

TOPIC 3

INTEGRATED PEST CONTROL

Scope

Chemical pesticides are now the traditional solution to pest problems, and they have saved lives and crops. Their use, however, has created significant problems, including (1) the development of pesticide resistance in the pest; (2) resurgence of pest species, both primary and secondary; (3) general contamination of the environment, which is a hazard to man, domestic animals, and wildlife; (4) phytotoxicity in crop plants; and (5) unacceptably high residues in commodities which hinder international trade and hence harm the balance of payments of developing countries. There is, at times, a tendency to exaggerate some of these problems, particularly the harmful effects on man, domestic animals, and wildlife. Nevertheless, there is evidence that unless an improved pest control system is adopted, these problems are expected to become alarmingly acute. Every effort must be made to seek alternatives to chemical pesticides. Any pest control plan adopted should provide maximum benefits while creating the least environmental damage, thus optimizing the benefit/cost ratio.

Options

Various other control methods exist as possible alternatives: biological control, the development of resistant crop species, the use of physical and mechanical agents, alteration of cultural practices, the release of pests with genetic lesions, and the development of chemicals with a narrow spectrum of activity and less persistence in the environment. The selection of alternatives should be governed by the type of pest complexes encountered. Individually applied, however, their usefulness is often limited, so the employment of a complex in an integrated manner is necessary. This approach is defined by the FAO's Panel of Experts on Integrated Control as "a system of pest management that, in the context of the associated environment and the population dynamics of the pest species, utilizes all the appropriate techniques and methods in the most compatible way that is possible and keeps the pest populations at levels below those that would cause economic damages."

Integrated control is based on ecological principles and requires multidisciplinary efforts. This implies the complete utilization of factors causing selective natural mortality, complemented, if necessary, by artificial methods. The system reduces dependence on chemical pesticides and at the same time provides adequate crop protection and maximum protection of the general environment. It is not a new system for it has been practiced in

the past by ecologically-minded pest control specialists and sensible farmers in several parts of the world, although they did not call it integrated pest control. It is important to note that success in control may vary greatly; some control is achieved by simple and straightforward integration of a few components over a short period of time, while another may require more complicated integration over a much longer period. An additional motivation for the use of integrated control is the present short supply of chemical pesticides.

Guidelines for national, regional, and international programs

The following guidelines for further developmental activities of this approach are recommended.

- (1) There is an urgent need to provide information and education for the general public at all levels since everyone should play a role in encouraging the successful implementation of integrated control.
- (2) There is a need to collect and collate essential data and to provide mechanisms for the dissemination of information adapted for the use of various groups in society. This may take the form of symposia, seminars, specialized courses, articles in the media, bulletins, newsletters, extension services, personal contacts, and demonstration plots, to give but a few examples.
- (3) The channeling of information on an international basis could be improved by the creation of a clearing house which would collect, collate, and disseminate information about research on integrated pest control, especially for active research and field workers and for appropriate governmental agencies. As a secondary service, such a clearing house would provide information to bridge the gaps in our knowledge and would facilitate contact between workers associated with similar problems in various parts of the world. This would help to ensure a cross-cultural interdisciplinary approach to the study and application of integrated pest control. The channeling of information should hasten the introduction of new technological developments related to integrated pest control and to suitable safeguards for the consumers.
- (4) At the research level, there is a need to increase cooperation and the coordination of activities so that a multidisciplinary approach can be developed. Similarly, with regard to application, emphasis must be placed on the involvement of a wide range of disciplines. Implementation may be effected through an organization which reflects the various facets of the individual discipline involved.
- (5) It is strongly recommended that all on-going pest control programs be periodically reviewed so as to ensure the inclusion of any new developments on integrated pest control which might be applicable.
- (6) Since some pests pose a serious problem in several countries, there would be obvious advantages in identifying such pests and their associated problems for cooperative projects. This would allow the most

efficient utilization of the limited resources available, the avoidance of a duplication of effort, and the exchange of ideas among scientific and technical personnel from countries within the region. This has been done in a few instances, but more of these projects should be instituted at suitable centers in the region. The coordination of such projects should be the responsibility of any appropriate existing regional organization or any recognized research center of accepted standing.

- (7) Sound pesticide legislation and quarantine services should be established where not available, and those already in existence should be strengthened and periodically revised in order to take new findings into consideration. This is of paramount importance since the unwitting introduction of even a single pest or the wrong pesticide may disrupt an established and satisfactory integrated pest control program. FAO, which has such extensive activities in the field, would be able to provide the detailed guidelines.
- (8) Immediate steps should be taken to increase the number of qualified and trained pest control personnel at research, advisory, and field levels. To achieve this end, every available means should be employed, such as specialized training courses, both overseas and local. National and international agencies should lend all possible support, both financial and otherwise, to this training program.
- (9) Developing countries are urged to strengthen any existing national institutions which are at present actively involved in the development of integrated pest control programs.

Research needs and priorities: national, regional, and international

(1) General

Although integrated pest control programs for a given crop and locality can sometimes be developed on the basis of available knowledge, to be scientifically sound, they should be based on research. In this connection, it is desirable that research be intensified, according to national priorities, in the following fields:

- (a) Taxonomic studies oriented to the correct identification of arthropod species being dealt with in any agricultural ecosystem (wrong identification and/or lack of identification can preclude biological control).
- (b) The influence of physical environmental factors on the development, physiology, behavior, reproductive rates, and population dynamics of key crop pests and those important to public health, particularly those pests which require a large number of pesticide treatments; that such knowledge is the basis for solving pest problems has been clearly illustrated by the case of the desert locust; international cooperation can serve a vital role in furthering this research.
- (c) The role of biotic factors causing mortality (predators, parasites, and diseases) in the population dynamics of key pests.

- (d) A search for the natural enemies of key pests and/or research on mass rearing in a continuous effort to achieve biological control. In connection with items (c) and (d), the studies in the field of biological control conducted by IBP and CIBC are pertinent. Attention should also be given to IOBC and the role it plays as a global center in the coordination and dissemination of information on biological control activities.
- (e) Determination of economic injury levels of key pests.
- (f) The effects of pesticides to be used against key pests on concurrent beneficial fauna.
- (g) A search for pesticides which will least impair the action of natural enemies.
- (h) A search for insect pathogens which might be used as microbial pesticides within integrated control programs.
- (i) The possibilities of crop manipulation for the control of key pests.
- (j) The side-effects of pesticides on wildlife, domestic animals, and man.
- (k) Monitoring for the presence of pesticide residues in water and edibles, even if limited to those chemicals of wide utilization in agriculture and animal husbandry and those entailing great potential risks to human and animal health.

(2) Specific

Within the framework of the above research needs, the following lines are suggested:

- (a) Controversial aspects of pesticide usage, such as their effects on wildlife, domestic animals, and man.
- (b) Monitoring the effects of pesticides on animal life through population censuses of organisms used as biological indicators (this biological monitoring could be carried out within the system being developed by UNEP for physical contaminants).
- (c) Research on pesticide residues resulting from pre- and post-harvest treatments, such as has been carried on by IUPAC, should be conducted in other countries; methods of chemical analysis, such as those approved by IUPAC and adopted by FAO, should be used as standard methods by countries carrying on research on pesticide residues.
- (d) Dosage-mortality base-lines for key pests should be established for any promising pesticides; such base-lines would allow scientists to follow up the development of pesticide resistance and to determine the thresholds of pesticide effectiveness.
- (e) Further studies on the fate of pesticides in living organisms (plant and animal) and the resulting metabolites.
- (f) Intensified research on biochemical control, since it can be a solution for some pest problems.
- (g) Systems of pest surveillance and warning should be established.

Finally, it is strongly recommended that efforts in the field of biological control be intensified because it is not only the soundest and most promising alternative to chemical control, but also the basic component of integrated pest control programs.

It is impossible, within the scope of this report, to give a detailed and precise outline of action (for developing an integrated control program) that will meet the requirements imposed by different pests and pest complexes. In addition, the more specific Integrated Control Guidelines for cotton currently being prepared by the FAO's Panel of Experts on Integrated Pest Control is due shortly (that for rice has already been initiated). In view of the imminent accessibility of such guidelines and the serious pest problems confronting the developing countries, it is strongly recommended that the integrated pest control program for this crop be implemented as soon as possible. Meanwhile some useful guidelines are as follows:

- Step One:* Establish "supervised pest control." A surveillance (scouting) service regularly assesses levels of infestation and decides on pesticide treatment (time, dosage, material, method, etc.), thereby avoiding scheduled and blind pesticide blanketing of whole areas. Such a service normally includes a pest control officer and a trained scouting team; they design record sheets which include the major pests and their natural enemies.
- Step Two:* Promulgate legal ordinances governing cultural practices. Such ordinances should fix planting and harvesting dates, the clean fallow period, deadlines for the destruction of crop remnants, etc., which would reduce the chances for pests to increase. The above list of cultural practices does not preclude the adoption of other regulations (such as crop rotation) suitable for certain local conditions. This second step may be taken simultaneously with Step One.
- Step Three:* Plan and carry on the research needed for building a more elaborate pest control program. The latest research findings should be used to fuel the program, ensuring its continuous improvement. Such research should be in progress during the application of Steps One and Two.