its natural enemies as possible. It also usually involves maintenance of year-round weather records and close attention to weather predictions during the growing season in order to predict when economic damage might occur and how much time might elapse before beginning active pest control measures such as spray applications.

It is only in insect control that natural enemies can be widely used--direct predator systems are not generally available for use in control of weeds, nematodes, fungi, bacteria, or viruses.

However, a few cases can be cited, e.g. the use of geese for general weed control in crops and the use of insects for control of specific weed species (Cinnabar moth for Tansy Ragwort and Chrysolina beetles for Klamath weed).

Pest management programs also place heavy emphasis on preventive measures to limit pest populations and minimize the use of chemicals. It is in this area of prevention that the term pest management finds commonality in the control of all plant pests. Prevention includes any pest control method or program that results in a marked reduction of the pest in the crop; for example, the use of weed-free and disease-free seed or planting stock, the use of cultural practices such as crop rotation, the use of sanitization to rid the premises of the pest before planting as in greenhouse bench and soil sterilization and in post-harvest field burning by grass seed growers. Prevention is the foundation cornerstone of any plant growing activity which, if not firmly established in practice, can lead to failure of the business. It is so important that laws for regulating plant and pest imports and interstate movement of plant and rules for establishing certification plant production standards have been established in both nursery and agricultural crops to prevent introduction and spread of serious plant pests.

Pest management programs place emphasis on the use of resistant varieties. This method of pest control has been most successfully exploited in disease control of agricultural crops. Agricultural scientists over the past 50 years have diligently devoted their careers to development of high performance, disease-resistant varieties of our major vegetable, cereal, and forage crops. Increasing efforts are evident in fruits and ornamentals, and we can expect more numerous future advances in these crops. Because of the capability of many insect populations to develop pesticide resistance, more entomologists are exploring crop varietal resistance and tolerance. They have been highly successful against spotted alfalfa aphid and wheat Hessian fly. It is a promising research area because the germ plasm diversity in crop plant species offers the potential that insect resistance or tolerance can be found after thorough research and effective testing. Varietal resistance as a weed control method has not yet been applied, probably because of the great success we have had with herbicides. However, we are beginning to see more studies reported on plant allelopathy--the phenomenon wherein a substance is produced by the roots or leaves (or both) of a plant that prevents the establishment of grass or other plant species in the immediate vicinity. A common example of this is the black walnut tree in which the allelopathic substance has been determined to be a quinone named juglone, coined from the genus name *Juglans*. Allelopathy is known in a number of natural plant communities. Effective allelopathic substances would be highly useful in reducing the need for preemergence herbicides if weeds were suppressed in the early growth of the crops so that timing of the first cultivation would be less critical and more effective. Recently, Michigan State scientists reported allelopathy in cucumber species. It will be interesting if future work proves this to be a genetic trait that can be incorporated into commercial varieties.

The philosophy of pest management is basically the integration of all control measures to take advantage of available natural systems of suppression and control of pests to supplement man-made methods and maintain economic control. Nurserymen and seedsmen have special responsibilities in pest management not only in their production activities, but in producing resistant varieties and pest-free plants that customers can grow with minimal use of pesticides.