
Present Scenario of Insecticides and Fungicides Use in Largest Mango Cultivation Area in Bangladesh

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Abstract: This study has been conducted to assess the present scenario of spraying insecticides/fungicides during the whole cultivation period of mango in Shibgonj upazilla of Chapainawabgonj district. A total number of 250 mango growers were randomly selected and interviewed by structured questionnaires from December, 2014 to June, 2015. The data were collected with respect to their educational level, cultivating land, times and types of insecticides/fungicides spray, and farmer's consciousness about the excessive use of insecticides/fungicides. Out of the 250 mango growers, 184 were illiterate which accounts almost 74% followed by under HSC, 51 (20%) and higher educated, 15 (6%). Around 1-3 acre of land was used by 145 (58%) mango growers for cultivation followed by 3-7 acre by 85 (34%) and more than 7 acres by 20 (8%). Eight insecticides and seven fungicides under different trade names were most commonly sprayed at 2, 3, 4, and even more than 7 times in the stage of mango flowering, green mango, and finally, in mature stages. Most importantly, 151 (60%) growers do not have any, while 99 (40%) have very little knowledge about the negative effects of using excessive amounts of insecticides/fungicides. The mango growers are randomly using same pesticides under different brand name. Additionally, they frequently use fungicides instead of insecticides that cause no death of mango pest. As a result, they could not protect early dropping of mangoes. Furthermore, 103 (41%) and 147 (59%) growers have little and no knowledge regarding the side effects of spraying of formalin and calcium carbide that are used for preservation and early ripening of mango, respectively. Therefore, necessary actions should be taken immediately keeping in mind not only to reduce the early fall out of mangoes but also to produce safe mangoes for consumption.

Keywords: Mango Cultivation, Mango Growers, Insecticides and Fungicides

1. Introduction

Mango (*Mangifera indica* L.) is one of the most important tropical fruits of the world and is called as "king of fruits". It is grown more than 85 countries in the world [1]. Bangladesh is one of the major mango producing countries along with India, Pakistan, Mexico, Brazil, the Philippines, etc [2]. The rank of Bangladesh in mango production is third among the tropical fruits grown in the world with a total production at nearly 35,000,000 tons in 2009 [3]. Furthermore, its mango rank is second in terms of area and occupies third position in production among the fruits grown in Bangladesh [4]. The leading mango growing districts are Nawabgonj, Rajshahi, Rangpur, Dinajpur and Kushtia. In the year 2010-2011, Bangladesh produced around 1.05 millions of tons of mango

[5]. According to BBS (2013), Bangladesh produces 945059 metric tons of mangos in 30666 ha of land during the period of 2011-2012 [6]. It is the leading seasonal cash crop of the northwestern region of Bangladesh and dominates the economy in Rajshahi and Chapainawabganj districts. However, *ChapaiNawabganj* district is the largest mango cultivated area in Bangladesh. The total area of this district is 1702.64 square Km, where 42263 acre are used for mango cultivation and 224764 metric tones mango is produced per year [7], which contribute 23.78% of the Bangladesh total production.

The mango is the most delicious and nutritious fruits in the world. However, attack by insects/pests is one of the most important hurdles in the massive production of mango. Insect pests and diseases not only reduce the yield but also

sometimes account for a complete crop failure [8]. Considering the above fact, toxic synthetic chemical pesticides have widely been used in Bangladesh to reduce the early fall out of mangoes and to increase the production yield. However, pesticides are often used indiscriminately and frequently at a very high concentration without knowing the actual purpose of the pesticide being applied. Mango Production Knowledge and Technological Gaps of Smallholder Farmers are common in many countries [9]. Consequently, the surrounding environment is polluted which also has an adverse effect on human health. Moreover, pesticide adulteration by wholesalers and retailers is a growing concern of many mango growers who are unsure whether insects are becoming more insecticide resistant or insecticides are being adulterated to the point of ineffectiveness. In most cases, mango growers use pesticides in their fields based on recommendations and advice from their local pesticide dealers. However, the dealers in general are not expert personnel.

The control of insect attack and fungal diseases are the emerging issues to protect premature mango fall out not only in *ChapaiNawabganj* district but also in all over the country. The insect and fungal attacks play a negative role for the low yield and poor quality mango production. Mango can be attacked by plethora of insect pests, however, mango hoppers, fruit fly, mango leaf cutting weevil, mango fruit borer etc are also considered as the major constraints of low yield mango production. In the present study, a survey on mango cultivation has been conducted in Shibgonj upazilla of *ChapaiNawabganj* district which is the largest mango production area of Bangladesh. Therefore, the aim of the present research is to find the present scenario of insecticides and fungicides use for protecting mango from early dropping.

2. Methods

The present study was conducted in four (04) unions: Shahabajpur, Mobarakpur, Kansat and Shampur in Shibgonj upazilla of Chapainawabgonj district during the period of January-June, 2015.

2.1. Study Subjects

A total 250 mango growers were selected from the study area. Out of 250, 80 mango growers were selected from Shahabajpur, 69 from Mobarakpur, 51 from Kansat and 50 from Shampur, who has less than 0.5 acre mango cultivable land that included in the study.

2.2. Study Procedure

The mango growers were asked face to face interview and structured questionnaire was used in this study. There were two survey teams; each containing three (03) members, who were assigned to visit the mango growers. It was also assigned that the survey team will not visit more than five mango growers per day to ensure quality of data to be collected and subsequent minimization of the possible error

of the survey. At the end of day, the quality of interview and collected data were evaluated by the experts to ensure completeness and consistency. Incomplete and inconsistent data were corrected by re-visit and re-examine the relevant mango growers. Informed written consent was taken from every respondent (mango growers) explaining the objectives of this study and it was confirmed that the personal information will be kept confidential and any time they can withdraw their opinion if they want. In addition, a prior permission was also taken from chairman of the Shibgonj upazilla for this study.

2.3. Status of Mango Growers

Mango growers were categorized into two groups. One is based on their level of education, which was further subdivided into three groups such as illiterate, under HSC and higher educated. The other one is based on the land that used for mango cultivation, which was subdivided into 1-3 acre, 3-7 acre and more than 7 acre.

2.4. Quantity of Insecticides and Fungicides Applied for Mango Cultivation

Mango growers usually applied different types of insecticides and fungicides from the starting of flowering until harvesting. Therefore, it was very difficult to exact quantification of insecticides used during the whole period of cultivation. However, to simplify our study, we divided the whole duration of mango cultivation into three stages based on application of insecticides and fungicides. These were- (i) during flowering of mango bud; (ii) in green mango; and (iii) in mature stage. Growers were asked to answer, how many times they had sprayed insecticides and fungicides in each stage, such as two, three, four, five or more than five times.

2.5. Consciousness to Insecticides/Fungicides and Other Chemicals

The doses and safety awareness are the prerequisites for applying insecticides/fungicides. The consciousness about the side effects and health hazards of insecticides/fungicides or any other chemicals like formalin, calcium carbide, etc. were assessed among the mango grower and other person through questionnaire. Subsequently, it was also assessed that whether they have taken any training on how to use pesticides.

3. Results

3.1. Status of Education and Cultivated Land

Table 1 shows that out of 250 mango growers, the maximum number of people, 184 (73.6%) are illiterate. Only 51 (20.4%) people have completed their Higher School Certificate (HSC) and 15 (6%) mango growers have the education more than Bachelor. In addition, the cultivable land used for mango cultivation for 250 mango growers were

assessed. Although mango production depends on land fertility and fertilizers use in soil when the land is infertile. Nevertheless, this study assessed cultivable land to explore the capacity of tentative mango production. 145 (58%) mango growers cultivate around 1-3 acre land, 85 (34%) mango growers cultivate 3-7 acres land, 20 (8%) mango growers cultivate above 7 acres land.

Table 1. Educational qualification and cultivable land of the mango growers in the study area.

Educational qualification			Cultivable land		
Illiterate	184	73.6%	1-3 acre	145	58%
HSC	51	20.4%	3-7 acre	85	34%
Higher education	15	6%	More	20	8%

3.2. Spray of Insecticides/Fungicides onto Mango Trees During Mango Growth

Mango is a very vulnerable fruit to be attacked by various insects and fungus. Therefore, recommended insecticides and fungicides spray is necessary to control insect and fungus to get better production of mango. These insecticides and fungicides spray started from mango flower (bud) until mango harvest. The mango growers frequently spray insecticides and fungicides in different stages of mango maturation without following any standard recommendations. As can be seen in Figure 1 at the stage of mango flowering, 29 (11.6%) mango growers used 2 times, 155 (62%) mango growers use 3 times, 56 (22.4%) mango growers use more than 4 times spray.

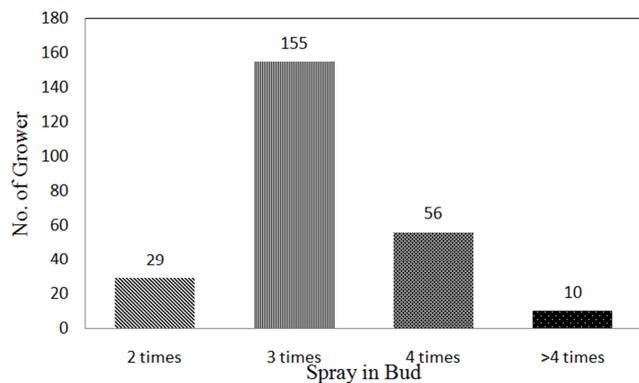


Figure 1. Number of spray of insecticides/fungicides on mango bud.

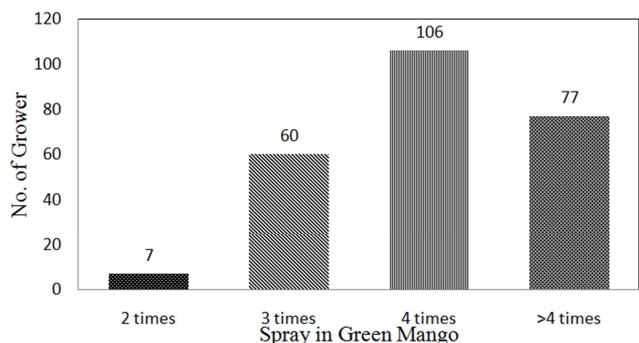


Figure 2. Number of spray of insecticides/fungicides on green mango.

At the stage of green mango, the insecticides/fungicides sprays were sorted out into 4 groups. This study was found to be 7 (2.8%) mango growers sprayed insecticides/fungicides for 2 times, 60 (24%) mango growers sprayed insecticides/fungicides for 3 times, 106 (42.4%) mango growers sprayed insecticides/fungicides for 4 times and 77 (30.8%) mango growers sprayed insecticides/fungicides for more than 4 times. The numerical data was presented in the Figure 2.

The separation of stages for green mango and matured mango is difficult. However, the stage of matured mango was considered after seed formation in mango. This study was found to be 46 (18.4%) mango growers uses insecticides/fungicides spray for 2-4 times, 184 (73.6%) mango growers uses insecticides/fungicides spray for 5-7 times and 20 (8%) mango growers uses insecticides/fungicides spray more than 7 times. The data was illustrated in the Figure 3.

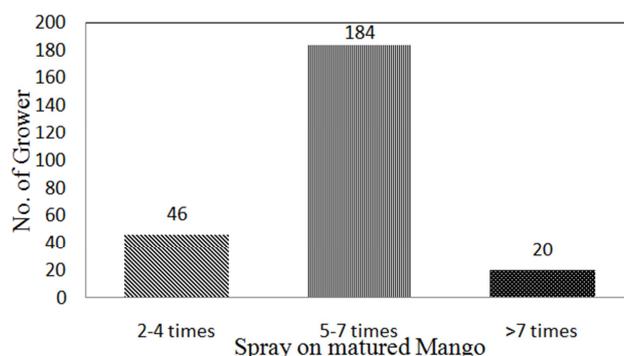


Figure 3. Number of spray of insecticides/fungicides on matured mango.

3.3. Name and Use of Insecticides/Fungicides During Mango Growth

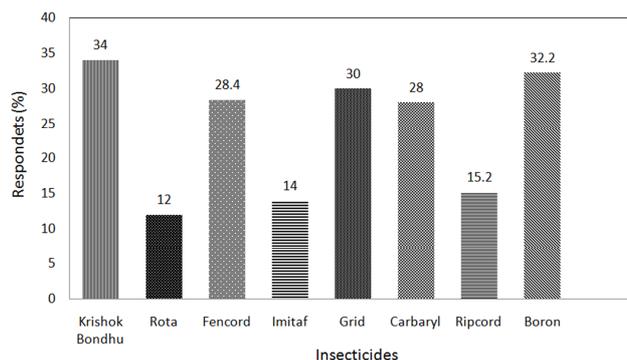


Figure 4. Insecticides used by the mango grower.

There are many insecticides used during mango cultivation in the study area. The mango growers are frequently used to Krishok Bondhu (Imidacloprid), Rota (Lambda-cyhalothrin), Fencord (Cypermethrin), Imitaf (Imidacloprid), Gird (Chlorpyrifos), Carbaryl (1-naphthyl methylcarbamate), Ripcord (Cypermethrin) and Boron. This study was found to be 34 % respondents used Krishok Bondhu, 12% respondents used Rota, 28.4% respondents used Fencord, 14% respondents used Imitaf, 30% respondents used Gird, 28%

respondents used Carbaryl, 15.2% respondents used Ripcord and 32.2% respondents used Boron. The numerical data was presented in Figure 4.

On the other hand, the mango growers were also used to spray many fungicides such as Mancozeb, Dithine M-45 (Mancojeb), Indofil M-45 (Mancojeb), Nativo (Tebuconazole + Trifloxystobin 100), Knowing (Carbendazime), Pencozeb (Mancojeb) and Power blast (Azoxitrobin+ Diphenconajol). We have found that 36% respondent used Mancozeb, 16% respondent used Dithine M-45, 18.4% respondent used Indofil M-45, 27.6% respondent used Nativo, 14% respondent used Knowing, 36.4% respondent used Pencozeb and 28% respondent used Power blast. The data was illustrated as in Figure 5.

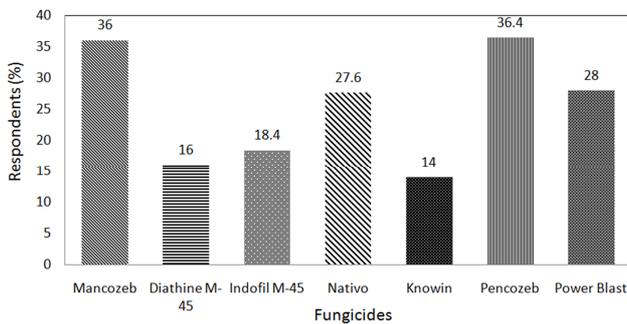


Figure 5. Fungicides used by the mango grower.

3.4. Consciousness About Side Effects of Insecticides/Fungicides of the Mango Growers

Every insecticides/fungicides have their own safety instruction before spray. That's why, in this survey, consciousness about insecticides/fungicides spray was also assessed for 250 mango growers in the study area. About 99 (39.6%) mango growers have little knowledge on insecticides/fungicides and 151 (60.4%) mango growers have no knowledge on insecticides/fungicides.

3.5. Knowledge and Consciousness of Side Effects of Formalin/Calcium Carbide of the Mango Growers

Table 2. Knowledge and consciousness of side effects of formalin/calcium carbide of mango growers, n=250.

	Yes	No
Knowledge on formalin/calcium carbide	133(53.2%)	117(46.8%)
Consciousness about side effects of formalin of the respondents	103(41.2%)	147(58.8%)

Sometimes formalin/calcium carbide is used to spray onto matured mango for mango preservation and artificially early ripen of mango respectively. Formalin is used for mango preservation and calcium carbide is used for early ripen of mango. In this study, the chemical idea of formalin/calcium carbide for 250 mango growers was assessed. 133 (53.2%) mango growers have little chemical knowledge on formalin/calcium carbide and 117 (46.8%) mango growers have no chemical knowledge on formalin/calcium carbide. In addition, the consciousness of side effect of formalin/calcium

carbide was assessed due to their devastating effect. 103 (41.2%) mango growers are little conscious about side effect of formalin/calcium carbide and 147 (58.8%) mango growers are not conscious about side effect of formalin/calcium carbide.

3.6. Taken Advice and Safety Measure of Insecticides/Fungicides of the Mango Growers

In this study, the targeted respondents were assessed on the basis of taking advice on health risk of pesticides/fungicides. Only 26 (10.4%) respondent/mango growers were taken advice on health risk of pesticides/fungicides and 224 (89.6%) growers did not take advice on health risk of pesticides/fungicides. Furthermore, 250 mango growers were classified on the basis of wearing extra cloth and glass. Where 236 (94.4%) mango growers did not used extra cloth and glass but only 14 (5.6%) mango growers were used extra cloth and glass was presented in Table 3.

Table 3. Mango growers taken advice and safety instruction of insecticides/fungicides, n=250.

	Yes	No
Taking advices on health risk of pesticides	26(10.4%)	224(89.6%)
Wearing extra cloth & glass during spray	14(5.6%)	236(94.4%)

4. Discussion

Education is a kind of factor which determines what is correct and what is wrong. It helps to make something correctly and increases the knowledge of an individual by removing ignorance. However, the most of the mango growers in the study are illiterate or educated upto HSC that strongly effect on insecticide or fungicide use. This illiteracy of mango growers makes knowledge gap for proper selection and use of pesticides/fungicides during mango cultivation. In addition, the most of the mango growers do not cultivate large land. They use land average from 1 acre to 7 acre.

A large mango production depends on fertile cultivated land at the root level. The fertile land links to more the production of mango. The mango growers are nursing their land and tree with great care. As a result, mango growers start spraying after the time of new mango leaves appearing. But, spray in large-scale is being started from flowering mango bud. So, the spray time is counted from mango bud until harvesting of matured mango. In general, mango bud is too sensitive to attack by insects, pests and fungi. Pest and disease control is very important on this stage. Majority of the growers use 3 times spray on mango bud whereas, 5 times spray by a few growers. After 5-7 weeks the small pale mango blooming from mango bud appears to deep green. This mango is called green mango. Insects like mango hoppers and other harmful insects should be controlled by spraying. On that time appropriate insecticides should be used at 6-10 days interval. However, in the study area the mango growers do not follow any recommendation of pesticides/fungicides spray. Interestingly, when mango growers do get result by using Pencozeb then they use

Dithane M-45. But they don't know both of these are fungicide and contain same chemicals due to their ignorance. Sometimes, they use fungicides instead of insecticides. Not only that but also they use these chemicals more and more until control of pest attack. Most of the cases they do not get any result due to mistake of pesticide selection for target pest control. In addition, when mango reaches maturity level and ready for plucking the mango growers use 5-7 times spray. Generally growers use a fungicide named Nativo in their mature mango. The use of Nativo should be stopped before 21 days of harvesting recommended by Bayer crop Science Company. But the growers marketed the harvested mango after 4-5 days of Nativo spraying. Those mangos may cause harmful to health by occurring various critical disease. This is the consequence of their ignorance and knowledge gap about using insecticides.

Due to the ignorance, the mango growers use huge amount of chemicals like insecticides and fungicides for control pests and diseases as well as to increase mango production. They use large amount of same pesticides by different trade name. This mistake is happening by private chemical company's representatives or agents and the companies did this only for their interest. The pesticides used by grower include under the trade name like Krishok Bondhu, Imitaf and Gain which contain chloronicotinylnitroguanidine chemical, Ripecord and Fenecord, that's are chemical name pyrethroid and Boron that chemical name is boric acid used as insecticides. The grower used Mancozeb, Pencozeb and Dithane M45 which contain the chemical ethylene-bis-dithiocarbamate, Knowin which contain Benzimidazol and Nativo which contain tebuconazol and trifloxystobin chemical as fungicides.

Furthermore, due to lack of knowledge of most of the mango grower in the study region, they are not aware about the side effect of pesticide. They spray huge amount of pesticide throughout the whole season of mango production without taking any kind of protective measures. These pesticides are very dangerous to human health. Pesticides may enter into the body through inhalation, ingestion and through the skin when it is spraying on the mango trees. Prolonged exposure of these pesticides may cause neurological, nephrological, dermal, intestinal and respiratory problem [10, 11]. But majority of the grower (about 151 of 250 respondents) were not conscious about the side effect of pesticides. The mango growers expressed their opinion that they are suffered from headache, irritation of eye, fatigue and dermal disorder etc. after prolong exposure of pesticide during spray. On the other hand they even do not know the right time of harvesting mango after spraying the pesticides. They harvest and market their mango within 5-7 days after spraying the pesticide though it was advisable to harvest mango at least 20 days after spraying the pesticide. As a result, huge amount of pesticide residues are consumed by consumer throughout the country that can develop serious health problem. On contrary rest of the respondents although conscious about the side effects of pesticides but most of them do not practice the proper method for spraying the pesticide.

Formalin is the dangerous chemical for human health which has preservative action against spoilage of substance. Formalin delay decomposition of fruits. The use of formalin for preservation of mango poses threat to public health and silently ruins our future generation. 134 growers out of 250 respondents admitted that they have idea about formalin though rest of the respondents has not. Although, majority of the growers have idea about formalin but most of the respondent approximately 147 have no consciousness about the side effect of formalin. Formalin is harmful to health and when it is ingested over a prolong period can develop respiratory, digestive, cardiac, nephrological and neurological problem along with cancer. Majority of the mango grower of this region only know that formalin is harmful to human health because formalin soaked mangoes have been frequently destroyed by government law enforcement bodies. Although the grower only very few of the respondent are conscious about the side effect of formalin. They learned it from their families, friends, television, newspaper or coworkers. It is a reality that most of the grower has idea about the formalin but they have no realization about the dangerous side effect of formalin. Actually the grower have no need to use of formalin for mango production but if they have awareness and consciousness about side effect of formalin, the vendor would not able to contaminate mango with dangerous chemical formalin.

The study was conducted using 250 mango growers as sample from where we found 44 respondents were illiterate and 140 respondents below the secondary level. Most of the Mango growers of this region are not aware about the side effects of pesticides they used. Due to their lack of knowledge they only know to use pesticides. But they don't know how to use it and also their effects. They use these pesticides in their own way locally. Even, they never feel to take advice from anywhere. During survey in the study area we found 26 growers taken advice and 224 are not. It also proclaimed that they are not conscious about health risk of pesticides. They spray huge amount of pesticides throughout the whole season of mango production without taking any kind of protective measures. They did not use extra cloths like apron, gloves, or glass during spray. Also they used to take food during and after spray without washing their hand properly. It is only happening due to their unconsciousness. During survey it was found that 14 growers used extra clothes and glass whereas, 236 were not.

5. Conclusion

The northwestern region of Bangladesh with its diverse agro-ecology is very suitable for the production of high quality mango both for domestic and foreign markets. However, the regional average mango productivity is below the national average need. To improve this situation high yielding, better quality, disease resistant and pest control is necessary. In the study area, the mango growers abnormally using many pesticides and very high quantity without getting successful pest control result due to the ignorance of

pesticide rules and knowledge gap for pesticides spray. They select wrong pesticide and it is continually happening by provoking locally untrained person. They are not aware about the importance of different agronomic and pest management practices. Thus, attempt should be taken immediately not only to reduce the early fall out of mangoes but also to produce safe mangoes for consumption and building awareness on mango pest management.

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