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Integrated pest management

We must increase agricultural output if we are to provide food and fiber for an expanding world population. But, as energy sources become more restricted and costly, and greater efforts are required to maintain the quality of the environment, it is evident that we will need new knowledge and different agricultural technologies.

One way to increase the food and fiber supply significantly would be to reduce the losses caused by pests and diseases. The impact of diseases, weeds, insects, and other organisms, in terms of crops damaged or destroyed, is serious and worldwide. In California, 10 to 20 percent of total food and fiber production is lost before harvest each year. In some developing countries, estimated crop losses run as high as 75 percent. Although losses induced by pests and diseases have already been dramatically reduced in many instances as a result of research on these problems, we are far from our goal of acceptable control.

Since World War II, the trend has been toward ever-increasing dependence on pesticides. These materials have played an essential and effective role in agricultural production. But the inherent drawbacks of reliance on this single line of defense have become apparent. It has introduced problems of pesticide resistance, destruction of natural controls, outbreaks of secondary pests, reduction of pollinators and other beneficial species, potential environmental contamination, and some health hazards.

Furthermore, the increasing price of keeping crop losses at their present unacceptable level reduces the net returns of the agricultural producer and increases costs to the consumer. Current California expenditures for pesticides alone add up to more than $200 million per year. The total pest control outlay—an estimated 10 to 20 percent of crop production costs—combined with the toll from crop losses, suggests that improved pest management could yield significant economic benefits as well as increase the supply of food.

One promising approach is the system of crop protection known as integrated pest management. Such programs have a flexible, multidimensional approach to control, using a range of biological, cultural, and chemical techniques, as required, to hold pests below damaging economic levels without disrupting the agro-ecosystem. A basic premise is that no single, arbitrary control method will suffice because of the remarkable adaptive powers of insects, weeds, and plant pathogens and because of the many variables related to season, location, and cropping patterns and pests.

Information is the key ingredient to the successful development of these programs. We must know the biology of the pest, its natural enemies, the host plant, and their interrelationships in the environment. We must be able to predict the pest's occurrence, its population levels, and the potential economic damage. We must have enough knowledge so that we can forecast the effects of control techniques and strategies that might be used on a particular crop. We must know more about the influence on pests of various weather conditions and of cultural practices such as irrigation, cover-crop management, and harvesting procedures.

Much has been learned, and the integrated approach is being used on a limited scale against specific pests, but the additional, extensive knowledge needed is slow to accumulate. Present research programs must be significantly expanded before coordinated, compatible techniques can be effectively mobilized against a wide variety of pests and their hosts under various environmental conditions. Crop protection is a vital part of the food production process and stopgap approaches are likely to provide only temporary solutions to the pest problems. A more judicious, better informed use of all existing control measures in a systems context promises to reduce environmental hazards and yield significant benefits for everyone from the farmer to the consumer.