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S&T REVIEW

IMPACTS OF IPM TACTICS IN NEPAL - A REVIEW

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ABSTRACT

Nepal, a country whose most of the economy is dependent on agriculture yearns to be self-sufficient but due to an unaware as well as ignorant population and poor infrastructure, the productivity is still unsatisfactory. As a result of which, haphazard use of pesticides was exercised. To resolve this problem, IPM tactics were introduced that includes a combination of biological, physical, chemical, cultural, and all kind of strategies to minimize pest risk and improve the yield sustainably. IPM components must be institutionalized in appropriate educational, research, extension, and farmer groups, as IPM has been proposed as an option for reducing pesticides overuse and misuse. The dissemination of these tactics to all levels of farmers is still underway in Nepal. However, the impacts seen are considerable. According to various research, the implementation of IPM tactics and approaches has drastically (more than 50%) reduced pesticide uses and increased yield by more than 10% in a very short period. Its complete execution is yet to be obtained which will revolutionize the agricultural practices and economic pattern of import and export.

KEYWORDS

Integrated Pest Management, Pesticide, Agriculture, Nepal, Productivity

1. Introduction

The agriculture industry continues to be Nepal's economic backbone, employing over 68 percent of the working population and accounting for approximately 34 percent of GDP, according to USAID, KISAN II project. Over the last three decades, improved variety cultivation has become increasingly popular in Nepal. However, those types are more susceptible to insect pests and illnesses, with insect pests causing roughly 35% of crop damage in Nepal, resulting in high doses and frequencies of pesticide applications due to which high input demanding crops are getting more polluted (Kafle et al., 2014). According to the national average of pesticide use is 396gm a.i/ha which is greater than the previous value of 142 gm. reported in 1995, but lower than the global average of 0.50 a.i.kg/ha (Parajuli et al., 2021). Unawareness of toxicity, the availability of harmful pesticides, aggressive marketing by dealers, and business motives all contribute to illicit usage. To fathom this global problem, IPM emerged as the best alternative.

IPM (Integrated Pest Management) is a long-term, science-based decision-making process that employs a combination of biological, biochemical, behavioural, cultural, physical, genetic and chemical strategies to identify, manage, and minimize pest risk while minimizing overall economic, health, and environmental concerns (Dara, 2019; Kurmi et al., 2022). Instead of being a rigid and constant guideline that applies to every case, IPM is a philosophy that can help the practitioner in applying it as best suits their situation. IPM integrates all pest management strategies proportionately so that there is less likelihood of pest resistance developing as a result of shifting management methods and the population is efficiently managed. The quality of output and its market/economic value can both be increased by implementing IPM tactics (Kurmi et al., 2022). This article overviews on such IPM tactics that have been implemented and its consequences upon the yield with time in Nepal.

2. Levels and Principles of Integration in IPM

The degree of integration that a production system may accomplish is frequently determined by its production scale. Higher levels of IPM integration necessitate community-wide systematic change. To classify degrees of integration, the following levels of integration have been proposed, as IPM is implemented into more sustainable farming practices:

Level 1- Individual pest species or pest species complexes

Level 2- Pest community (insects, weeds, pathogens)

Level 3- Environment (crop and non-crop host plants)

Level 4- Farming community (social and economic aspects included) (Kogan, 1998)

IPM's levels of integration are designed to assist farmers on deciding how much-integrated management they want to use. The benefits captured by these levels of IPM are primarily private and immediate (Hurley and Sun, 2019). Management that is really integrated considers a diverse set of biotic and abiotic factors elements, however, IPM can be used at different levels. In the context of Nepal, all levels should be implemented as per the feasibility and requirement. Assorted set of principles are used in IPM, out of which six-tiered implementation approach is popular which includes - Prevention of infestation, Identification of pest, Establishment of periodic inspection and monitoring system, Determination of economic injury as well as activity threshold of pest, Development of management strategies and evaluating and record keeping.

3. Types of Control

According to (Bryant et al., 2020), following control approaches have been applied as IPM tactics for the pest control in Nepal:

3.1 Cultural Control

It entails the use of pest-resistant plant varieties and farm management practices to reduce the impact of pests. Examples comprise Corn cultivation is rotated with other crops to avoid corn rootworms from carrying out their life cycle, disease-resistant landscape variety, or sanitation to reduce pest burden in the home.

3.2 Biological Control

It refers to any type of physical activity engaged to capture pest species, keep them out of the area, or eradicate them which emphasizes on protecting helpful species in the arena and, in some situations, introducing beneficial species to reduce target pest concentrations. Reducing broad-spectrum pesticide use in the field or landscapes to increase populations of beneficial predators, or introduction of lady beetles to greenhouses in order to control the aphid populations, are two examples. Several entomopathogenic fungus (EPFs), entomopathogenic nematodes (EPNs) and various botanicals like neem (*Azadirachta indica*) and bacteria like *Bacillus thuringiensis (B.t.)* have been found very effective against several field pests) (Rwomushana et al., 2019; Buragohain et al., 2021b, 2021a; Ndereyimana et al., 2019; Sci, 2015).

3.3 Mechanical Control

Any physical action used to trap pest species, keep them out of the region, or destroy them is referred to as mechanical pest control. Using a grease band on fruit trees in the spring to keep wingless female moths from depositing eggs on sprouting plants, trapping crops to keep vermins out of cultivated fields, and discing weeds to eliminate get rid of them are just a few examples.

3.4 Chemical Control

It can still be used in IPM, despite the fact that it is normally used as a last choice in integrated management systems. Chemical control purposes to use chemicals that (as few as possible) target a specific pest while reducing the number of sprays by using frequent sampling and action thresholds. Pesticides that target lepidopteran pests (such as spinosad) with negligeable impact on natural enemies is an example.

3.5 Behavioral Control

It frequently entails utilizing pesticides, but it does not imply that pest species will be killed directly. It simply is application of pheromones and semiochemicals to sway pest behavior such as breeding, aggregation, and host identification. Pheromones are chemical cues used by insects to communicate with one another, while semiochemicals are substances that transmit messages from one insect to the other. Both can be made and used to alter pest species' behavior. Using mating disruption pheromones, for example, to reduce pest species populations in the field is one example.

4. IPM in Nepal and Its Impacts

According to (Kafle et al., 2014), The Nepalese government embraced IPM as part of its plant protection program in 1990, but the program was not implemented at the farm level until 1998 due to a lack of trained staff and funds. However, Nepal embraced the Community IPM (CIPM) in 1997, with the first project, the Farmer's Field School (FFS) in rice, being launched in 1998. Several crop season-long FFS have been undertaken in Nepal in recent years to provide IPM education to vegetable farmers in the hopes of reducing the usage of such chemicals and making the vegetable production system more sustainable (Jha, 2008). Seed/seedbed treatment with Trichoderma/Pseudomonas, solarization of soil, roguing virus-infected plants, use of nylon nets in the nursery, monitoring of insects with pheromone traps, vegetable grafting against diseases, use of plastic trays and coco-peat, neem-based pesticides, bio-fertilizers, bio-control agents, and so on are all included in IPM packages. IPM packages considerably minimize the usage of chemical pesticides and is also cost-effective when compared to farmer practices.

As per a case study based on IPM Farmers' Field Schools of Bhaktapur district by (Jha, 2008), An important distinction was noticed in the amount of pesticide utilized by FFS participants compared to non-participants. Participant farmers used 36% less active ingredient (a.i.) of pesticides than non-participant farmers, and the overall IPM FFS was effective in reducing pesticide use by 11% in cereal crop production in Bhaktapur. Recognizing the importance of plant protection in sustainable agriculture, Agriculture Prospective Plan and subsequent periodic plans had adopted Integrated Pest Management (IPM) as the new extended method to tackling pest and pesticide problems. Farmers' field schools were established as successful extension teaching tools as part of the IPM program, and they became a pioneering strategy to address farmers' problems through community participation. More than 15,000 farmers, including 4,500 women, have been educated through 600 FFS around the country, leading in a 55 percent reduction in pesticide use and a ten percent increase in crop yield (Pokhrel and Pant, 2009).

According to studies, vegetable cultivation consumes more than 90% of all pesticides imported into the country and here misuse is frequent and not uncommon (Atreya and Sitaula, 2011). In Nepal, chemical pesticides in vegetables are overused and misused which have rekindled public and academic interest in Integrated Pest Management (IPM). Between 2009 and 2014, the USAID-funded Integrated Pest Management Innovation Lab (IPM IL) developed and tested full-season IPM packages for major vegetable crops such as tomato, cucumber, and cauliflower in a number of locales. In 2013, the Nepal program was extended through an associate award from the USAID Mission to set up a structure to facilitate the technology transfer of IPM packages for high-value vegetable crops in the Feed the Future (FtF) districts in collaboration with the USAID KISAN project, as well as work with the private sector to improve and support the bio-product supply chain while also promoting IPM tools (Muniappan and Heinrichs, 2016). According to the research, more than 80% of farmers in the IPM IL and 42% in the KISAN project have already used vegetable IPM methods and packages. In vegetable-growing areas, spreading and promoting IPM methods and technologies is currently a work in progress.

In all of the vegetables examined, including tomato, cabbage, cauliflower, bitter gourd, and cucumber, the upgraded alternative system with CA and IPM approaches provided greater yields than the conventional system. In a study of 85 IPM projects (including vegetables) from Asia and Africa, a similar increase in yield (40.90 percent higher than conventional systems) was reported in the IPM system. In regions of Africa and Southeast Asia, CA technologies have also increased vegetable productivity (Paudel et al., 2020). The slow adoption in developing countries recommends revising the IPM curriculum and implementation strategy for Nepal. As a result, IPM has been offered as a solution to decreasing pesticide abuse and misuse whose components must be institutionalized through relevant educational, research, extension services, and farmer groups.

5. Conclusion

To recapitulate, the impacts that IPM has left in Nepalese agriculture is remarkable from the early times. Productivity as well as efficiency in cost management are gradually increasing in all the areas where IPM is applied. Despite the fact that extension service should be mobilized, the impacts till now are substantial in a developing country like Nepal. A rigorous, science-based IPM program and research-backed are nevertheless essential. Government strong support and other technology transfer measures should stimulate the implementation of Integrated Pest Management approaches. However, the belief that "if a little is good, more is better" when it comes to pesticides has caused chaos in humans and other forms of life, putting the objective of sustainable agriculture in jeopardy. Thus, hands down IPM has sustainably boosted the productivity within the adopted areas and efforts from different levels should be done for its implementation.

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