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Knowledge Gap on Integrated Pest Management in Chumoukedima District, Nagaland

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Abstract

The present study was carried out from December, 2022 to April, 2023 in Chümoukedima district of Nagaland with the aim of assessing farmers' knowledge level on Integrated Pest Management (IPM) practices. A multistage random sampling method was used to select 100 farmers from five purposively selected villages under Dhansiripar block, an area known for its active farming community. Data were gathered through personal interviews using a carefully prepared set of questions, and the responses were later analyzed with the help of descriptive statistics like percentages, averages, and standard deviations. Correlation analysis was also done to find out how farmers' backgrounds affected their knowledge of IPM. The results showed that every farmer knew about traditional practices such as summer ploughing, crop rotation, handpicking pests, and sieving stored grains. However, when it came to biological control methods and the use of plant-based pesticides, awareness dropped, with only 61% and 53% of respondents familiar with them, respectively. The overall Knowledge Index for IPM in the study was calculated at 83.29, and most farmers (77%) fell within a medium knowledge category. Knowledge showed significant positive correlation with age, education, occupation, and social participation. The study highlighted the need for more localized awareness programs, practical demonstrations, and farmer training sessions to bridge this knowledge gap and encourage wider adoption of sustainable pest management techniques in the region.

Keywords: IPM, farmer awareness, knowledge gap, Nagaland

1. Introduction

The global crop production loss due to insect pests is estimated to be between 20 to 40% annually (Anonymous, 2018a). For decades, farmers have been utilizing chemical pesticides/herbicides for disease, pest, and weed control. However, for multiple reasons, e.g., a lack of pest-management knowledge, misleading information, the pursuit of high crop yield, and pest resistance, the misuse of pesticides/herbicides (including incorrect application, overuse, underuse, and use of restricted or even banned products), agricultural and environmental sustainability and human health have been heavily threatened (Sun et al., 2019). Misuse of pesticides also causes pest resistance, the emergence of new pests, and the destruction of beneficial insects. Although the use of chemicals did increase crop productivity (Kamaruzaman et al., 2020) but the overuse of pesticides has led to environmental and human health risks (Khan et al., 2021). Besides, most of these chemicals are expensive and thereby increases the cost of production for the resource poor farmers (Nayak et al., 2019). Residues in food, soil, water and environment, development of resistance to insecticides, resurgence of sucking pests, outbreak of minor pests, widespread killing of non-target organisms like predators, parasitoids and pollinators necessitates the adoption of suitable Integrated Pest Management (IPM) (Dhinda et al., 2023). All these negative impacts and limitations of indiscriminate pesticide and insecticide use have led to a shift toward eco-friendly pest management approaches. The philosophy of integrated pest management (IPM) has evolved over time through integrated crop production to integrated farming system targeted at improved crop health. IPM is knowledge intensive, requires holistic approach, expert advice, timely decision making and actions on fast track. Needs of farmers in pest management revolves around pest diagnostics, surveillance, forecasting and dissemination of expert information in a short time (Bhagat et al., 2016). Integrated pest management (IPM), as a sustainable pest-management approach, has gained much attention. Integrated Pest Management (IPM) is a holistic approach to combat pests (including herbivores, pathogens, and weeds) using a combination of preventive and curative actions and only applying synthetic pesticides when there is an urgent need (Green et al., 2020). It is a comprehensive science-based decision-making process that identifies pest-relative risks and coordinates multiple disciplines to prevent and control pest damage using the most economical means, at the same time relieving stress on humans, property, resources, and the environment (Young, 2017). IPM does not completely exclude the application of chemical pesticides but emphasizes the growth of healthy crops with the least possible disruption of agro-ecosystem and encourages natural pest control mechanisms (Baker et al., 2020). Currently, IPM is the primary paradigm in plant protection, approved by all stakeholders in the agricultural value chain to maintain pesticides and other interventions at levels that are ecologically and economically justified (Sawinska et al., 2020). In comparison to its surrounding states, pesticide use in Nagaland is relatively low (Anonymous, 2018b). However, a greater focus on yield maximization will almost certainly result in an increase in insect problems, so farmers should be urged to use traditional pest control methods such as bio-organic pesticides and IPM. Predominantly an agrarian state, the farmers in Chümoukedima district rely on agriculture and has become the economic activity for the farmers. The people have a strong sense of tradition and culture with progressive farmers largely practicing IPM in the district. Therefore, keeping all these in view, the aim in this endeavour was to discover farmers' knowledge and adoption level of IPM as one of the primary requirements for promoting sustainable agriculture and development.

2. Materials and Methods

The study was conducted during December, 2022 to April, 2023 in Chümoukedima district of Nagaland (25.77°N, 93.79°E), focusing on Dhansiripar block. Five villages were purposively selected based on farmer participation in IPM activities. A total of 100 farmers (20 village^{-1}) were selected through simple random sampling. The knowledge test was based on validated items (Kumar et al., 2016; Vijayan et al., 2022) comprising 21 IPM components: 11 cultural, 5 physical, 2 mechanical, 1 chemical, and 2 biological practices.

2.1 Scoring

- Aware=1
- Not Aware=0

2.2 Knowledge index (KI) was calculated as

Knowledge Index (KI)=(Total score obtainedTotal achievable score)×100\text{Knowledge Index (KI)}=\left(\frac{\text{Total score obtained}}{\text{Total achievable score}}\right)\times 100

Knowledge Index (KI)=(Total achievable scoreTotal score obtained)×100

2.3. Categorization

Low knowledge: < Mean – ½ SD

- Medium knowledge: Mean ± ½ SD
- High knowledge: > Mean + ½ SD

2.4 Statistical Tools

Descriptive statistics and Pearson's correlation coefficient were used to examine relationships with socio-economic variables.

3. Results and Discussion

3.1. Knowledge on IPM practices

Data presented in table 1 showed that, for cultural practices: All (100.00%) of the respondents had knowledge on summer ploughing (Choudhary et al., 2022), time of sowing, removal of weeds and crop rotation which aligns with the findings of Odyuo et al., (2018). However, only 51.00% of the respondents

Table 1: Knowledge level of farmers on IPM practices (n=100)

Sl. No.	IPM practice	% Aware
A. Cultural practices		
1.	Soil testing	95
2.	Summer ploughing	100
3.	Resistant/Tolerant variety	82
4.	Seed rate	91
5.	Time of sowing	100
6.	Plant spacing	94
7.	Water management	94
8.	Removal of weeds	100
9.	Crop rotation	100
10.	Trap cropping	51
11.	Fertilization	88
B. Physical practices		
1.	Cold storage of fruits/vegetables	44
2.	Sun drying of seeds	100
3.	Light traps	83
4.	Pheromone traps	31
5.	Yellow sticky traps	89
C. Mechanical practices		
1.	Handpicking and destroying insects	100
2.	Sieving and winnowing	100
D. Chemical practices		
1.	Use of pesticides	93
E. Biological practices		
1.	Bio-control agents	61
2.	Botanical pesticides	53

had knowledge on trap cropping. This was due to the reason that farmers in the study area often relied on pesticides as a quick and visible solution to pest problems, reducing interest in preventive methods like trap cropping.

For physical practices: (100.00%) the respondents had knowledge on sun drying of seeds followed by 89.00% on application of yellow sticky traps and 83.00% on application of light traps. Light traps were generally effective in capturing both sexes of pests, reducing their population and mating opportunities (Tarigan et al., 2024). Whereas only 31.00% of the respondents had knowledge on application of pheromone traps. According Nahar et al., 2020, pheromone traps were technically and economically viable for insect control, but farmers have difficulty understanding their mechanisms.

For mechanical practices: All the respondents (100.00%) had proper knowledge on i.e. handpicking and destroying of insects and sieving and winnowing of grains. Farmers reported that these practices were cheap and easy to carry out and does not require much effort. Handpicking was usually practiced for small scale pest management program like in lawns, kitchen gardening, small-scale tunnel farming, inside greenhouses. This technique was the most practical way in certain conditions like, when cheap labour was available, insects and their eggs/egg-masses were large and conspicuous, and insects were too sluggish, have congregating behaviour and were easily accessible to the pickers (Thakur et al., 2021)

For chemical and biological practices: Majority (93.00%) of the respondents had knowledge on application of chemical practices which was similar with the findings of Sandy et al. (2024). Most farmers demonstrate good knowledge of pesticide use (Paudel et al., 2024) and rely heavily on chemical pesticides due to lack of access to alternative techniques and extension services (Karamidehkordi and Hashemi, 2010). The knowledge on application of biological practices were Bio-control agents (61.00%) and botanical pesticides (53.00%) respectively which aligns with the findings of Panda et al., (2023). Farmers were aware about the Bio-control agent *Trichogramma* spp. (egg parasitoid) and as for the botanical pesticides they had knowledge on NSKE, Minchu$^+$.

Farmers showed high awareness of cultural and mechanical practices, which are traditional and passed down through generations (Odyuo et al., 2018). However, knowledge of newer IPM components such as pheromone traps and biological control agents was comparatively low (Nahar et al., 2020; Panda et al., 2023).

3.2. Overall knowledge level of the respondents

To measure the knowledge level of the respondents, knowledge index was used:

Knowledge index=(Total score obtained in knowledge level)/(Total achievable score in knowledge level)×100

For calculating Knowledge Index (KI), a total of 21 were presented to the respondents to check the knowledge level. The respondents aware of the practices was given ‘1’ point, while the respondents not aware was given ‘o’ then the respondents were categorized based on low, medium, and high.

Table 2 stated that majority (77.00%) of the respondents were under the category of medium knowledge level and 9.00% of the respondents comes under low level of knowledge. This was in line with the results found by Grewal et al., (2023) in his research that majority of the respondents had medium level of knowledge. Whereas 14.00% of the respondents were under high level of knowledge. The overall knowledge index of the respondents was 83.29 in the study area. The medium-level awareness reflected findings from Grewal et al. (2023), who also reported similar trends among citrus growers in Punjab.

Table 2: Distribution of the respondents based on overall knowledge level n=100

Sl. No.	Level of knowledge	%
1.	Low (<15)	9
2.	Medium (15–20)	77
3.	High (>20)	14
	Total	100

Mean=17.49, SD=2.62

3.3. Relationship between knowledge level of the respondents and socio-economic variables

Table 3 provided information about how socio-economic factors and knowledge level relate to one another. Age, education, occupation, social participation was found to have significant and positive correlation at 0.05 level. Kumar et al. (2022) also received similar relationship. In his study Wason et al. (2009) found that the adoption of Integrated Pest Management by the farmers was affected significantly by the factors like level of education, environmental orientation, scientific orientation and extension contact which means that the variable like age, education, occupation, social participation were also key factors in increasing the knowledge of the farmers thereby leading to adoption.

Table 3: Correlation of knowledge with selected variables

Sl. No.	Variables	Correlation
1.	Age	0.256*
2.	Education	0.247*
3.	Occupation	0.248*
4.	Social participation	0.200*

*=Significant at p=0.05 level of significance

These relationships indicated that more educated and socially active farmers were likely to possess higher awareness, which was consistent with findings by Wason et al. (2009), Raju et al. (2022), and Kumar et al. (2022).

4. Conclusion

IPM knowledge among farmers in Chümoukedima was predominantly moderate, with a good grasp of cultural and mechanical techniques, but lower familiarity with advanced biological and physical control practices. Strengthening extension services through hands-on demonstrations and participatory learning methods was vital for promoting sustainable pest management.

5. Further Research

Future studies can examine the effectiveness of digital extension methods and evaluate knowledge retention following different training interventions across time.

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