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POPULAR SCIENCE ARTICLE

INTEGRATED PEST MANAGEMENT AND ITS ADVANCES IN INDIA

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Introduction: Integrated pest management (IPM) is a broad ecological pest control approach aiming at best mix of all known pest control measures to keep the pest population below economic threshold level (ETL). In 1967, Food and Agriculture Organisation of the United Nations panel of experts defined IPM as: A pest management system, that in the contex of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible manner as possible and maintains the pest population at levels below those causing economic injury. IPM emphasizes the need for simpler ecologically safer measures for control to reduce environment pollution and other problems caused by exclusive and indiscriminate use of pesticides.

Why IPM : It is an economically justified and sustainable system of crop protection that leads to maximum productivity with the least possible adverse impact on the total environment.

Objectives of IPM

1. To keep the pest numbers below harmful levels (ETL) instead of their eradication.
2. To protect and conserve the environment including biodiversity.
3. To make plant protection feasible, safe and economical even for the small farmers.

Advantages of IPM

1. Protects the environment from pesticidal through air, water, soil and food chain system.
2. Maintains ecological balance.
3. Economically viable and socially acceptable proposition.
4. Benficial to public health.
5. Minimises the chances of the development of insect resistance to insecticides pest resurgence and secondary pests.
6. Protects beneficial insects and natural enemies from the hazardous effects of chemical pesticides.
7. No waiting time for harvest is required.
8. Enhance acceptability and value of produce for exports.
9. Well suited for rural areas.
10. Bio-degardable, no residues.
11. Essentials for food processing industry, particularly for export.

Constraints of I.P.M.

1. Institutional Constraints: The IPM is an interdisciplinary, multifunctional approach and fragmentation between disciplines, between research, extension and between the institutes lead to a lack of institutional integration. Secondly, the donor agencies and national programmes of developing countries have lacked a policy commitment to IPM in the context of national economic planning and agricultural development which resulted in a low priority for IPM from national progrommes and donors alike. Thirdly, the real needs of farmers are not taken into consideration due to research priorites of the institutions, therefore, they do not take interest in adopting the technology.

2. Informational Constraints: The major constraints in the implementation of IPM is the lack of information to the farmers and extension workers. Under field conditions, limited knowledge is available to use the control measures in a integrated fashion, whole the individual control techniques are very well

known. The non availability of training materials, curricula and experienced workers on the principles and practices of IPM is another major constraint.

3. Economic Constraints: The funding for research, extension and farmers training needed for an accelerated programme is a major constraint, even if IPM is taken in principle. Practically, IPM should be taken as an investment like other forms of investment and in long term programmes may become self generating due to savings on resources inputs for production.

4. Sociological Constraints: The pesticide industries have put forth chemicals which are highly effective and simple to apply and the farmers and farm level extension workers are fully convinced to use them. This acts as a major constraint in IPM implementation. There is a direct conflict between industry objective to sale more and the IPM message of rational use of pesticides. Therefore, there is a need to work in a more complementary manner by the private industry and public sector extension agencies.

Strategies for IPM Implementation

1. Farmers Participation: In this method the farmer may be trained by way of group discussion, demonstrations of IPM and Non IPM technology in the field and this is how they may be convinced to reduce the pesticidal spray and get higher yield of the crop.

2. Government Support: National Policy should include to promote IPM at the grass root level. In the case of pesticides which do not meet prescribed standards for safety, persistent etc. the import and manufacturing of such pesticides should be banned. At a minimum, the conditions laid out by the FAO code of conduct on the regulation, distribution and use of pesticides should be adopted. Pesticide subsidy should be discouraged in order to make IPM an attractive alternative.

3. Legislative Measures: The farmers using hazardous, broad spectrum synthetic pesticides indiscriminately, should be punished under suitable insecticidal legislation.

4. Improved Institutional Infrastructure: IPM can not be effectively implemented where there is no basic infrastructure of plant protection in a country. There is a dire need to develop and support national programme capabilities for on a farm testing and technology, extrapolation.

5. Improve Awareness: NGOS and consumer groups need to be strengthened so that there is a public oriented movement for implementation of IPM programmes in the country in general and at the grass root level in particular.

The role of agrochemicals in improving food security and human health cannot be undermined. They are, however, like a double-edged weapon; their indiscriminate use could result in a serious threat to the sustainability of the agricultural production system and human health. Though their long-term effects on environment and human health are yet to be fully understood, the short-term adverse effects of their indiscriminate use became apparent soon after their invention during the World War II. Many insect pests have developed resistance to chemical pesticides, and a number of beneficial insects that are natural enemies of the pests have disappeared. Realizing these threats, the scientific community has been proactive and developed safer alternatives using flora and fauna as substitutes for chemical pesticides. These alternatives are claimed to be as effective as chemical pesticides. A pest management system, that in the contex of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible manner as possible and maintains the pest population at levels below those causing economic injury.

Since the adoption of IPM as a cardinal principle of plant protection in 1985, India has devised and implemented many IPM programmes encompassing research, extension and education with the objective to reduce the use of chemical pesticides, improve farm profitability, conserve environment and reduce adverse effect of pesticides on human health. Their effect is revealed in considerable reduction in pesticide-use, particularly during 1990s. The effectiveness of chemical pesticides in reducing the pest-induced losses has diminished in recent years. A number of insect pests have developed manifold resistance to the pesticides intended to control them. Further, with the destruction of natural enemies of insect pests, a number of new pests have emerged. These imply that intensive use of chemical pesticides is leading to increased cost of pest control and reduced farm profitability. Under such a situation, alternative technologies such as biopesticides could provide some solutions. Research has generated a number of technologies using plants and pathogens. Many of these have, however, not been commercialized perhaps due to lack of their proven economic feasibility, short shelf-life, slow effect and incompatibility with chemical

pesticides. Technologies such as, *Trichogramma chilonis* and *Crysoperla carnea* despite their proven effectiveness, do not find favour with industry as well as farmers because of their short shelf-life, sensitivity to chemical pesticides and higher cost of application. Plant-based pesticides are often slow in action. This suggests that the research should target overcoming these technological problems. Genetic manipulation of seed varieties for pest resistance is an important constituent of plant protection strategy. Genetically modified varieties of some crops, such as cotton and rapeseed-mustard, have been developed but these are surrounded by controversies regarding their long-term effect on the environment and human beings. Nevertheless, genetic resistance could be an effective tool in pest management.

Role of Public-Private Sector: While most of the technologies have been developed by the public sector, private sector does not find investment in commercial production mainly because of their short shelf-life and stochastic pest behaviour. Most of the biopesticides are produced by the public sector firms. These hardly comprise 2 percent of the agrochemical market. Further, the pesticide has been biased 263 towards chemicals, and views biopesticides as a threat to the existing chemical industry. Moreover, the firms engaged in production and promotion of biopesticides face stiff competition from the pesticide industry. There is no denying the fact that transition from chemicals to biopesticides would be less remunerative in the short run. But, in view of global concerns of environmental conservation and rising consumer awareness about food quality, the industry has to switch over to biopesticides to harness the emerging opportunities. Nevertheless there is considerable scope to promote biopesticide industry as a small-scale industry with use of local resources, but with strict quality control.

Economic Viability: Scientists claim IPM to be an effective way of protecting the crops against insect pests. The claims are based on controlled experimental evidences and its wide scale testing under field conditions is yet to prove its economic feasibility. Its environmental and health benefits are well recognized. But farmers in the developing countries have a myopic view, and heavily discount the environmental and health benefits. They adopt a new technology only if it generates as much economic returns as the current technology. Evidences on economic feasibility are limited and scattered. Nevertheless, these indicate IPM as profitable as chemical control. Thus, in order to make IPM acceptable under field conditions, it is necessary to demonstrate its economic worth through large scale on-farm trials. In other words, there is a need for greater integration of biological and social science research.

Area-wise Implementation: There is hardly any information available on area protected with IPM. Estimates based on production statistics of biopesticides indicate that only about 1 per cent of the gross cropped area receives application of IPM inputs. One of the major impediments is the lack of availability of biopesticides and information thereon to the farmers. IPM is akin to a new technology and farmers often resist its adoption because of risk aversion. Further, as indicated above, many of the biopesticides are slow in action and are sensitive to chemicals. Since pest is a detrimental common property resource, it requires common action for its effective management. Application of 264 chemicals in the neighbourhood of IPM farms reduces the effectiveness of IPM. But, the technological characteristics of biopesticides are such that demand greater involvement of community for realizing their full potential. The current efforts are largely individual-centered. The future of IPM would largely be determined by the community participation. There is a need to devise an 'incentive system' for the farmers who participate in community pest management. Involvement of local administrative units (*Panchayats*) and Non-Governmental Organizations (NGOs) could be of great help in pushing IPM forward.

Awareness: India has a well-developed agricultural extension system. It has, however, not been tuned to the emerging technological requirements of the farmers. Extension personnel often lack awareness on the IPM inputs in terms of their technological characteristics, application rates and method of application. In recent years though considerable efforts have been made to train extension personnel in IPM, the required skills have not percolated down to the farmers. A system of reward and punishment for extension personnel should be devised.

Funding Agencies: The current efforts to promote IPM are largely on account of the initiatives of the Government of India through its Central Integrated Pest Management Centres. Under the national programme for promotion of IPM, the state governments are required to

allocate at least 50 per cent of the plant protection funds for promotion of IPM.

Rules and Regulations: The production of biopesticides is controlled by the same regulations as applicable to that of chemical pesticides. The process of registration is often cumbersome and costly. This encourages small entrepreneurs to undertake production of biopesticides. Moreover, there are more than 150 pesticides registered for use in agriculture. There are many pesticides that have been banned in the developed countries, but these are freely available in India. Biopesticides require entirely a different set of registration norms.Banning hazardous pesticides would help emergence of biopesticide industry.

Food Security and Quality: Until recently, food security has been an over-riding policy concern. Now with sufficient stocks of foodgrains, this has dissipated. A few years back it was apprehended that reduction in pesticide-use would adversely affect the production of food as well as non-food crops. And this might endanger the food security. Recent evidences, however, have indicated that gradual reduction in pesticide-use may not have much adverse effects on agricultural productivity. Further, there is a rising awareness about the food safety, particularly among the rich consumers. These concerns are going to be stronger in the future. Promotion IPM besides ensuring environmental protection would also ensure production of quality food. At present, IPM is not very popular among the farmers. A number of technological, socio-economic, institutional and infrastructure related factors are responsible for this. The success of IPM would be determined by the extent to which these constraints are alleviated.