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RESEARCH ARTICLE :

Prospects of integrated pest management in India

PANDA SHUBHAOM AND RATHORE RAKESH

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SUMMARY : The contribution of agrochemicals in improving food security and human health cannot be undermined but their indiscriminate and injudicious use of in agriculture has resulted in several associated adverse effects such as environmental pollution, ecological imbalances, pesticides residues in food, fruits and vegetables, fodder, soil and water, pest resurgence, human and animal health hazards, destruction of bio-control agents, development of resistance in pests etc. Use of pesticides, globally, has grown over last 20 years to 3.5 billion kg/year, amounting to a world market of $45 billion. The effectiveness of chemical pesticides in reducing the pest-induced losses has diminished in recent years, resulting in increased cost of pest control and reduced farm profitability. Realizing these threats, the scientific community has been proactive and developed safer alternatives as substitutes for chemical pesticides. Evidences indicate that these provide effective protection against pests when used in combination with other methods of pest control, including a chemical pesticide, which is referred to as Integrated Pest Management (IPM).Moreover it's also difficult to say that pesticides alone can kill pests or alternative tactics alone can control pests. A holistic, systems-oriented integrated, approach is needed, with farmers empowered to innovatively manage soils, water, biological resource, pests, disease vectors, genetic diversity and conserve natural resources in a culturally appropriate manner. The approach of IPM would be meaningless if it will not be transformed and repackaged to suit the farmer's needs. What is therefore needed is an effective extension mechanism, appropriate diffusion approaches and other information support services on crop protection to make the technology usable by the targeted clientele. These IPM approaches must be developed and customized and made well-suited to the social system of small farmers. This paper identifies the scope of IPM in India by which the farmer society can be greatly benefited.

KEY WORDS :
Pesticides, IPM, Agrochemicals, Management

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Author for correspondence :
PANDA SHUBHAOM
Institute of Agri-Business Management, BIKANER (RAJASATHAN) INDIA
Email : shubhaom.iabm@gmail.com

See end of the article for authors' affiliations

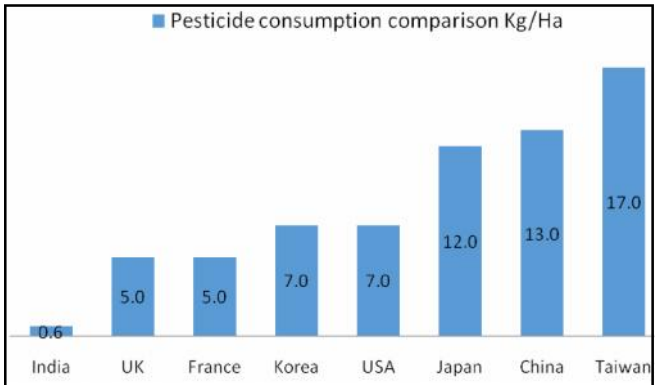
BACKGROUND AND OBJECTIVES

Agriculture being the lifeline of India holds for near about 15 per cent of the country's GDP. Near about 58 per cent of the total rural population depend on agriculture as their primary occupation. India is highly populated. This is the only reason why productivity, not production, should be given prior importance. By 2022, India may surpass China in population and become the largest populated country in the world. India currently holds nearly 17.84 per cent of the world's population, 2.4 per cent land resources and 4 per cent of water resources. Crop protection is a major tool in achieving the required

productivity in future. Notably, about 15-25 per cent of crop production is lost due to pests, weeds and diseases.

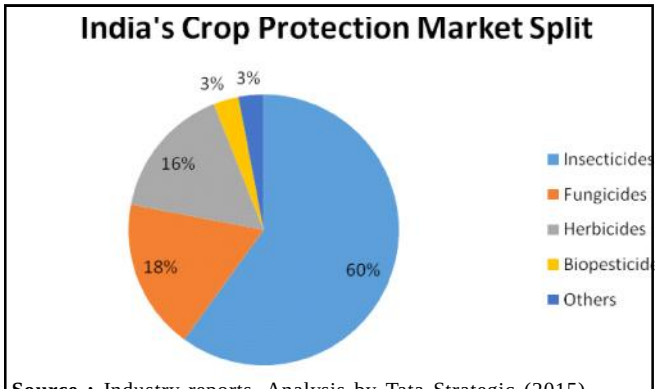
India stands fourth in agrochemical production followed by US, Japan and China. But, India is among the lowest in per capita consumption in the world and stands at 0.6 kg/ha compared to nearly 13 kg/ha in China. Per hectare productivity in India is 4 tons/ha, compared to 7 tons in USA. Still India needs to focus on enhancing crop productivity through sustainable agriculture. Integrated Pest Management (IPM) is the need of the hour, adopting features of Good Agricultural Practices (GAP). Government of India is attempting to meet the needs of the farmers with the help of various schemes like Soil Health Card Scheme, Paramparagat Krishi VikasYojna, National e-Governance (NeGP), M-Kishan, etc. From the Fig. 1, it can be seen that the pesticide consumption of India is very less.

It can be seen from the Fig. 2 that Indian pesticide market is dominated by insecticide (60 %), followed by fungicide (18 %) and herbicide (16 %). Still there is a great opportunity for biopesticides.



Source : Industry reports, Analysis by TATA Strategic, 2015

Fig. A : Pesticide consumption worldwide



Source : Industry reports, Analysis by Tata Strategic (2015)

Fig. B : Indian crop protection market split

Crop protection is the key to a successful agricultural production in the absence of which even the most meticulously planned and raised crops amount to nothing. Today, India's challenge lies in protecting the crop produced in the field as they are constantly exposed to the elements of pest and diseases.

Integrated Pest Management (IPM) was evolved as a sustainable approach to pest management using a combination of techniques like mechanical control, biological control, different agronomic practices and to use resistant varieties.

Pesticides only form the last line of defence and that too in a manner that minimises risks to human health, beneficial and non target organism and the environment.

Bio control, which uses biological agents to bring down the pest or diseases, has been considered to be environmentally safe and eliminates the positivity of pesticide residues in final produce.

W.H.O. estimates 1 Million pesticides poisoning cases and 20,000 deaths every year globally. This is due to high pesticide residues in food chain including cereal, pulses, vegetables, fruits, milk and milk products. Most of the chemical pesticide presently used in India fall under extremely hazardous and highly hazardous categories.

According to the Food and Agriculture Organization (FAO) of the United Nations, IPM means considering all available pest control techniques and other measures that discourage the development of pest populations, while minimizing risks to human health and the environment.

A good Integrated Pest Management Program has three components :

– Identifying and monitoring pest problems
– Selecting the best pest management tactics
– Recordkeeping and evaluating the program

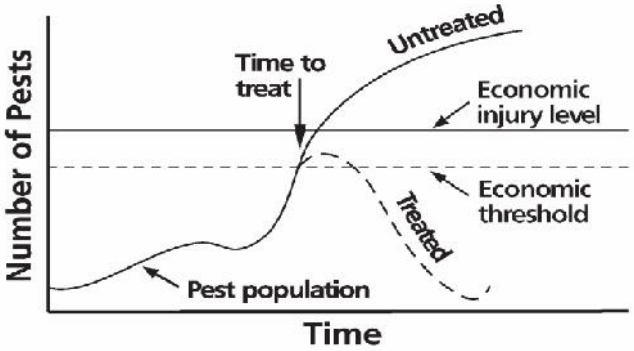
Three important components to making informed pest management decisions involve the number of pests present:

– Economic injury levels – this is a research based population level of a pest that represents the smallest pest population that will cause economic damage (that is where the costs to treat are covered by the resultant yield and quality saving from making the treatment).

– Economic threshold – this is the population of a pest that is large enough to trigger a treatment response to avoid the population reaching the economic injury level. This allows time for a decision to be made and the

product to be applied at or before economic injury levels are reached.

General equilibrium position – this is the average density of a population over time. It is useful to help in tracking peaks and crashes of a given pest population.



Source : National Pesticide Application Certification Core Manual, NASDARF

Fig. C : Graph of ETL and EIL

Review of literature :

In the absence of technical support, the indiscriminate use of synthetic organic pesticides gave rise to their residue problems in foodstuffs. Most of these pesticides were considered capable of causing chronic toxicities in human beings, like carcenogenecity, tetrogencity, allergic reactions, neurotoxicity, and infertility. Of the different groups of insecticides the organochlorine insecticides are specifically fat soluble and long persistent compounds. These, therefore, remain stored in body fat of animals for considerable time.

Integrated Pest Management (IPM) is the hope for all concerned with the pesticide residues in foodstuffs. The idea was initially given by Bartett, B. R. about four decades back in 1956. He combined biological control with the use of synthetic pesticides and called it Integrated Pest Control. Later Geir, P. W., in 1970, blended all available benign pest control techniques with pesticide use and named it IPM. FAO, NAS, and the like organisations subsequently refined the concept into more specific definitions. Basically, IPM programmes rely on biological control, scouting of crops, and cultural practices to prevent pest population build-ups to economic threshold levels (ETL) and economic injury levels (EIL) and minimize thus the use of synthetic pesticides. It provides long lasting and stable benefits to farmlands in a consumer-safe manner (Dent, 1995, Dhaliwal and Arora, 1994 and 1996; Kandalkar*et al.*, 2001; Upadhyay *et al.*, 1996).

The pesticide market is mostly a fragmented and generic market where a single technical grade is available under several brand names. Sometimes, there may be over 50 brands for a single technical material (Pappa 1992). For example:

- Imidaclorprid (> 80 Companies)
- Thiamethoxom (> 30 Companies)
- Acetmiprid (> 50 Companies)

Again since more than one technical grade is recommended for the control of a pest, there are a number of brands available for a problem situation. A case in point is the change in the pesticide usage with the change in the seed type. Introduction of hybrids has influenced the pesticide market significantly, as this increased the incidence of pests, and this influenced the type of pesticide used. Farmers used different types of pesticide varied with the intensity of pest attack. While mild (organophosphates) brands were used for prophylactic applications, strong brands (synthetic pyrethroids) were preferred for curative low attack and very strong (combination) brands were preferred for curative high attack. Again, the demand for pesticides decreased after the introduction of the Bt Cotton seeds. In India, unlike other countries where he herbicide use is high because of shortage of labour, the herbicide usage in India has been low. Similarly, since India is a tropical country, the incidence of diseases is lower than what it is in some of the other temperate countries, and therefore, the consumption of fungicides has been low. However, the incidence of the insect attacks on crops like cotton, rice, pulses, and vegetables has been quite high making them large markets for pesticides.

Though prophylactic pesticide application is not recommended by international agricultural research institutes and integrated pest management, the market conduct of agri-input companies in India has encouraged prophylactic application. Prophylactic application of pesticides follows a standard spray schedule without taking into account the actual requirement.

The market could not control the supply of inferior quality inputs. (FICCI, 2010 states that approximately US$233 Million worth of pesticides was counterfeit.) The unscientific use of inputs by farmers led to unprofitability of agriculture which in turn led to low investment in agriculture. Centre for Sustainable Agriculture (2007)

states that in 2000-01, crop loss in India was about 60,000 crore of rupees despite plant protection measures.

This led to disinterest of the farmers in agriculture. NSS survey (NSSO 2005) revealed that 27 per cent of farmers reported that they did not like the profession of farming because it was not profitable. The study also found that 40 per cent of farmers, given a chance, would quit farming (NSSO 2005).

RESOURCES AND METHODS

The research design of the paper is based on descriptive approach. The source of the data relating to the paper is secondary in nature. Books, journals, websites, etc. were the sources of secondary data.

OBSERVATIONS AND ANALYSIS

The contribution of agrochemicals in improving food security and human health cannot be undermined but their indiscriminate and injudicious use of in agriculture has resulted in several associated adverse effects such as environmental pollution, ecological imbalances, pesticides residues in food, fruits and vegetables, fodder, soil and water, pest resurgence, human and animal health hazards, destruction of bio-control agents, development of resistance in pests etc. Use of pesticides, globally, has grown over last 20 years to 3.5 billion kg/year, amounting to a world market of $45 billion. The effectiveness of chemical pesticides in reducing the pest-induced losses has diminished in recent years, resulting in increased cost of pest control and reduced farm profitability. Realizing these threats, the scientific community has been proactive and developed safer alternatives as substitutes for chemical pesticides. Evidences indicate that these provide effective protection against pests when used in combination with other methods of pest control, including a chemical pesticide, which is referred to as Integrated Pest Management (IPM).

Challenges of IPM :

Most private sectors do not find suitability in promoting IPM because shifting from chemicals to biopesticides would be less remunerative and highly competitive. The public sectors are now holding the biopesticide market share of 2 per cent only. For the global concern the private sectors need to switch over to biopesticides to harness the emerging opportunities.

The wide adoptability of IPM still possesses a question mark because of its acceptability over the field. Taking economic returns into account IPM, farmers are still in a whirl, whether to adopt it or not. In order to promote IPM, it is necessary to have much of field demonstrations in the farmers' level. There is hardly any data about the adoption of IPM in India. Based on the statistics of Biopesticide production, it is estimated to have 1 per cent gross cropped area under IPM. Resistance to change is prevalent in case of accepting IPM practices. Biopesticides are even slow in action compared to pesticides. Being individual handling IPM may be difficult for the farmers. If IPM is to be promoted, then it is better to promote it as a group centric methodology. Community centered approach should be followed in India for the wide adoption of IPM. Participation an involvement of the local administrations and NGOs would promote IPM in a constructive way.

Food security is a major concern in the recent future. Whether IPM is going to fill the gap is also a matter of concern. Because stopping all the pesticides may invite the disaster of food availability. So, with progress in a marginal speed IPM and gradual reduction in pesticide use may fill the gap with a sustainable outlook.

Opportunities of IPM :

The Government of India has accepted the Agenda 21 of the United Nations Conference on Environment and Development (UNCED), 1972, which welcomes IPM as an effective way to reduce the use of chemical pesticides. In 1985, India adopted IPM as a weapon for crop protection. Since then India has invited so many initiatives for the adoption of IPM.

India has set 26 central IPM Centres (CIPMC) to promote IPM in 22 states and 1 union territory. Also Indian government has proposed to establish new centres at north-eastern states of Arunachal Pradesh, Meghalaya, Manipur and Tripura. Central government has assisted financially for the setting up 29 biological laboratories and production of bio-control agents. The state government is also providing 50 per cent subsidy to farmers to promote IPM. Under the centrally sponsored schemes of the Department of Agriculture and Cooperation, Ministry of Agriculture of the Government of India, the funds are being released by the Central Government on 75:25 sharing basis (Central:State) to the states for IPM programmes.

The private plant clinic centres also help in promotion of IPM programmes in various states. There are 130 biocontrol agents/biopesticides units in the private sector.

Besides, the government is doing training programmes for the training for the trainers, setting up Farmers' Field Schools (FFS) to train Agricultural Extension Officers and farmers in IPM skills and doing field Demonstration of field tested IPM practices. The resources for training courses in IPM have come from international organizations like FAO, ABD-CABI and UNDP.

The government is now phasing out subsidies on pesticides and diverting the savings for promotion of IPM. The government is taking strict actions to restrict the use of hazardous pesticides. It promotes for the registration of biopesticides with a liberal procedure. Also, it gives importance to the production and use of biocontrol agents, biopesticides and pheromones.

Apart from major policy, government is also doing top level meetings with the senior executives, scientists of the Indian Council of Agricultural Research, and State Agricultural Universities, and company professionals for the effective implementation of IPM.

To promote IPM, biopesticides like neem-based formulations, Bacillus thuringiensis, Trichoderma have been registered for commercial use by the farmers. Also to get quality biopesticides, other biopesticides like NPV, GV, entomogenous fungi, etc. have been brought under the provision of Insecticides Act, 1968.

Conclusion :

IPM is the need of the hour, particularly of India, to prevent damage to people health by minimising toxic residues of chemical pesticides causing health problems including cancer, neurological disorders and deaths, its wide adoption is also essential to minimise the suicides by farmers not getting desired control of pests and diseases of crops through sole use of chemicals and to manage resistance and resurgence in pests and diseases. It would also result in minimising the number of sprays and in preventing the prevalent use of chemical cocktails.

IPM is the only recourse to conserve bio-diversity comprising of beneficial pollinators/parasites/predators, insects, to obtain higher yields of crops through superior control of pests and diseases of crops and to avoid loss of exports caused by presence of toxic residues in grapes, spices, tea, coffee and tobacco.

The concept of bio-pesticides and bio-control in farming is still in infancy. Only 1 per cent of 143 Million hectare crop area and only 2500 villages out of over 6 lakh villages in the country have been covered so far under IPM. The adoption of Integrated Pest Management is the future of sustainable agriculture. The approach of IPM would be meaningless if it will not be transformed and repackaged to suit the farmer's needs. What is therefore needed is an effective extension mechanism, appropriate diffusion approaches and other information support services on crop protection to make the technology usable by the targeted clientele. These IPM approaches must be developed and customized and made well-suited to the social system of small farmers.

Authors' affiliations :

RATHORE RAKESH, Institute of Agri-Business Management, BIKANER (RAJANSATHAN) INDIA

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