INTEGRATED PEST MANAGEMENT AND USE OF AGROCHEMICALS

1. Insects, weeds, pathogens and other pests[1] are a fact of agricultural life. They thrive on a concentrated and reliable food source and unfortunately, the measures commonly used to raise productivity of crops (e.g., monoculture with high-yielding varieties, multiple cropping with reduction or elimination of fallow periods, use of fertilizers, etc.) create an even more favorable environment for pests. Therefore, knowledgeable management of pest problems is required in any effective agro-system. The Bank's support of the integrated pest management (IPM) approach in its agricultural lending operations is perhaps best discussed in historical perspective.

2. The introduction of chemical pesticides[2]in the 1940s was widely regarded as a revolution in agriculture. They were relatively inexpensive and highly effective, and it became common practice to spray fields regularly throughout the season as a preventive measure even if there were no visible attack. Advances in plant protection have contributed to increased yields and production consistency.

[1] "Pests" refers to all animals, plants and micro-organisms which have a negative impact on agricultural production.

[2] The term pesticide is used here as it is better known than the more precise generic term biocide (literally: chemical killers of life). The term pesticide suggests that pests can be distinguished from non-pests, that pesticides will not kill non-pests, and that pests are wholly undesirable.

Impacts of the use of agricultural chemicals

3. Experience since then, however, has shown this approach not only to be environmentally damaging but also ineffective in the long term. Where pesticides have been used indiscriminately in this way, pest species have become resistant and difficult or impossible to control. In some cases, resistance in important disease vectors (e.g., malarial mosquitoes) has resulted or new agricultural pests have emerged. For example, all mite pests were created by pesticides since there were no mite pests before pesticides were used.

4. The irrational use of pesticides can lead to serious illness or be fatal, contaminating soil and water, endangering livestock and wildlife and even harm the natural enemies of pests.

5. Once in the air pesticides move through greater or lesser air masses sometimes traveling over several tens of kilometers (or more). 25% to 75% of pesticides intended initially for crops are found in the air we breathe and this through several methods. Soils, surface waters, but especially the atmosphere are contaminated by pesticides. Therefore, pollution of these areas generate impact on both animal and human health.

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6. Out of this experience, crop protection specialists devised a more diversified and sustainable approach, Integrated Pest Management (IPM), which is based on three fundamental principles:

(a) To the extent possible, reliance is placed on using nonchemical measures to keep pest populations low. (For example, breeding and cultural practices are used to make the environment less hospitable to pests and to keep the crop healthy and resistant or tolerant to attack. This may include the introduction of non-indigenous pathogens or natural enemies.)

(b) The goal is to manage pests, not to eradicate them. Populations of important pest species are monitored and control interventions are made only as necessary[3].

(c) When pesticides [4] have to be used, they are selected and applied in such a way as to minimize adverse effects on beneficial organisms, humans and the environment3. Within these basic principles, approaches may vary depending on the crops or pests involved. The level of control necessary may also vary considerably, particularly for fruit and vegetable crops where cosmetic damage may significantly decrease market value.

[3] The common statistical models used are the economic threshold level (ETL) and the action threshold level (ATL). The ETL is established through crop-loss assessment of the value of the crop, the amount of damage it can tolerate at each growth stage without significant effect on yield and market value, and the cost of crop-production measures. The ATL is the pest population at which control action should be taken to prevent its reaching the ETL. Use of appropriate ATLs minimizes the frequency of pesticide application.

[4] "Pesticides" include insecticides, acaricides, herbicides, arboricides, rodenticides, fungicides, muticides, molluscicides, nematicides, etc., and also plant growth regulators (e.g., hormones and generically engineered compounds).

Relationship to BOAD financial Investments

7. BOAD's investments are to be designed according to the principles of environmentally sound and economically sustainable pest management The use of pesticide can represent one of the aspects of the IPM program "5/ Pesticides may be one component of an agricultural pest management strategy in the context of an IPM program.
8. Such justifiable practice, however, requires special knowledge of the particular substances being used, and how they are stored and applied. It is important to remember that pesticides are, for the most part, toxic compounds that are dispersed in the environment and handled by large numbers of people. They vary greatly in degree of hazard to humans and the environment and in margin of safety for misuse.

9. Therefore, control and supervision of pesticide use will continue to be of critical concern in projects funded by BOAD during designing of projects.

10. The required level of evaluation of pesticide aspects will be determined by the promoter of the project in collaboration with Techincal Serivces in charge early in the project cycle. Factors that should trigger close attention during project preparation, appraisal and supervision, include: (a) significant financing or use of pesticides; (b) introduction or promotion of pesticide use in areas where they are currently little used; (c) introduction or expansion of crops (such as cotton, vegetables or rice) in which pesticide use is often high; (d) use of pesticide that is judged to present a significant hazard to health or the environment; or (e) questions concerning the likely return on investment in pest management.

11. For projects where none of these factors apply, it will usually be sufficient to pass these guidelines to the promoter and provide assurance in the legal document that the guidelines will be followed. BOAD's policy clearly states that its requirements on pesticide selection and use are to be applied for any Bank-financed investment or adjustment operation under which pesticides may be procured, whether or not Bank funds are used for this purpose directly.

12. While pesticides are an easily recognized issue in agricultural projects where crop production is a goal, they are often overlooked where they are used in the reduction of post-harvest losses. Various types of pests (including molds) cause considerable losses in quality and quantity of stored foods. Climatic conditions and lack of appropriate storage facilities come in addition to this problem. Produce in bulk storage is usually fumigated or treated with dilute insecticide dusts. Fumigation can be extremely hazardous to humans, requiring specialized equipment and training, and can leave potentially dangerous residues on the food.

The bank's guidelines

13. These guidelines address aspects:

• Consideration of the integrated pest managment in the planning of programs, plan or project undertaken or supported by the BOAD

Crop protection is an integral part of agricultural development and BOAD's approach is to encourage the "best practice" of the moment. In this context, it supports the development of a program to fight against pests for any

agricultural development project, a program that takes into account economic, environmental and health and safety.

There must be a IPM program, which means that the use of pesticides is considered a last resort. The Bank encourages the development and dissemination of methods of IPM through research, extension and training as well as using promotion campaigns undertaken in borrowing countries . BOAD encourages the assessment of impacts of the use of agricultural chemicals on the environment.

The following criteria must be considered:

(a) types of pesticides for which procurement should be prohibited or restricted; (b) specifications for product quality, packaging and labelling; (c) preparation of bidding documents; (d) qualification of bidders and after-sales service; and (e) evaluation of bids taking into account effectiveness, cost and human and environmental hazards.

Below BOAD complies with FAO on the types of information that a plant protection product label should give:

- The trade name of the product;
- The name and address of the manufacturer and distributor of the product;
- The name of the active ingredients and their concentration ;
- The dates of manufacture and expiry;
- The approval number or Authorisation in Market
- The level of use permitted;
- Uses ;
- The precautions and conditions of use (protection of the individual ...)
- The toxicological classification symbols and indications of danger ;

• The risk phrases (R) and mentions on the toxicity and ecotoxicity on wildlife and the environment;
• The safety advice (S).

The label must always present pictograms indicating graphically the information necessary for safest handling of the product.
It is essential that farmers are properly informed about the use of pesticides

14. Many pesticides are powerful and hazardous toxins which pose major risks (e.g., health damage to humans, creation of pest resistance, death of non-target species such as birds). Therefore, the ESA should scrutinize the selection of pesticides with special care. Since it is impossible to be categorical, BOAD refrains from listing banned pesticides. However, the ESA team and the Project manager should avoid broad spectrum persistent pesticides, and move towards IPM and the more modern less risky pesticides such as Bthuringiensis. All pesticides selected should be justified in the ESA report.

Protection lors de la manipulation
L'équipement de protection individuelle (EPI) sert de barrière contre l'exposition aux pesticides.

Guidance for Environmental Assessments

15. IPM does not necessarily involve sophisticated information gathering and decision-making procedures. It can be introduced at any level of agricultural development, for example, through variations in such basic crop management practices as planting times, crop spacing and residue disposal. A useful beginning can be made with relatively little specialized information or management requirements. However, the effectiveness of any IPM program will be strengthened by the following:

(a) An understanding of the interactions between the elements of the local agro-ecosystem (e.g., crops, pests, beneficial organisms, the abiotic environment) and of any disruptions that may arise from overuse or misuse of pesticides.

(b) The development, with farmer involvement[5] (involvement of the people (often women) doing the work) of a pest management plan using practical methods to reduce pest levels (including methods related to the total crop production system as well as those targeted specifically for pest control).

(c) The establishment of realistic economic and action threshold levels for key pests.

(d) The development of practical systems for monitoring pest populations or infestation levels (either collectively or by individual farmers) and of whatever support structures are necessary to sustain them.

(e) The existence (or promotion) of farmer education concerning the principles and practices of IPM.

(f) The availability of appropriate materials and equipment, including establishment of insectaries to facilitate biological pest control where appropriate.

(g) Social and/or economic policy support that gives the farmer both incentive and opportunity to minimize pest management costs and increase productivity on a sustainable basis.

16. Similarly, research on crop protection/pest management methods does not necessarily have to be sophisticated, but it should be comprehensive. In addition to testing the efficacy (and environmental and toxicological characteristics) of pesticides, a complete research plan should include:

[5] "Farmer involvement" means involvement of the people (often women) doing the work. ,

(a) Basic studies of the agro-ecosystem, including biology and life cycles of crops, pests and beneficial organisms and interactions among them (e.g., identification and classification of pests and natural enemies and evaluation of the impact of indigenous natural enemies on pest populations).

(b) Development and improvement of pest-resistant crop varieties.

(c) Examination of cultural practices for reducing pest populations e.g., crop rotations, intercropping, timing of planting and irrigation, crop hygiene, land preparation, plant spacing, etc..

(d) Investigation of biological control methods, such as release of indigenous or introduced natural enemies, microbial pesticides, pheromones, repellents, etc.

(e) Identification of pesticides and techniques of pesticide use with minimal impact on beneficial organisms, humans and the environment.[6]

(f) Determination of the actual impacts of different pests and population levels on crop yield and quality.

(g) Review of traditional pest management practices of local farmers, as these often have a sound biological basis.[7]

17. Research carried out with the active participation of the intended beneficiaries is more likely to result in technologies that are practical under local field and socioeconomic conditions and thus to be adopted by the intended users. Therefore, an essential element of all pest management research should be an integration of farmers and field workers into planning

[6] For discussion of criteria to be used to determine which pesticides should be restricted (e.g., acute mammalian toxicity, environmental persistence, chronic health effects, toxicity to non-target organisms, etc.), see the World Health Organization's WHO Recommended Classification of Pesticides by Hazard.

[7] Sometimes, however, such practices are based on misperception of the importance of highly visible pests or may no longer be effective due to changing conditions. Also, natural compounds may have been developed that are extremely toxic. An attempt should be made to identify the substances and to control their use.

and implementation and an emphasis on trials in farmers' fields. The agricultural extension service should provide a useful link between farmers and researchers for these field trials.

18. Project support for IPM research can include: (a) technical assistance to evaluate and help develop pest management plans or research programs in specific areas; (b) training fellowships for researchers and technicians; (c) improving research facilities; and (d) grants for specific research projects and institutional strengthening. The organizational unit in charge of environment of BOAD can assist in identifying appropriate consultants or training institutions.

Training and Extension

19. The IPM approach should be the central focus of education and training related to crop protection at all levels: government policy makers, major buyers of crops, agricultural schools and colleges, pesticide suppliers, extension workers, farmers, etc. Education in IPM for farmers is particularly important because, in many countries, the farmers' primary alternative sources of information and advice on such matters are the pesticide sales representatives or commercial middlemen who have little or no knowledge of the technical aspects of their safe use, and have strong incentive to emphasize benefits over risks.

20. The important role of natural enemies in controlling pest populations must be emphasized. Many farmers have no understanding of this concept nor of its underlying principles (e.g., many do not distinguish at all between beneficial and harmful insects). Not surprisingly, many farmers do not distinguish between the various pesticides believing that any product is good for any pest in any crop, nor do they recognize the importance of using the correct dose at the right time. Because pesticides are often sold second or third hand in remote rural areas, farmers may purchase products with no

reliable information on what they are or how to use them. Extension workers should be prepared to advise farmers on the proper handling and use of pesticides, and on the hazards they pose to the farmers and to their families and livestock.

21. Training should therefore include a thorough understanding of pesticides: their effects and limitations, their associated health and environmental hazards, and requirements for safe and effective use and handling. In addition to conventional extension channels, a variety of methods and media should be used (e.g., radio, television, movies, illustrated pamphlets and comic books, etc.) to circumvent illiteracy and get the widest possible dispersion of information.

22. Special training, information and educational materials relating to IPM and pesticides should also be given to:

(a) Shopkeepers, vendors, farmers' groups or agricultural cooperatives involved in sale or distribution of pesticides, to ensure that all understand the toxic nature of the pesticides they are dispensing.

(b) Doctors, community health clinics and women's groups (particularly on symptoms and treatment of pesticide poisoning).

(c) Staff of credit institutions, to help them understand the economic advantages of IPM and to encourage them not to impose loan conditions that promote dependence on chemical pesticides or the use of very hazardous materials.

(d) School teachers and pupils and their parents in rural areas.

Policy Framework

23. While research, education and supply channels can provide the tools necessary for rational and cost- effective pest management, farmers must also have incentives to apply it. Therefore, in evaluating the crop protection component of a project, it is important to examine the economic policy framework and incentive structure and, if necessary, to propose measures to correct them. Clearly, when pesticide use is encouraged by subsidies from the government or donor agencies or by market requirements, the incentive for limiting their use is reduced.

Monitoring, Evaluation, and Supervision

24. Monitoring and evaluating progress on development and implementation of IPM programs is difficult because the scientific base may take a long time to develop, and also because farmers may not immediately adopt the technology offered. Often, therefore, progress must be measured initially just by correct processes being established: appropriate types of research and training programs (with adequate staffing and support) going on; strong linkages in place between research and extension; etc. Improvements relating to policy or infrastructure (e.g., the removal of pesticide subsidies), to safety of pesticide use and human exposure, and to environmental contamination (e.g., surface or ground water, wildlife) also should be tracked and evaluated. Because market competitiveness is a major factor for the farmer and any successful IPM program will address that concern effectively.

25. When an IPM program is introduced in an area where pesticide use has been high, a reduction in pesticide application within a few years is probably a good indicator of successful implementation. A system of pest population monitoring should be established early in the project and linkage made between the results of such monitoring and control intervention decisions.

26. Where the necessary technical or institutional capability for such monitoring and supervision does not exist locally, provision to develop them should be planned. Formal or informal cooperation with local nongovernmental organizations (NGOs) should be sought. Where appropriate, BOAD's supervision should be readily available, including involvement by technical experts (local or international).

Contents of the BOAD Staff Appraisal Report (AR)

27. The AR for an agricultural loan should indicate how these guidelines have been followed in project preparation and how implementation will be evaluated and supervised. It should describe as fully as possible the anticipated pest problems and current pest management practices. Where these are not consistent with IPM principles, the AR should include a schedule of the steps to be taken in the proposed projects to bring them in line. Areas of conflict should be discussed (e.g., malaria vs. swamp, drainage vs. use of insecticides). Pesticides selected should be explicitly justified in the AR, together with training, monitoring, precautions, and other preventive measures to reduce environmental risks.

28. Similarly, the AR should address current practices and problems, and propose measures for improvement regarding pesticide selection, use and disposal. Aspects to consider include:

(a) Existing or anticipated pest problems. Information on specific crop/pest targets should be provided to aid in identifying available IPM technologies that have been developed in other areas and may be adapted to local conditions. Information on pests that pose a public-health threat locally and control programs already in operation should also be provided, as these can influence agricultural pest management options.

(b) Proposed pest management plans and methods.

(c) Current institutional framework for crop protection (e.g., is pest management the responsibility of a government or company service or of individual farmers? are pesticides supplied by the government or through private commercial channels? are pesticides subsidized by the government? does market demand for a particular product quality encourage pesticide use?).

(d) The existing institutional structure and capacity for:

(i) dealing with pest problems (including diagnosis of pests and monitoring of population levels, impacts in the field and exchange of information on a regional basis);

(ii) applied research for development and testing, with farmer involvement, of pest management technologies (including biological control, intercropping, improved cultural practices and development of resistant varieties);

(iii) extension of pest management information and new technologies, and training of farmers; and

(iv) provision of services and inputs, and measures for cost-recovery for any services or inputs (including presence or absence of subsidies) provided by the public sector.

(e) Any aquatic or other important environmental resources in the proposed project area that may raise special concerns regarding pesticide use or other aspects of pest management (e.g., underlying aquifers used for domestic water supply, downstream commercial or natural fisheries or breeding grounds for aquatic species, adjacent natural parks or reserves, presence of endangered species that may be adversely affected).

(f) Legislation, regulations and enforcement capability relating to crop protection and to importation or use of pesticides. This includes: regulations

concerning application procedures, training for application personnel, and application instructions accompanying products (fertilizers, fungicides, pesticides, etc.); and the capacity for reliable assessment of pesticide toxicity, human pesticide exposure and pesticide residues in foods and the environment.

(g) Technology packages extended to farmers for increasing agricultural production (usually including improved seeds, fertilizers, pesticides, cultural practices, etc.). IPM does not lend itself to standard packages; but in most cases, introduction of these packages has a significant impact on the pest situation, and vice-versa. Therefore, they must be evaluated with respect to their potential impact both on the agro- ecosystem and on prospects for adoption of an IPM approach.