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The Status of Insect Management Practices of Mango Farmers in Chapainawabganj District of Bangladesh

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ABSTRACT

The study aims to assess the impact of insect management practices on mango cultivation and the socio-economic status of mango growers in the Chapainawabganj district of Bangladesh. Data were collected from 40 randomly selected mango farmers through in-person interviews. The findings reveal that 72.5% of farmers rely on chemical insecticides as their primary pest control method, while a smaller proportion integrates biological and cultural practices. Although 82.5% follow recommended insecticide dosages, concerns about health hazards and environmental pollution persist. The study underscores the necessity of sustainable pest management strategies to reduce dependency on chemical control, enhance mango yield, and minimize negative health and environmental effects. Training programs and government interventions are crucial to promoting eco-friendly pest control practices and ensuring sustainable mango production in Bangladesh.

Keywords: Eco-friendly**,** Insect control, Mango farmers, Socio-economic, Sustainable management

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1. INTRODUCTION

Bangladesh is an agricultural country divided into 30 Agroecological Zones (AEZs), classified based on climate and terrain, which facilitate the growth of diverse crops. Bangladesh's socio-economic stability heavily relies on agricultural production. Fruits occupy 1% to 2% of the country's total arable land and contribute 10% to the national GDP (Mondal et al., 2011). According to HIES (2010), the average daily fruit intake per capita is 44.7 grams nationwide, with rural areas consuming slightly less at 42.6 grams. This falls below the minimum recommended intake of 100 grams per person (FAO/WHO, 2003). One of the most widely consumed fruits, the mango (*Mangifera indica* L.) is frequently referred to as the "King of fruits" (Purseglove, 1972) because of its superior flavor, eye-catching hue, and high nutritional content. Although they are grown practically everywhere in Bangladesh, commercial and high-quality mangoes are primarily grown in the country's northwest areas. The country's top mango-growing districts are Chapainawabganj, Rajshahi, and Dinajpur. There are around 500 types of sweet, edible mangoes in the districts of Rajshahi and Chapainawabganj. Approximately 85% of the residents of the aforementioned districts are thought to be either directly or indirectly dependent on the business and cultivation of mangoes (Dhaka Tribune, 2018). In Bangladesh, mangoes were grown on 109584 acres, yielded 11,65,804 metric tons, and took up 25.22% of the garden area planted to fruits in 2017-18 (BBS, 2019). The invasion of disease-causing organisms and insect pests has significantly reduced Bangladesh's mango crop (MoA, 2014). Mango fruit is severely harmed by fruit borer, hopper, stone weevil, thrips, and scale insects. According to Khan et al. (2007), only the mango hoppers have the potential to destroy 20-100% of the

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inflorescence. There are numerous options for controlling insect pests. The insect-control method is dependent on the farmer's socio-economic status and the influence of surrounding people. Mangoes grown especially for Asian markets still have a significant pest interception problem, despite growers using insecticides as their primary control method. Farmers frequently apply harmful chemical pesticides to mango groves nationwide to guarantee desired production or reduce loss from insect infestation (Rahman et al. 2021). According to Abdulahi et al. (2011), insecticides like pyrethroids and organophosphates are typically used to combat fruit flies. In addition to endangering the environment and human health, the careless use of toxic pesticides causes beneficial insects to disappear, encourages the emergence of insecticide resistance, and upsets the delicate balance between pests and their natural enemies, which leads to an increase in the number of target pests and even the emergence of new insect issues. This study aims to evaluate the effectiveness of different insect management practices employed by mango growers, their impact on yield and sustainability, and the associated socio-economic implications.

2. MATERIALS AND METHODS

2.1 Study Area

Chapainawabganj is located in the north-western part of Bangladesh. It is the part of Rajshahi division. It is situated beside the Mohananda River. The study was conducted in Nawabganj Sadar, Nachole, and Shibganj upazila of Chapainawabganj district. The study area covered Maharajpur, Sundarpur, Ranihati, Balidanga, Gobratala, Nezampur, Nachol, Kansat, Chhatrajitpur, Nayalabhanga and Ghorapakhia unions under Chapainawabganj district.

2.2 Data Collection

The study was based on the primary data collected from the Chapainawabganj district. The primary data was collected from the farmers through a personal interview. The survey or interview was carried out from 20th November to 10th December 2021. Data were collected by interview based on a prepared questionnaire.

2.3 Sampling Technique

For this study, data were collected to investigate the insect attack and socio-economic status of mango cultivation in Chapainawabganj district. The study was confined to selected unions under the Chapainawabganj district. A total number of 40 respondents were selected randomly from the selected areas. A structured questionnaire was carefully prepared, keeping the objectives of the study in view. The variable was chosen based on some previous studies (Alam et al., 2024 & 2023). The questionnaire consisted of two parts. The first part includes farm and household attributes (respondent's gender, age, family size, educational qualification, occupation, land information, and mango farm size). The second part includes pest management practices where most of the questions were arranged in closed form: farmer's participation in pest management training programs, methods of insect management, source of information about insect pest control, the timing of insecticide application, insecticide spraying techniques, opinions about the harmful effects of pesticides, farmer's perception on the recommended dose, natural enemies and insecticide label.

2.4 Analytical Tools

The collected data were properly edited and coded before the final analysis. Inconsistent data were avoided to eliminate errors and faults. The Statistical Package for Social Sciences (SPSS) was used for data management. Many statistical properties, such as average, percentage, frequency, etc., were used for analysis.

3. RESULTS AND DISCUSSION

3.1 Farm and Household Attributes

According to Table 1, all the respondents of that study were men. Their ages ranged from 24 to 57. According to the data, only 27.5% of respondents were young, and middle-aged respondents comprised 40% of the sample, followed by older respondents (32.5%). Middle-aged people are interested in mango production. The observed family sizes of the respondents ranged from two to sixteen people on average. Of the respondents, 20% belonged to large families (>8 individuals), whereas 32.5% belonged to medium-sized households (5-8 members). The percentage of respondents with a small family (0-4 members) was only 47.5%. Consequently, the tabulated data clearly shows that people in the research area prefer to live as a family. The educational backgrounds of the respondents varied from post-graduation to illiteracy. Data showed that the largest percentage of respondents (45%) had secondary education, followed by primary education. The percentages were 25% for primary, 15% for higher secondary education, 7.5% for graduation education, and 5% for illiteracy. The majority of mango growers have at least a secondary education. Four categories, including wage-earning and mango cultivation, business and mango cultivation, service and mango cultivation, and others, were used to classify the respondents' occupations. According to Table 1, 47.5% of the Respondents relied on business and mango farming, whereas 30% relied on wage earning and mango cultivation also 15% on providing services and growing mangoes, and 7.5% on other occupations. The majority of mango producers in the study region have ties to other businesses. Results evinced that 65% of the respondents took cultivable land as a lease, 25% of the respondents used their own land, 5% of the respondents took land as both lease and borga, and no one (5%) took land as borga respectively in the research area. The majority of respondents in the investigated area grew mangoes on property that was leased. For our study, we categorize the mango producers into three groups: marginal, medium, and large growers, based on the size of their plantations. No one found the small-scale mango growers who own between 0.02-0.2 hectares of land. Large farmers use more than one hectare, whilst medium farmers use 0.2-1 hectare. The bulk of mango farmers (63%) are large farmers, followed by medium farmers (37%) and no farmers

with fewer than 0.02 hectares of mango land. Different farmers produced varying quantities of mangoes due to variables such as market price, farm size, and mango quality. In a previous study Ghosh et al. (2019) reported that the majority of the mango farmers in Chapainawabganj district were middle-aged. They also observed most of the farmers had farm sizes of more than 1 ha and the farmers completed secondary education.

Table 1 Distribution of the respondents according to their farm and household attributes

Variable	Categories	Frequency	Percentage
Gender	Male	40	100
	Female	0	0
Age	Young Age (<30)	11	27.5
	Middle Age (31-50)	16	40
	Old Age (>50)	13	32.5
Family size	Small (0-4)	19	47.5
	Medium (5-8)	13	32.5
	Large (>8)	8	20
Education	Illiterate	2	5
	Primary (1-5)	10	25
	Secondary (6-10)	18	45
	Collage (11- 12)	6	15
	Graduation or above	4	10
Occupation	Wage earning and mango cultivation	12	30
	Business and mango cultivation	19	47.5
	Service and mango cultivation	6	15
	Others	3	7.5
Land Information	Own	10	25
	Lease	26	65
	Borga	2	5
	Lease+Borga	2	5
Mango Farm Size	Marginal farmers (0.02-0.2)	0	0
	Medium farmers (0.2-1)	15	37
	Large farmers (>1)	25	63

3.2 Insect Management Practices used by Mango Farmers

According to Table 2, 20% of the respondents got training on pest management, and the rest of the respondents 80% did not attain any training program. Khan et al. (2022) also observed that most of the farmers (90%) have no training experience in that region. Although there are seven different categories for managing insects, we only identified the three primary types of management strategies. The seven categories included the

Table 2 Insect management practices used by the respondents

Variable	Categories	Freq.	%
Participation in the Pest Management Training Program	Yes	8	20
	No	32	80
Method of insect pest management	Chemical method	29	72.5
	Chemical + Biological method	6	15
	Chemical + Cultural method	5	12.5
Source of information about insect pest control	Extension Workers	6	15
	Neighbor	15	37.5
	Radio/ Television	3	7.5
	Relatives	3	7.5
	Other sources	2	5
	Radio/ Television + Relatives	6	15
	Neighbor + Other sources	5	12.5
Timing of insecticide application	Before attack	28	70
	During severe attack	7	17.5
	Before + During severe attack	5	12.5
Insecticides spraying techniques	Knapsack Sprayer	5	12.5
	Motorized Sprayer	29	72.5
	Knapsack + Motorized Sprayer	6	15
Opinions about the harmful effects of pesticides	Air pollution + Water pollution	3	7.5
	Air pollution + Health hazard	6	15
	Water pollution + Health hazard	2	5
	Air pollution + Water pollution + Health hazard	27	67.5
	Not harmful	2	5

chemical method, biological method, cultural method, IPM, chemical + biological method, chemical + culture method, and others. According to the results, the majority of responders (72.5%) controlled different insects with chemicals. To manage the insects on mangoes, 15% of respondents utilize a chemical and biological approach, while the remaining 12.5% use a chemical and cultural approach. Other techniques of controlling insects, such as biological, IPM, and cultural strategies, were not properly known to them. The majority of respondents (37.5%) stated that their neighbors gave them guidance on how to control insects, followed by radio/television+ relatives (15%) and extension agents (15%). They obtain useful information from additional

sources, such as the radio or TV (7.5%). Just 5% of respondents got guidance from outside sources. Three classes of pesticide application timing were identified. Before the attack, during the severe attack, and before + during the severe attack. The 70% of respondents claimed to have used the pesticide before the attack 12.5% of responders used the pesticide before a severe attack, and 17.5% used it during a severe attack. Not all responders are sufficiently aware, even if the majority were aware that insects attack mangoes and use insecticides before attack. Therefore, farmers' awareness needs to be raised. When it came to developing automation, the majority of respondents (72.5%) applied insecticide using motorized sprayers. The remaining 15% of respondents utilized a backpack plus a motorized sprayer, while 12.5% used a backpack sprayer to apply insecticides. The majority of respondents (67.5%) knew that insecticides have a negative impact on air pollution, water pollution, and health hazards. The remaining 15% said that there is a negative impact on air quality and health hazards, 7.5% said that there is a negative impact on air and water quality, 5% said that there is a negative impact on water and health hazards, and only 5% respondents were unaware of the negative impact of insecticides. Islam et al. (2023) found that the farmers mostly used chemical pesticides. They also reported that chemical insecticides negatively impacted air, water bodies, and human health.

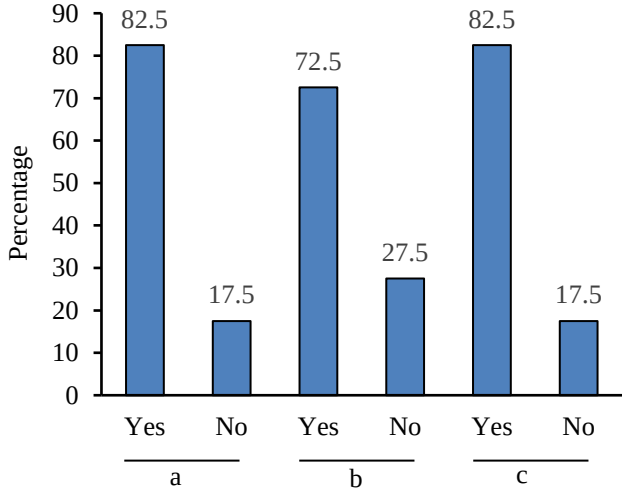

Fig. 1 Farmer's perception of the recommended dose, natural enemies, and insecticide label (Percentage). a) Following the recommended dose of insecticides, b) Have concern about natural enemies, c) Read and follow insecticide label.

According to Fig. 1, most of the respondents 82.5% followed the recommended dose provided by the insecticide dealers and the rest 17.5% respondents did not follow the recommended dose. Most of the respondents (72.5%) had a concern about natural enemies and the rest 27.5% respondents had no concern about natural enemies. Most of the respondents 82.5% read the information on pesticide packages before application and the rest 17.5% respondents did not read the information on pesticide packages before application.

4. CONCLUSION

The findings of this study highlight the critical challenges faced by mango farmers in Chapainawabganj district of, Bangladesh where middle-aged men with secondary education levels primarily cultivate mangoes on leased land. While mango farming remains a potentially profitable venture, farmers struggle with low-profit margins due to high input costs, landowner shares, and limited awareness of efficient pest management practices. The heavy reliance on chemical insecticides to combat major mango pests- thrips, fruit flies, and mango hoppers- poses significant environmental and health risks. Repeated and indiscriminate use of these pesticides not only leads to resistance but also disrupts the natural balance by eliminating beneficial insects. This calls for an urgent shift towards sustainable pest control measures, including biological methods, integrated pest management (IPM), and the judicious use of chemicals with proper timing and dosage. To enhance profitability and sustainability in mango cultivation, it is crucial to implement farmer training programs, introduce high-yielding and disease-resistant mango varieties, and promote greater organizational involvement among growers. Strengthening farmer awareness through education and policy support will facilitate the adoption of eco-friendly pest management strategies while ensuring long-term agricultural and economic viability. By addressing these challenges, Bangladeshi mango farmers can achieve a more resilient and prosperous future in mango production.

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