



MONITORING OF PESTICIDE APPLICATION IN BANANA CULTIVATION AT SELECTED AREAS OF BANGLADESH

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ARTICLE INFO

Article History:

Received 19th May, 2017

Received in revised form 12th

June, 2017 Accepted 6th July, 2017

Published online 28th August, 2017

Key words:

Banana, Pesticide application, Insecticide, Fungicide, DDT.

ABSTRACT

The study was conducted to monitor pesticide application in banana cultivation during 2015-16 at four districts (Gazipur, Narshingdi, Mymensingh, Chittagong) of Bangladesh. In this study, a survey was conducted in the Banana cultivated areas of four districts to collect information about the pesticides use with particular emphasis on the application of persistent insecticides. The survey revealed that the banana farmers commonly had used lambda-cyhalothrin, cypermethrin, fenitrothion, cypermethrin+quinalfos, quinalfos, thiamethoxam and DDT powder in banana cultivation. Results indicated that majority of farmers (67%) use DDT to control banana leaf and fruit beetle (*Nodostomaviridipennis*). It was also observed that fungicides such as carbendazim, difenoconazole, hexaconazole, mancozeb, propiconazole, tebuconazole had been used by majority of the farmer. The average Pre-Harvest Interval (PHI) ranged from 13.87 to 23.07 days while it was 12.5 days for Amritsagar and 13.87 days for Sabri. There are below the recommended PHI index (14 days). On the other hand, Kachkola, Gerasundari and Chinichampa showed PHI higher than the recommended level. Frequency of pesticide application in banana ranged from 3.45 to 9.67 times in a cropping season with higher frequency in Amritsagar (9.67 times) followed by Sabri (9.48 times). Interval between two sprays found minimum in Kachkola (3.45 days) and maximum in Amritsagar (9.67 days). Forty-eight percent farmers used DDT as suggested by pesticide retailers.

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INTRODUCTION

Banana is one of the important fruit crops in Bangladesh. Major areas of banana cultivation are Narsingdi, Gazipur, Mymensingh, Bogra, Natore, Pabna, Noakhali, Faridpur, Khulna district of the country. Areas of wild Banana are the Sylhet, Moulvibazar, Netrokona, Rangamati, Khagrachhari, Bandarban districts. There are several banana varieties are cultivated in Bangladesh. Among them, BARI Kola-1, Amritsagar, Sabri, Chinichampa and Kabri are the commercial varieties. The other varieties are Mehersagar, Dudsagar, Agniswar, Gerasundari, Kanaibanshi, Basrai, Binisuta and kachkola, etc.[1]. The pattern of banana cultivation is usually monoculture. Large-scale monoculture cropping systems is heavily dependent on high inputs of synthetic fertilizers and pesticides to achieve high yields. The total estimated production of banana in Bangladesh was 8,01,000T from a cultivated area of about 1,31 acres in 2012-13 [2]. However, commercial banana cultivation is pesticide-intensive because bananas are grown in massive monocultures, without crop rotation. These practices render

the plants vulnerable to insect pest infestation and diseases[3]. Some experts estimate that banana growers use 86.40 pounds of pesticide per hectare [4], dramatically more than for other crops. The use of other persistent insecticides may be applied by the farmers to get rid of these two obnoxious insect pests are banana leaf and fruit beetle and banana weevil.

Farming communities of Bangladesh are not adequately informed about the potential risks and hazards associated with the chemicals. As a result, farmers use pesticides without full understanding of their impact on human health and environment. Although their hazardous effects on environmental quality and human health, these noxious pesticides have been randomly used by most of farmers of Bangladesh.

Therefore, it is essential to monitor the cultivated area to determine whether the farmers are using these persistent insecticides (in particular) for suppressing these two obnoxious insect pests are banana leaf and fruit beetle and banana weevil [5]. The present study was undertaken to determine whether banana growers utilize these insecticides in particular and to observe whether they use any protective device(s) during the application of these kinds of hazardous chemicals. The aims of this study were to identify the

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commonly used pesticides in different banana varieties and its perception of usage in different areas and to monitor the use of any persistent insecticide in particular.

MATERIALS AND METHODS

This study was conducted during the period from July 2015 to February 2016 at Gazipur, Narsingdi, Mymensingh, Chittagong districts of Bangladesh with a view to assess the pesticide application, perceptions and potential risk. A predesigned questionnaire was prepared in advance to collect data during interview of the respondent banana farmers.

Study area

The study was conducted in some selected banana growing areas (Unions) under four districts of all over the Bangladesh (Table 1). The selected districts were Gazipur, Narsingdi, Mymensingh and Chittagong. The Farmers of these districts use different varieties of banana and apply various pesticides to control insect pests and diseases.

Table 1 List of surveyed areas under different districts of Bangladesh at upazilla and union level

District	Upazilla	Unions / Post offices
Gazipur	Kapasia	Kapasia, Rayed, Sanmania, Singasree, Chandpur.
Narsingdi	Monohordi	Khidirpur, Lebutala, Shukundi, Daulatpur, Barachapa
Mymensingh	MymensinghSadar	Sutikhali, Ghagra, Dapunia, Baera, Chorkhai.
Chittagong	Hathazari	DakshinMadarsa, Dhalai, Hathazari, Mirzapur, Nangolmora

Banana varieties

In this study farmers are asked about the banana varieties they commonly grow in their area. In Bangladesh, banana varieties are cultivated mainly from Musaceae family under *Musa sapientum* species. But all of modern varieties cultivated in Bangladesh were developed from *Musa acuminata* and *Musa balbisinina*[6].

Respondent farmers

Respondent farmers and farm workers were interviewed at village level under union/post office in different upazilla (Table 1) where bananas were mostly cultivated using farm inputs including pesticides. The respondents comprised 100 farmers (90 males and 10 females) from the selected districts.

Data Collection & Analysis

The questionnaire was designed based on published literature on the subject as well as the requirement of the study. Data were collected through a farm survey by face to face interviews with farmer's /farm workers and field observations during farming activities. The questionnaire was designed in English and translated into Bengali for easy understanding of the respondent. The collected data were coded, analyzed and presented in the tabular form. Data were collected, coded, analyzed, and tabulated using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2016 program.

RESULTS AND DISCUSSION

A total of 100 farmers from 4 districts were evaluated by interviewing with predesigned questionnaire to know their socioeconomic, demographic, use of banana varieties and

pesticide with application methodology in banana cultivation (Table 2).

Socio-economic characteristics of the studied farmers

The socio-economic characteristics are presented in the Table 2. This survey is similar with an experiment was made by Rahman et al. in 2014. The report showed that most of the farmers had general experience in agricultural production like rice, wheat, maize vegetable and fruits.

Table 2 Socio-economic characteristics of the studied farmers at different upazillas of Gazipur, Narsingdi, Mymensingh and Chittagong during July 2015 to February 2016

Parameters	Categories	No of farmers	Percentages (%)
Age (Yrs.)	15-25 years	06	06
	26-40 years	17	17
	40-50 years	11	11
	50-60 years	52	52
	>60 years	14	14
Sex	Male	90	90
	Female	10	10
Marital status	Single	03	03
	Married	97	97
Primary Occupation	Agriculture	97	97
	Business	01	01
	Others	02	02
Secondary Occupation	Agriculture	08	08
	No secondary occupation	80	80
	Others	12	12
Educational status	Illiterate	89	89
	PSC (1-5)	08	08
	JSC (6-8)	01	01
	SSC (9-10)	00	00
	HSC (11-12)	01	01
	Above HSC	01	01
	1-10 years	07	07
Experience in banana cultivation	11-20 years	33	33
	21-30 years	56	56
	31-40 years	4	4

Pesticide use in banana cultivation

The data regarding common insecticides and fungicides used by the banana farmers were listed in the Table 3 and 4. The results of this survey indicated a wide variety of chemicals were being applied and sprayed as pesticides in banana cultivation. The majority of pesticides were insecticides and fungicides. Although 13 different pesticides were reported by farmers which were being used in the selected areas (Gazipur, Mymensingh, Narsingdi and Chittagong) yet it could practically be lower than the actual number of pesticides being applied.

Insecticides

A total of 7 insecticides were reported by the respondent's farmer (Table 3). These insecticides were bought by the farmers as different trade names. Among these insecticides, the highest percentages (67%) of the farmers use DDT powder which is followed by fenitrothion, lambda-cyhalothrin and cypermethrin. This result is consistent with the result reported by Rahman et al.[7].

Table 3 Major chemical insecticides used by the farmers, in banana cultivation with their trade name, company name and target pests

Common name	Trade name	Company	Applied to Control	% Users Farmer
Lamda-cyhalothrin	Bojro	LalTeer	Fruit Fly	8
	Carate Sythrin	Syngenta ACI United	Hopper Hopper	37 33
Cypermethrin	Ostad	phosphorous Bangladesh Ltd.	Hopper	22
	Cyraux	LalTeer	Banana leaf and fruit beetle	23
Fenitrothion	Sumithion	Sato agro-industries.Ltd.	Fruit Fly	36
Cypermethrin + Quinalfos	Virat	LalTeer	Banana leaf and fruit beetle	19
Quinalphos	Echallas	Lalteer	Fruit Fly	11
Thiamethoxam	Actara 25WG	Syngenta Bangladesh Limited	Banana leaf and fruit Beetle	6
DDT Powder	DDT	Unknown	Banana leaf and fruit Beetle	67

Fungicides

A total of 6 fungicides were commonly used by the studied banana farmers (Table 4). These fungicides were sold in different trade names in the local market. Among these fungicides, the highest percentages (71%) of the banana farmer used propiconazole consisting tilt 21%, proud 27% and canzole 23%. This was followed by mencozeb (54%) which includes, flowin 37% and baizeb 17%. tebuconazole was used by the least percentage of farmers (27%).

Table 4 Major chemical Fungicides used by the banana farmers.

Common Name of the Products	Trade Name	Company name	% User Farmers
Carbendazim	Ravistin 50 WP	Raven Aqua Agriculture Ltd	14%
	Ravzim 50 WP	Raven Aqua Agriculture Ltd	23%
Difenoconazole	Score 250 EC	Syngenta Bangladesh Limited	43%
	Conza 5 EC	ACI Formulation Limited	22%
Hexaconazole	Ravzole 5 EC	Raven Agro Chemicals Limited	27%
	Flowin HT	Auto Crop Care Limited	37%
Mancozeb	Baizeb 80WP	Bangladesh Agricultural Industries	17%
	Tilt 250 EC	Syngenta Bangladesh Limited	21%
Propiconazole	Proud 25 EC	ACI Formulation Ltd	27%
	Canzole 25 EC	ACI Formulation Ltd	23%
	Tebuconazole	Tebuzole 250 EC	ACI Formulation Ltd

Pre-harvest interval (PHI) of insecticide in Banana cultivation

PHIs varied greatly, depending on the insecticide being used and the particular crop being treated [8]. The respondent farmers were asked about the PHIs of pesticide on five cultivated banana varieties individually. The selected varieties were Chinichampa, Gerasundori, Amritasagar, Sabri and Kachkola. The result indicates that the average PHI ranged from 12.50 to 23.07 days followed by banana farmers. The observed PHI of Amritasagar (12.50±2.59) and Sabri (13.87±1.68) were found below the recommended PHI index (7-14 days). As a thumb rule the PHIs for fruits was 7-14 days [9]. It means that all the banana fruit contain pesticide toxicity more than the tolerable level at harvest. It was found that

litchi had the lowest PHI (13.87 days) followed by Amritasagar (12.50 days). Kachkola (23.07±03.32 days), Gerasundari (15.55±1.50 days) and chinichampa (18.56±2.90 days) also showed PHI higher than the minimum recommended level (Table 5). The standard PHI is 3.45 to 11.90 days for fruits. In case of litchi PHI was found 3.45 days which is the lowest and for mango PHI was found 5.63 days. Guava, jackfruit and ber also showed PHI higher than the minimum recommended level [10]. The result of this present investigation showed that the respondent farmer in the studied areas do not follow the PHI index in pesticide application.

Table 5 Pre-harvest interval of insecticide observed in banana after spraying

Banana varieties	Pre-harvest interval (Days after spraying)
Chinichampa	18.56±2.90
Gerasundori	15.55±1.50
Amritasagar	12.50±2.59
Sabri	13.87±1.68

Application frequency, interval between two spray and cost of pesticide

The interviewed farmers were asked about the frequency of pesticide application, interval between two sprays and how much money does it cost for a crop season. The data were presented in the (Table 6).

Pesticide application frequency

Frequency of pesticide application in banana ranged from 3.45 to 9.48 times in a cropping season (Table 6). Number of pesticide application per cropping season (frequency) was found higher in Amritasagar (9.67 times) followed by Sabri (9.48 times). The lowest frequency was found in Kachkola (3.45times) followed by Gerasundari (5.38 times) showed the higher frequency in litchi fruit (20.65 times) followed by banana and the lowest frequency was found in jackfruit [7].

Interval between two spray

Every pesticide had certain interval for re-spray. This interval was essential to maintain strictly. Among the five selected banana variety the interval between two sprays was ranged between 6.25 days to 27.20 days. This interval was found minimum in Sabri followed by Chinichampa (Table 6) showed more or less similar result some fruit plant, where the interval ranges from 3.48 to 10.29 days. The interval was found minimum (3.48 days) in litchi followed by mango (5.46 days) and it was higher in jackfruit (10.29 days)[10].

Table 6 Application frequency, interval and cost of pesticide in a crop season

Banana Varieties	Number of application per season	Interval between two spray (Days)	Cost of pesticide (Taka ha ⁻¹)
Chinichampa	7.52	8.45	2510.00
Gerasundori	5.38	10.15	3585.00
Amritasagar	9.67	13.40	4039.00
Saabri	9.48	6.25	4527.00
Kachkola	3.45	27.20	1510.0

Cost of pesticide

The respondent farmers spent 1510 TK to 4527 TKha⁻¹ for banana cultivation. The maximum money (TK4527) was spent for Sabri variety in a cropping season. This might be due to the highest frequency of application and lowest time of interval between two sprays (Table 6). Result is also similar

with Rahman *et al.* [7]. The sampled farmers spent money from 3529.77 TK. to 9020.16 TK/ha for vegetables and 1640.32 TK to 4714.64 TK/ ha for fruits.

Use of DDT in banana cultivation

The survey record revealed that banana farmers are applying DDT in their field for insect control. It was estimated that out of 100 respondent farmers 67 farmers of different district use DDT during the initiation of inflorescence that is usually called 'Thor' to control severe infestation caused by banana leaf and fruit beetle (*Nodostoma viridipennis*) (Table 3).

Source of DDT

The farmer called it "DT powder" which they get from the pesticide non-recognized dealer or retailer. This DDT is sold by rural retailer unlawfully. Those non recognized dealers also sell the other insecticide or pesticide of different company. So, farmers trust them and buy those insecticides to manage the insect pests attacking banana for good management of insect pest. Farmers found them very effective against the insect pests. Similar work was done on dried fishes The research findings showed that the highest level of DDT residue (6.73 ppm) was found in GuraChingri (Spider Prawn) sample collected from Chittagong metropolitan city market (Reazuddin Bazar) which was followed by Chaka chingri (Indian white shrimp - 5.49 ppm)[7].

Source of suggestion for using DDT in Banana

The farmers of the selected areas were interviewed to know how they get advice to use DDT in Banana cultivation. These information of advice were collected in six advisory group such as retailers, recognized dealers, non-recognized dealers, pesticide suppliers, neighboring farmers and own choice (Table 7).

Table 7 Information of DDT use by the farmers in banana cultivation with their advisors

DDT application advised from	Sampled farmer	
	Number of farmer	Percentage of farmer
Retailers	48	48.00%
Recognized dealers	11	11.00%
Non recognized dealers	29	29.00%
Pesticide suppliers	5	5.00%
Neighboring farmers	3	3.00%
Own choice	9	9.00%

Reason of DDT Use

Farmers explained that when banana fruit initiate then a sweet and an attractive smell emitted which attract "Banana leaf and fruit beetle". Beetle attacks the young fruits and feed on their surface in an irregular patch. As fruit matured was dark irregular scars are seen which affect size, shape and color of the fruit. Thus the quality of fruit become deteriorated and reduces the market value up to 50%. If control measure was not taken, 100% percent of the fruits were damaged [11]. The market value of healthy fruits was much higher than that of scarred ones [12]. Therefore, the farmer of Bangladesh takes chemical control measures to reduce the infestation by the pests. Various chemical insecticides were used by the farmers to control this pest such as, Lamda-cyhalothrin, Cypermethrin, Fenitrothiom and Quinalphos (Table 4). The present investigation revealed that the banana growers were more interested to use DDT to prevent *Nodostoma*

viridipennis compared to other chemical and mechanical control measure.

Extent of DDT use

Farmers preferred to use DDT against Banana leaf and fruit beetle (*Nodostoma viridipennis*). About 67% of the farmer use DDT in banana cultivation (Table 4). The farmers used DDT 2-3 times per season. Sometimes these frequencies become higher due to increasing pest attack. Basically, the survey reported that studied farmers were ignorant about how to use DDT and its consequence, they only knew about its effectiveness against the insect pest control.

CONCLUSION

Study revealed that the banana farmers were commonly used lamda-cyhalothrin, cypermethrin, fenitrothion, (cypermethrin+quinalfos), quinalfos, thiamethoxam and DDT powder for the control of banana leaf and fruit beetle. Among them DDT were used by 67% of the studied farmer (n=100). Farmers used carbendazim, difenoconazole, hexaconazole, mancozeb, propiconazole, tebuconazole as fungicides for sigatoka disease.

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How to cite this article:

Mazed M.K *et al* (2017) 'Monitoring of Pesticide Application in Banana Cultivation at Selected Areas of Bangladesh', *International Journal of Current Advanced Research*, 06(08), pp. 5250-5254.
DOI: <http://dx.doi.org/10.24327/ijcar.2017.5254.0682>
