The Pharma Innovation Journal 2022; SP-11(11): 488-490

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(11): 488-490
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www.thepharmajournal.com
Received: 15-08-2022
Accepted: 19-09-2022

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Adoption of integrated pest management practices in wheat crop in district Kannauj, Uttar Pradesh

Supragya Krishan and AK Singh

Abstract
It is widely acknowledged that one of the main obstacles to boosting and maintaining agricultural productivity in India is the presence of insect pests. The agricultural systems have changed significantly as a result of recent research advances, allowing farmers to cultivate a variety of crops throughout the year that were formerly quite seasonal (Sethi *et al*., 2002) [1]. Additionally, this resulted in a major change in the dynamics of insect populations and the status of various insect pests. Recent interactions with farming communities have shown that 93% of Indian farmers use chemical control, 51% get advice on plant protection from dealers, while 22% get it from extension agents, and the majority of farmers (73%) start the plant protection process when the pest first appears, regardless of its population, crop stage, or damage relationships (Kumar *et al*., 2006) [2]. In the case of wheat crops, plant protection expenses ranged from 7 to 40% of the crop's overall production costs. Despite the fact that integrated pest management (IPM) has been promoted for the past 20 years, only 3.2% of farmers used IPM methods in their wheat crops. However, IPM research over the past 10 years has revealed changes in farmers' attitudes towards pest management, which led to a 20–100% reduction in the use of pesticides in various crops. The current consortium-based farmer participation strategy was particularly successful in transferring technologies. Despite the positive outcomes, IPM adoption in Indian agriculture still needs to be strengthened through increased funding for both basic and applied plant protection research in order to displace the three wicked "Rs" now in use (Resistance, Resurgence, and Residues). Rethinking policies to promote eco-friendly solutions, increase extension, and include farmers should be prioritised in order to be more effective.

Keywords: IPM, wheat, adoption, chemical, biological, agronomic

Introduction
Indian agriculture is diverse, with a wide range of crops and environmental factors that influence growth. In developing nations like India, ensuring food security, reducing poverty, and enhancing the living conditions of the poor are the major issues that must be resolved due to population growth (James, 2006) [3]. While addressing the aforementioned problems, Indian agriculture research made significant strides in crop output but paid little regard to operational and environmental risks. Where intensive agriculture was practised, farmers used massive amounts of pesticides to increase crop productivity (Logiswaran & Mohanasundaram, 1985) [5]. The intensity of pesticide use in crops like wheat in India suggests that even though the current insecticidal use was previously thought to be lower than that of developed nations, the insecticidal pressure per unit area of these commercial crops must be significantly higher than that of pesticide use in developed nations. Insect pests become resistant to chemical pesticides as a result of overuse (Kranthi *et al*., 2002) [4], residues appeared in the food supply (Ranga Rao *et al*., 2009b) [10], and smaller pests began to reappear. Although farmers field schools on the wheat crop were held in Uttar Pradesh to emphasise the value of IPM in reducing pesticide-induced risks at the farm level without reducing yields (Mancini, 2006) [6], it was observed that chemical control was widely used (93%) in Indian agriculture to manage a variety of insect pests in a variety of crops (Ranga Rao *et al*., 2009a) [9].
In order to achieve the following goals, it is important to employ Integrated Pest Management Practices in the wheat crop in the District of Kannauj, Uttar Pradesh.

- To learn whether wheat crops in the Kannuaj district are using Integrated Pest Management Practices.

Methodology
The district of Kannuaj in Uttar Pradesh was specifically chosen for the study.

Chhibramau and Kannauj were the two blocks used for the selection of responders. From each chosen block, 10 village panchayats were chosen. Approximately 10 farmers were chosen proportionally from each village, for a total of 120 farmers.

Findings

Due to the intricacy of IPM, stakeholders (researchers, extension specialists, and farmers) must take an active role in reducing concerns through participatory/adaptive research trials. Even though the majority of farmers are aware of the advantages of collective action, there are a number of socioeconomic and technical factors that hinder the programmes' ability to spread quickly. Despite the Indian government's serious efforts and significant resources allocated to the implementation of IPM, 93% of farmers still rely solely on chemical control, and more than 50% of farmers continue to get guidance from pesticide sellers, which is disheartening. When the majority of farmers start chemical sprays when pests appear for the first time rather than adhering to the thresh hold idea, one cannot currently expect large levels of IPM adoption. IPM has been used successfully in a number of Indian crops, and more of these case studies need to be presented in order to increase the capacity of farmers and researchers. Young adults in rural areas who are educated and unemployed should be urged to start small-scale bio-pesticide production facilities at the village or block level. The production of bio-pesticides could be boosted by policies including entrepreneurship training, institutional financing, subsidies, insurance, and tax and duty exemptions. Additionally, there are stringent registration and quality control requirements for biopesticide manufacturing facilities. Potential business owners are put off by the time-consuming and expensive registration process. Given the importance of bio-pesticides for ecological preservation and their safety for human health, registration restrictions ought to be loosened without lowering the level of quality.

Table 1: Before and after IPM adoption in various crops in 2018–2019, insecticidal sprays

Crop	No. of insecticidal sprays		Reduction (%)
	2018	2019	
Wheat	11.4	3.8	65.1

* Information collected from 10 villages involving 120 farmers

Table 2: Quantities of commonly used pesticides used by farming communities and their recommended doses-2018-2019

Chemical (Number of Farmers)	Quantity of chemical used (ml /ha)		Recommended
	Mean	Range	
Endosulfan (185)	1580	375-5000	1000
Monocrotophos (251)	1590	250-3750	750
Indoxacarb (169)	418	63-1250	250
Spinosad (133)	213	50-500	125
Cypermethrin (82)	1753	250-2500	500
Imidacloprid (51)	305	63-750	125

A variety of pesticides used in agriculture have recently been outlawed by the government due to their detrimental impact on the environment and public health. Despite this, there are a lot of these on the market. For instance, DDT and BHC, which are approved for use in the control of mosquitoes, are commonly used in agriculture. Furthermore, Indian farmers have access to a variety of pesticides that have been outlawed in other parts of the world. The market could be cleaned up if standards governing pesticide manufacture, use, distribution, and quality were strictly enforced.

Though Indian farmers were now aware of the value of IPM and its effects on the environment and human health, adoption levels were not as high as anticipated. The most recent projections, however, show a significant decline in chemical consumption, from $26.7 billion in 2005 to $25.3 billion in 2010, which is highly positive. However, it's interesting to note that the market for biopesticides is expanding quickly, going from $672 million in 2005 to over $1 billion in 2010. The market share of bio-pesticides, which presently accounts for 2.5% of the entire pesticides market, was anticipated to reach over 4.2% by 2020.

It is thought that the following actions need to be strengthened for the benefit of farming communities, the environment, and human health in order to combat the current ills of Indian plant protection.

- In order to stop future degradation of natural resources caused by toxic residues and to reclaim them, investment in the development and use of plant protection research needs to be increased.
- A top focus is given to collecting and disseminating data on hazardous residues in food, feed, and water sources.
- Build the capacity at the farm level to provide better information about integrated pest management
- It's crucial to conduct effective, intensive crop monitoring throughout their most vulnerable stages and to connect that monitoring to a weather-based advice system.
- Periodic assessments of pests and diseases to update their incidence, distribution, and economic significance in various geographical areas.
- Farmers networks should be used to find crop types that are resistant to biotic stressors and make them available to farmers.
- It should be a top priority to use agronomic measures for pest management that increase the effectiveness of natural enemies.
- It is important to promote the use of bio-rationales and indigenous technology in place of hazardous chemicals.
- Promote community involvement by having farmers participate effectively at every stage.
- Through a farmer participatory approach, strategic research produced at the research stations needs to be shared on a regular basis.
- Create agricultural clinics to improve sustainability.
- Village-based IPM needs to take precedence over crop-based IPM in the future.
- IPM inputs need to be registered, marketed, and used differently with regard to biopesticides in order to promote environmentally and health-friendly practises.
- With input and output market intelligence, appropriate certification for IPM/residue-free products should be put into effect.

Conclusions

In order to fulfil the challenges of producing wholesome food from the available land with little harm to the environment, adequate support for plant protection research is crucial. Technologies including creating resistant strains, boosting natural enemies, enhancing cultural control, using chemical pesticides sparingly, and integrating

They will play a big role going forwards. To manufacture

products with no harmful residues and be eligible for both domestic and foreign markets, it is imperative that the threshold concept in plant protection be defined and adopted. It may be risky and ineffective to execute traditional biological control programmes at this point, thus efforts should be made to assess the presence of natural enemies and try to strengthen them.

Although plant protection research has made considerable strides in the past in addressing productivity, hunger relief, and poverty reduction, there is still a substantial vacuum that needs to be filled. This can be accomplished by creating a consortium approach and including non-governmental organisations, international organisations, national agricultural research and extension systems, and farmers in the research agenda to address the demands.

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