**Journal of Interdisciplinary and Multidisciplinary Research (JIMR)**
E-ISSN:1936-6264| Impact Factor: 3.886|
Vol. 04 Issue 02, Feb- 2009
Available online at: https://livejimrjournal.in/
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

# INTEGRATED PEST MANAGEMENT IN INDIAN AGRICULTURE

**Dr. Kiran Yadav[1]**

## ABSTRACT

Over the next three decades, production of foodgrains in India has to increase at least 2 million tonnes a year to meet the food demand of the growing population. In the past, agricultural production increased through area expansion and increasing use of high yielding seeds. chemical fertilizers, pesticides and irrigation water. Now, prospects of raising agricultural production through area expansion and application of existing technologies appear to be severely constrained.

## KEYWORDS

Pesticide, Integrated Pest Management, Technology, Bio-pesticides, Ecological conservation

## INTRODUCTION

Land frontiers are closing down, and there is little, if any, scope to bring additional land under cultivation. Green revolution technologies have now been widely adopted, and the process of diminishing returns to additional input usage has set in. Concurrently, agricultural production continues to be constrained by a number of biotic and abiotic factors. For instance, insect pests, diseases and weeds cause considerable damage to potential agricultural production. Evidences indicate that pests cause 25 percent loss in rice, 5-10 percent in wheat, 30 percent in pulses, 35 percent in oilseeds, 20 percent in sugarcane and 50 percent in cotton. The losses though cannot be eliminated altogether, these can be reduced. Until recently, chemical pesticides were increasingly relied upon to limit the production losses. Pesticide use in India increased from a mere 15 g/ha of gross cropped in 1955-56 to 90 g/ha in 1965-66. Introduction of green revolution technologies in mid-1960s gave a fillip to pesticide use, and in 1975-76, it had increased to 266 g/ha, and reached a peak of 404 g/ha in 1990-91. Although, there is a paucity of reliable time-series information on

[1] Reader, Department of Zoology, Maharana Pratap Govt. P.G. College, Hardoi

pest-induced production losses, anecdotal evidences suggest increase in losses, despite increase in the pesticide use. The paradox is explained in terms of rising pest problem, technological failure of chemical pesticides and changes in production systems. Nevertheless, pesticide use has started declining since 1990-91reaching 265g/ha in 1998-99, without much affecting the agricultural productivity. The declining trend in pesticide use in agriculture during the 1990s can be attributed to central government's fiscal policy and technological developments in pest management. During 1990s, taxes were raised on pesticides and phasing out of subsidies was initiated. Programmes on training of both the extension workers and farmers in the Integrated Pest Management (IPM) were started throughout the country. In fact, the Government of India had adopted IPM as a cardinal principle of plant protection in 1985. Notwithstanding these initiatives, adoption of IPM has not been encouraging as biopesticides capture hardly 2 percent of the agrochemical market. This overview provides a synthesis of the papers presented at the workshop and identifies technological, socio-economic, institutional and policy issues important in making IPM work under field conditions.

## AVAILABLE TECHNOLOGIES

Research has generated new technologies using naturally occurring enemies of insect pests (parasitoids, predators and pathogens) for use in IPM. Some important commercially available products include Trichogramma, Bracons, Crysoperla carnea, Crytaemus montrouzieri, Bacillus thuringiensis, Bacillus sphaericus, Nuclear polyhedrosis viruses (NPV) and Trichoderma. In addition, a number of plant products such as azadirachtin (neem), pyrethrum, nicotine, etc. are also valuable as biopesticides. In India, more than 160 natural enemies have been studied for their utilization against insect pests. Technologies have been standardized for multiplication of 26 egg parasitoids, 39 larval/nymphal parasitoids, 26 predators and 7 species of weed. The Directorate of Plant Protection and Quarantine, Ministry of Agriculture, Government of India, has evolved location-specific IPM packages for both the Kharif and Rabi crops in consultation with IPM experts from the Indian Council of Agricultural Research, State Agricultural Universities, and the State Departments of Agriculture.

## ECONOMIC FEASIBILITY

Technical feasibility is a necessary but not a sufficient condition for commercialization and adoption of a technology. The necessary condition is the net benefits it entails to the producers over the conventional technology. Net benefits can be measured in terms of the difference in per hectare net revenue due to application of new technology and/or changes in unit cost of production. Studies included in this volume suggest IPM as a cost-effective technology. The magnitude of net benefits however would depend on the type of input used in IPM package, its application rate and price. Evidences show that even under experimental conditions some technically feasible IPM packages turn out to be economically infeasible because of higher prices of some of its constituents. The inference is 'IPM has the potential to substitute chemical pesticides without demanding any additional resources and without having any adverse effects on agricultural productivity. Nevertheless, inputs prices are an important determinant of the economic feasibility of IPM, and any increase in prices of critical inputs may upset its economics'.

## SOCIO-ECONOMIC AND POLICY ISSUES

Despite its techno-economic superiority over conventional chemical control, adoption of IPM remains restricted to hardly 2 percent of the area treated with plant protection inputs. This estimate is based on the informed opinions of the researchers, extension personnel and policy makers. The structure of agrochemical market also suggests a similar level of adoption; bio-pesticides share only 2 percent of the agrochemical market in India. There could be a number of technological, social, economic, institutional and policy factors restricting large scale adoption of IPM.

## TECHNOLOGY CHARACTERISTICS ARE IMPORTANT DETERMINANTS OF ADOPTION

The characteristics of technology have an important role in farmers adoption decisions. IPM draws heavily on complementarities and interactions of different methods of pest control (chemical, biological, cultural and mechanical), and each of the components has its own specific characteristics and requirements for application. This makes IPM a complex technology. Generally, the farmers adopt those components that show immediate effect, and are easily available Bio-pesticides comprise a major component of IPM. Most of the bio-pesticides are host-specific, slow in action and have short shelf-life. Besides, application of some of the components is labour intensive compared to conventional chemical control. In other words, farmers are risk averse and such technological characteristics create an apprehension among the farming about their efficacy to control pests. The complexity of IPM necessitates active involvement of stakeholders (researchers, extension workers and farmers) to alleviate apprehensions through participatory/ adaptive research trials. The major issues that the researchers would be confronting in the decades to come include basic research for development of broad-spectrum biological pesticides and improvements in their efficacy and shelf-life. At present, problems of insecticide resistance, resurgence and secondary pest outbreak are not reported against biological substitutes. Maintenance of this property would require sustained research efforts. Bio-pesticides based on predators, parasites, viruses, fungi, etc. are sensitive to chemical pesticides. This warrants research emphasis on development of bio-pesticides having better compatibility with chemical pesticides. Genetic engineering for resistance breeding will remain a gray area for long. Biotechnology has got tremendous potentialities for developing bio-pesticides.

## COMMUNITY PARTICIPATION: KEY TO SUCCESS OF IPM

Pest has the characteristics of a detrimental common property resource. It does not recognize spatial boundaries. In other words, successful pest control demands collective efforts. Yet, most of the times pest control efforts are individualistic, giving rise to a number of pest control related problems, such as pest resistance, resurgence and secondary outbreak, destruction of natural enemies of insect pests and other beneficial insects. Collective pest management assumes greater significance in the context of IPM. There are a number of management practices such as observance of synchronicity in sowing dates, use of resistant varieties, crop rotations, etc. that require close cooperation among farmers to achieve maximum pest control efficiency. Further, IPM relies on inputs derived from living 5/9 organisms, and the application of different control methods in a locality, in particular chemical pesticides, would adversely affect the activities of the biological inputs. Though, a majority of the farmers could be aware of the benefits of collective action, a number of socio-economic factors act as a disincentive to participate in it. Further, the farmers applying IPM technologies were more willing to participate. The need therefore is to evolve institutional mechanisms that promote group action. The current concept of Farmers' Field School though is based on the principles of collective action; it is often observed that either the groups are not formed, or even if the groups are formed, thev disappear once the program is withdrawn.

## SUPPLY OF BIOPESTICIDES IS CRITICAL TO SUSTAINABILITY OF IPM

As noticed earlier, bio-pesticides capture only 2 percent of the agrochemical market, although the mass production standards and techniques have been developed for a number of bio-pesticides. Further, most of the production takes place in public sector units. So is their distribution. Of over 400 biocontrol laboratories in India, 70 percent are in the domain of public sector. Most of the laboratories are small and cater to the location-specific needs only of a small area. The average gross cropped area per biocontrol laboratory is large. This shows that production of bio-pesticides is thinly spread. Nevertheless, the continental dimensions of the agricultural sector offer vast scope for expansion of bio-pesticide industry. Some inherent technical characteristics of bio-pesticides however act as disincentive to the entry of private sector. Unlike chemical pesticides, most of the bio-pesticides are not broad spectrum and are slow in action. Many of these like Trichogramma and Crysoperla have a short shelf-life, ranging from a few weeks to few months. Thus, production of bio-pesticides is fraught with risk. Other constraints in expansion of bio-pesticide industry are uncertain demand, and lack of appropriate infrastructure for transportation, storage and marketing. Rural unemployed and educated youths should be encouraged to establish small-scale bio-pesticide production units at village or block level. Measures, such as training to the potential entrepreneurs, provision of institutional credit, subsidies, insurance against low offtake of inputs due to low pest infestation, and exemption from taxes and duties would stimulate production of bio-pesticides. Further, bio-pesticide manufacturing units are under strict registration and quality control requirements. The process of registration is cumbersome and costly, which discourages potential entrepreneurs. Considering the role of bio-pesticides in ecological conservation and human health safety, registration requirements should be relaxed, though without reconciliation with quality standards.

## CONCLUSION

India has successfully reduced pesticide consumption without adversely affecting the agricultural productivity. This was facilitated by appropriate policies that discouraged pesticide use, and favoured IPM application. Despite it, adoption of IPM is low owing to a number of socio-economic, institutional and policy constraints. On the supply side, lack of commercial availability of bio-pesticides and inappropriate institutional technology transfer mechanisms are the critical impediments to increased application of IPM. The presence of private sector in bio-pesticide production and marketing is marginal, and needs to be improved through economic incentives. On the demand side, farmers though are aware of technological failure of pesticides to control pests, and their negative externalities to environment and human health, pest risk is too high to experiment with newer approaches to pest management. IPM is a complex process and farmers lack understanding of biological processes of pests and their predators and methods of application of new technology components. The socio-economic environment of farming is also an important factor in adoption of IPM. There are a number of IPM practices that work best when applied by the entire community and in a synchronized mode. This is unlikely to happen without demonstrating benefits of group approach, and external motivation and support to the farmers. Though many technology programs are based on community approach, they do not have any proper exit policy to sustain the group approach. The IPM policy should also provide incentives to farmers to adopt IPM as a cardinal principle of plant protection.

**REFERENCES**

1. (Pradhan 1 National Centre for Agricultural Economics and Policy Research, Library Avenue, New Delhi 110 012 1983, Atwal 1986, Dhaliwal and Arora, 1996)
2. (Adesina and Zinnah. 1993: Lapar and Pandey, 1999)
3. Kogan, Marcos, “INTEGRATED PEST MANAGEMENT: Historical Perspectives and Contemporary Developments” Annu. Rev. Entomol. 1998. 43:243–70.
4. Thomas, Ecological approaches and the development of “truly integrated pest management”, *Proc. Natl. Acad. Sci. U.S.A.* 96 (11) 5944-5951, https://doi.org/10.1073/pnas.96.11.5944 (1999).