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USE PATTERN OF INSECTICIDES IN COUNTRY BEAN (*DOLICHOS LABLAB* L.)

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Abstract

A survey was conducted in intensive country bean growing areas of Jessore on the use pattern of insecticides by farmers growing country bean. One hundred farmers were interviewed using objective oriented questionnaires concerning the type of insecticides used, their frequency and interval of application, time of application prior to harvest, major pests observed in the fields and the safety measures followed by the farmers while applying insecticides. About 100 per cent farmers of twelve selected locations considered pod borer and aphid as major pests. Mite was recorded as the second most important pest of country bean by 40.00 to 87.50 per cent farmers. The most commonly used insecticides in country bean were Carbaryl (Sevin 85SP), Carbosulfan (Marshal 20EC), Carbofuran (Furadan 5G), Cartap (Suntap 50SP), Malathion (Diethion 57EC, Hilthion 57EC), Quinalphos (Korolux 25EC), Chloropyrifos (Dursban 20EC), Sulphur (Thiovit 80WG), Imidachloprid (Admire), Mancozeb (Dithane 45M), Diazinon, Abamectin Benzoate (Proclem 5SG), Arostar, Fenvalerate, Fipronil (Regent 50SC), Thiomethoxam (Actara 25WG), Cypermethrin (Cymbush 10EC, Ripcord 10EC, Fenom 10EC, Ostaad 10EC, Peskil 10EC, Basathrin 10EC) etc. As a common practice, the country bean growers used different combinations of insecticides instead of single insecticide. All of the insecticides used in different combinations were non-selective and highly toxic to both pests and natural enemies. In all selected locations, 10.00 to 50.00 per cent farmers applied different insecticides every day and in some cases even twice in a day on country bean. On an average, 35.63 per cent farmers in the study areas applied insecticides at a frequency range of 61-90.

Keywords: Country bean, insecticides, frequency, interval, application, time, safety measures

Introduction

The country bean (Hyacinth bean) *Dolichos lablab* L. is a delicious winter vegetable crop in Bangladesh. It belongs to the family Leguminosae. It is mentionable that bean crops show a broad range of adaptation to the most varied climatic conditions within a wide range of geographic area that extends from around 50° north latitude to 32° south latitude (Thompson, 1951). Country bean plays an important role in the agro-economy and national health of Bangladesh. The crop has multipurpose usage. Its young pods and tender beans are consumed as vegetables (Purseglove, 1968). The ripen and dried seeds are used as a split pulse (dhal) and in various curry preparation. It has got a unique ability to fix atmospheric nitrogen to the soil through rhizobial symbiosis at root zone and can enhance soil fertility as a green manure crop. Its green pods and mature seeds are rich source (25 per cent) of protein (on dry basis), vitamins viz. vitamin A, vitamin C, riboflavin etc. and mineral such as magnesium, calcium, phosphorous, potassium, iron, sulfur and sodium (Deka and Sarker, 1990; Newaz, 1992). Thus it is an important source of cash income as well as alleviating malnutrition and sickness caused by dietary deficiencies.

A survey on pesticide use in vegetables conducted in 1988 revealed that only about 15 per cent and 6 per cent of the farmers received information from the pesticide dealers and extension agents, respectively (Islam, 1997).

Jessore is one of the dominant country bean growing areas in Bangladesh. It has been documented that a considerable number of farmers of greater Jessore region of Bangladesh spray insecticides on country bean every or every alternate day and thus on an average 80 sprays are applied in a single season (Kabir *et al.*, 1996).

It is obvious that modern insecticides are highly toxic to every organism of the animal kingdom including human beings. Even in a well-managed condition spillover of spray materials on soil, water and other abiotic materials is highly likely to cause pollution. Transformation and volatilization of such materials cause residue load in the environment (Spencer *et al.*, 1973). It is evident that the more persistent the pesticide, the greater is the danger to the environment. Although it is not well documented, insecticide residues hamper microbial activities in soil, destroy aquatic lives and non-target invertebrates and cause enormous damage to higher vertebrates (Ware and Roan, 1970; Duggan and Duggan,

1973; Edwards, 1974). Thus, it was felt to undertake the present study to explore the use pattern of insecticides in country bean intensively grown in Jessore area of Bangladesh.

Materials and Methods

A study comprising survey of insecticide use pattern in country bean. The survey was conducted in Jessore a south western district of Bangladesh administering a pre-designed (structured) questionnaire during 18th October to 26th December, 2009. Jessore is an important country bean growing area so it was selected as the study area. The survey was conducted in twelve (12) important country bean producing villages of Jessore such as Daulatdihi, Abdulpur, Mominnagar, Churamonkati, Shahbajpur, Bagdanga, Dakatia, Shantola, Kismatpur, Kutilaokhali, Pultadanga and Chaugachi (Figure 1). These locations are situated at 23.11° N latitude and 89.14° E longitude with an elevation of 6.71 meter from sea level characterized by Agro-ecological Zone "High Ganges Flood Plain" (AEZ 11).

Eight farmers from each of Daulatdihi, Abdulpur, Mominnagar, Churamonkati, Shahbajpur, Bagdanga, Dakatia, Shantola, Kismatpur, Kutilaokhali and ten farmers from each of Pultadanga, Chaugachi were randomly selected as a sample respondent to have a total of 100 respondents from the twelve locations. Farmers who were involved in growing of country bean over the last couple of years were selected as a sample respondent. These selected farmers were interviewed during the year 2009; administering pre-tested questionnaire to collect information on the selected parameters such as major insect pests, commonly used insecticides with their frequency and pre-harvest interval of application. In order to get valid and reliable data, these were verified, corrected and rationalized by repeating questions, asking neighboring farmers and considered interviewer's own judgment in evaluating the accuracy of responses. The interview schedule was designed to collect information in local units. Farmers' practice related data were collected at two levels: directly from the sample farmers by administering pre-tested questionnaires and recording of data in pre-formatted register at 1 month interval from the sample farmers' crop fields through field and crop inspection. Such field data collection activities were assisted by the Scientific Assistant of the Entomology Division of Regional Agricultural Research Station, Jessore of Bangladesh Agricultural Research Institute (BARI). The collected data were coded, analyzed and presented in the tabular form. Data were collected

from farmers to find out the insect pest status of country bean, number of insecticide used in a season, spray intervals, harvesting time of country bean after spray etc.

Results and Discussion

Insect Pest Infesting Country Bean in Survey Area

Country bean grown in twelve different locations was attacked by different insect pests and mites. Insect pests and mite of country bean with their scientific names and percentage of incidence observed by the farmers in their field are presented in Table 1. In most cases, insect pests for each location were similar. Country bean was seriously affected by bean pod borer, aphid, and their infestation were much higher than other insect pests of country bean. About 100 per cent farmers of all locations identified bean pod borer and aphid as major pests. Mite was recorded as the second most important pest of country bean with higher percentage of farmers where 87.50 per cent farmers were capable to identify, and mite was the second major pest in Daulatdihi. 75.00 per cent farmers in Abdulpur, 87.50 per cent in Shahbajpur, 62.50 per cent in Bagdanga, 50.00 per cent in Dakatia, 87.50 per cent in Shantola, 75.00 per cent in Kismatpur and 50.00 per cent in Kutilaokhali found mite as an important pest of country bean. In Pultadanga, higher percentage of farmers (90.00 per cent) reported leaf miner infestation in country bean. In Mominnagar, 75.00 per cent farmers reported leaf miner infestation. In Churamonkati, 62.50 per cent and in Chaugachi, 50.00 per cent farmers found leaf miner infestation. In other eight locations, 37.50 to 75.00 per cent farmers reported leaf miner infestation. Leaf beetle was also a common pest in all selected locations and 25.00 to 75.00 per cent farmers reported the leaf beetle attack (Table 1). Almost similar findings were also reflected in the study of Ahmed (2002). In his study, seven insect pests were found to infest country bean at different growth stages. They were in descending order of their incidence as aphid (*Aphis craccivora* Koch), pod borer (*Maruca* sp.), leaf miner (*Cosmopterix* sp.), leaf beetle (*Madurasia obscurella* Jacoby), leaf eating caterpillar (*Amsacta albistriga* W.), mite (*Tetranychus* sp.) and hooded hopper (*Leptocentrus taurus* Fb.). Aphid and pod borer were found to occupy the same status of incidence in both north Edilpur and south Mohadebpur. They were found to inflict severe infestation in country bean in farmers' field of both the villages.

Table 1. Percentage of the incidence of insect pests of country bean in twelve country bean growing locations of Jessore district during October to December, 2009.

Identified insect pest regarding opinions of the respondents & field visit of the researchers	Insect incidence (%) in farmers' field											
	Name of survey area											
	Daulatdihi	Abdulpur	Mominnagar	Churamonkati	Shahbajpur	Bagdanga	Dakatia	Shantola	Kismatpur	Kutilaokhali	Pultadanga	Chaugachi
Bean pod borer (Maruca sp.)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Aphid (Aphis craccivora K.)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mite (Tetranychus sp.)	87.50	75.00	62.50	50.00	87.50	62.50	50.00	87.50	75.00	50.00	70.00	40.00
Leaf miner (Cosmopterix sp.)	62.50	37.50	75.00	62.50	50.00	75.00	62.50	50.00	62.50	62.50	90.00	50.00
Leaf beetle (Madurasia obscurella J.)	50.00	25.00	75.00	25.00	37.50	25.00	37.50	75.00	25.00	37.50	30.00	60.00
Leaf-eating caterpillar (Amsacta albistriga W.)	37.50	–	–	–	–	–	–	25.00	–	–	–	–
Green semilooper (Plusia orichalcea Fb.)	25.00	–	–	–	–	–	–	–	–	–	–	–
Hooded hopper (Leptocentrus taurus Fb.)	12.50	–	–	–	–	–	–	–	12.50	–	–	–
Plume moth (Sphenarches anisodactylus W.)	–	12.50	–	–	–	–	–	12.50	–	–	–	–
Leaf weevil (Blosyrus oniscus Ol.)	–	37.50	–	–	–	–	–	–	–	–	–	–
Shoot weevil (Alcides collaris P.)	–	–	12.50	–	–	–	–	–	–	–	–	–
Bean bug (Coptosoma cribrarium F.)	–	–	–	12.50	–	–	–	–	–	–	20.00	–
Bean fly (Melanagromyza phaseoli T.)	–	–	–	–	12.50	–	–	–	–	–	–	10.00
Shoot borer (Sagra carbunculus H.)	–	–	–	–	–	–	12.50	–	–	–	–	–

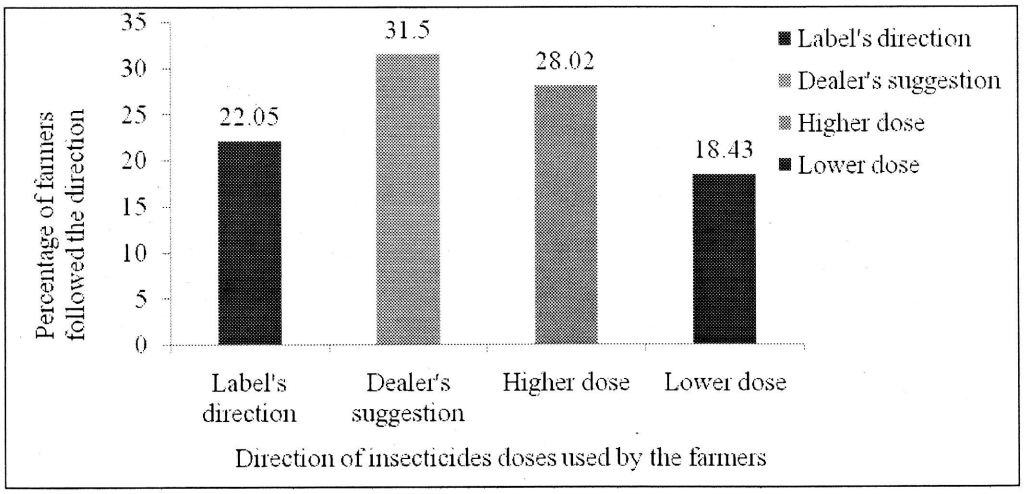

Figure 1. Direction of insecticides doses used by the farmers of Jessore district during October to December, 2009.

Commonly Used Insecticides to Control Country Bean Insect Pests

The list of commonly used insecticides by the farmers to control different insect pests of country bean in their field during the season is depicted in Table 2. The farmers used 25 to 30 types of insecticides against the insect pests in a single season. These insecticides mainly belonged to three group's viz., Organocarbamate, Organophosphate and Synthetic Pyrethroid. Among the locations, the highest number of insecticides was used in Daulatdihi. The most common insecticides used in country bean were Carbaryl (Sevin 85SP), Carbosulfan (Marshal 20EC), Carbofuran (Furadan 5G), Cartap (Suntap 50SP), Malathion (Diethion 57EC, Hilthion 57EC), Quinalphos (Korolux 25EC), Chloropyrifos (Dursban 20EC), Sulphur (Thiovit 80WG), Imidachloprid (Admire 200SL), Mancozeb (Dithane M45), Diazinon, Abamectin Benzoate (Proclem 5SG), Arostar, Fenvalerate, Fipronil (Regent 50SC), Thiomethoxam (Actara 25WG), Cypermethrin (Cymbush 10EC, Ripcord 10EC, Fenom 10EC, Ostaad 10EC, Peskil 10EC, Basathrin 10EC) etc (Table 2). In Shahbajpur and Abdulpur, 89.00 per cent farmers used Malathion to control insect pests of country bean. Only 6.00 per cent farmers in Dakatia and Mominnagar used Dithane M45.

Table 2. Commonly used insecticides in twelve country bean growing locations of Jessore district during October to December, 2009.

Survey Location	Insecticides				Percentage of sample farmer
	Group	Common name	Trade name	Mode of action	
Daulatdihi	Organocarbamate	Cartap	Suntap 50SP	C., St	50.00
		Carbaryl	Sevin 85SP	C, St	25.00
		Carbosulfan	Marshal 20EC	C, St	37.50
	Organophosphate		Malataf 57EC	C, S	62.50
		Malathion	Fyfanon 57EC	C, S	25.00
		Chloropyrifos	Korolux 25EC	C, St	75.00
	Synthetic Pyrethroid	Fenvalerate	Sumicidin 20EC	C, St	12.50
			Thiovit 80WG	-	37.50
		Mancozeb	Dithane 45M	C	75.00
		Fipronil	Regent 50SC	-	12.50
			Proclem 5SG	-	50.00
		Abamectin	Arostar 5SG	-	37.50
		Benzoate			
Abdulpur	Organocarbamate	Cartap	Suntap 50SP	C, St	12.50
		Carbofuran	Furadan 5G	S, St	25.00
	Organophosphate	Carbaryl	Sevin 85SP	C, St	62.50
		Quinalphos	Korolux 25EC	C, St	75.00
		Chloropyrifos	Dursban 20EC	C, St	12.50
	Synthetic Pyrethroid	Cypermethrin	Cymbush 10EC	C, St	37.50
		Fipronil	Regent 50SC	St	25.00
		Thiomethoxam	Actara 25WG	C, S	62.50
		Abamectin	Proclem 5SG	-	75.00
		Benzoate	Arostar 5SG	-	50.00
		Carbendazim	Knowin 50WP	St	37.50
Mominnagar	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	12.50
		Cartap	Suntap 50SP	C, St	62.50
		Carbaryl	Sevin 85SP	C, St	50.00
		Carbofuran	Furadan 5G	S, St	75.00
	Organophosphate	Chloropyrifos	Dursban 20EC	C, St	12.50
		Monocrotophos	Megafos 40SL	C, St, S	62.50
		Quinalphos	Korolux 25EC	C, St	37.50

	Synthetic Pyrethroid	Cypermethrin	Ustaad 10EC	C, St	75.00
			Thiovit 80WP	-	25.00
Churamonkati	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	50.00
		Cartap	Suntap 50SP	C, St	12.50
	Organophosphate	Malathion	Hilthion 57EC	C, S	75.00
			Fyfanon 57EC	C, S	37.50
		Fenitrothion	Sumithion 50EC	C, St	12.50
	Synthetic Pyrethroid	Fenvalerate	Fenfen 20EC	C, St	25.00
		Carbendazim	Knowin 50WP	St	50.00
		Fipronil	Regent 50SC	-	12.50
		Mancozeb	Dithane 45M	C	75.00
		Abamectin	Proclem 5SG	-	50.00
		Benzoate	Arostar 5SG	-	25.00
Shahbajpur	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	12.50
		Cartap	Suntap 50SP	C, St	62.50
		Carbofuran	Furadan 5G	S, St	37.50
		Fenitrothion	Sumithion 50EC	C, St	75.00
	Organophosphate	Chloropyrifos	Dursban 20EC	C, St	25.00
		Malathion	Fyfanon 57EC	C, S	50.00
		Quinalphos	Korolux 25EC	C, St	62.50
	Synthetic Pyrethroid	Fenvalerate	Sumicidin 20EC	C, St	12.50
		Cypermethrin	Ustaad 10EC	C, St	37.50
			Thiovit 80WG	-	50.00
		Clabendyamide	Belt 24WG	C	12.50
Bagdanga	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	62.50
		Cartap	Suntap 50SP	C, St	75.00
		Carbaryl	Sevin 85SP	C, St	25.00
	Organophosphate	Malathion	Hilthion 57EC	C, S	12.50
			Fyfanon 57EC	C, S	50.00
			Malataf 57EC	C, S	37.50
		Chloropyrifos	Dursban 20EC	C, St	62.50
		Quinalphos	Korolux 25EC	C, St	25.00
		Fenitrothion	Sumithion 50EC	C, St	75.00
	Synthetic Pyrethroid	Cypermethrin	Ripcord 10EC	C, St	12.50
			Ustaad 10EC	C, St	50.00
			Cymbush 10EC	C, St	37.50
			Thiovit 80WG	-	62.50

Use pattern of insecticides in country bean (Dolichos Lablab L.)

Dakatia		Cartap	Suntap 50SP	C, St	25.00
	Organocarbamate	Carbaryl	Sevin 85SP	C, St	75.00
	Organophosphate	Chloropyrifos	Dursban 20EC	-	50.00
		Malathion	Malataf 57EC	C, S	37.50
			Hilthion 57EC	C, S	12.50
		Quinalphos	Korolux 25EC	C, St	62.50
	Synthetic Pyrethroid	Fenvalerate	Milfen 20EC	C, St	25.00
		Abamectin	Proclem 5SG	-	37.50
		Benzoate	Arostar 5SG	-	62.50
		Clabendyamide	Belt 24WG	C	87.50
		Carbendazim	Knowin 50WP	St	25.00
		Thiomethoxam	Actara 25WG	C, S	50.00
Shantola	Organocarbamate	Cartap	Suntap 50SP	C, St	12.50
			Symitap 50SP	C, St	75.00
		Carbaryl	Sevin 85SP	C, St	62.50
		Mancozeb	Dithane 45M	-	37.50
	Organophosphate	Quinalphos	Korolux 25EC	C, St	50.00
		Fipronil	Regent 50SC	St	12.50
	Synthetic Pyrethroid	Cypermethrin	Synothrin 10EC	C	25.00
			Thiovit 80WG	-	25.00
		Abamectin	Proclem 5SG	-	37.50
		Benzoate	Arostar 5SG	-	75.00
Kismatpur	Organocarbamate	Cartap	Suntap 50SP	C, St	12.50
		Carbaryl	Sevin 85SP	C, St	50.00
	Organophosphate	Carbosulfan	Marshal 20EC	C, St	37.50
		Malathion	Hilthion 57EC	C, S	75.00
			Malataf 57EC	C, S	62.50
			Fyfanon 57EC	C, S	25.00
		Chloropyrifos	Korolux 25EC	C, St	12.50
	Synthetic Pyrethroid	Fenvalerate	Sumicidin 20EC	C, St	50.00
		Mancozeb	Dithane 45M	C	37.50
		Fipronil	Regent 50SC	-	75.00
		Abamectin	Proclem 5SG	-	62.50
		Benzoate	Arostar 5SG	-	25.00

Kutilaokhali	Organocarbamate	Cartap	Suntap 50SP	C, St	12.50
		Carbofuran	Furadan 5G	S, St	25.00
	Organophosphate	Carbaryl	Sevin 85SP	C, St	37.50
		Chloropyrifos	Korolux 25EC	C, St	75.00
	Synthetic Pyrethroid	Cypermethrin	Cymbush 10EC	C, St	12.50
		Fipronil	Regent 50SC	St	62.50
		Thiomethoxam	Actara 25WG	C, S	50.00
		Abamectin Benzoate	Proclem 5SG	-	12.50
			Arostar 5SG	-	75.00
		Carbendazim	Knowin 50WP	St	37.50
Pultadanga	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	40.00
		Cartap	Suntap 50SP	C, St	20.00
		Carbaryl	Sevin 85SP	C, St	80.00
		Carbofuran	Furadan 5G	S, St	30.00
	Organophosphate	Chloropyrifos	Dursban 20EC	C, St	40.00
		Monocrotophos	Megafos 40SL	C, S, St	60.00
		Quinalphos	Korolux 25EC	C, St	10.00
	Synthetic Pyrethroid	Cypermethrin	Ustaad 10EC	C, St	20.00
			Thiovit 80WG	-	70.00
Chaugachi	Organocarbamate	Carbosulfan	Marshal 20EC	C, St	10.00
		Cartap	Suntap 50SP	C, St	30.00
		Carbaryl	Sevin 85SP	C, St	60.00
	Organophosphate	Malathion	Hilthion 57EC	C, S	80.00
			Fyfanon 57EC	C, S	70.00
			Malataf 57EC	C, S	40.00
		Chloropyrifos	Dursban 20EC	C, St	20.00
		Quinalphos	Korolux 25EC	C, St	30.00
		Fenitrothion	Sumithion 50EC	C, St	10.00
	Synthetic Pyrethroid	Cypermethrin	Ripcord 10EC	C, St	60.00
			Ustaad 10EC	C, St	40.00
			Cymbush 10EC	C, St	70.00
			Thiovit 80WG	-	20.00

C= Contact poison, St= Stomach poison, S= Systemic poison

Use Pattern of Insecticides by the Farmers

In all the twelve selected locations of Jessore, only 22.05 per cent farmers used insecticides according to the direction given on the label of insecticide container bottle and 31.50 per cent farmers used insecticides according to the dealer's suggestion. In those study areas, 28.02 per cent farmers used higher dose and 18.43 per cent farmers used insecticides at lower dose (Figure 1). It was opined by the farmers in some areas that they used higher dose of insecticides than the directions provided on the label due to low efficacy of sprayed insecticides to kill the target pests in the country bean field and some farmers used lower dose due to high price of insecticides.

Method of Selecting Time to Spray Insecticides

On an average 69.34 per cent farmers of twelve study areas selected the time of spray insecticides according to their own decision and 30.66 per cent farmers followed dealer's suggestion (Figure 2). It was recorded from the study that, in case of some highly toxic insecticides, the dealers suggested the farmers not to go inside the field within 1 week after spraying. But the farmers did not maintain the interval and they sprayed insecticides on their crops according to their own decision, almost every day or 1-2 days interval.

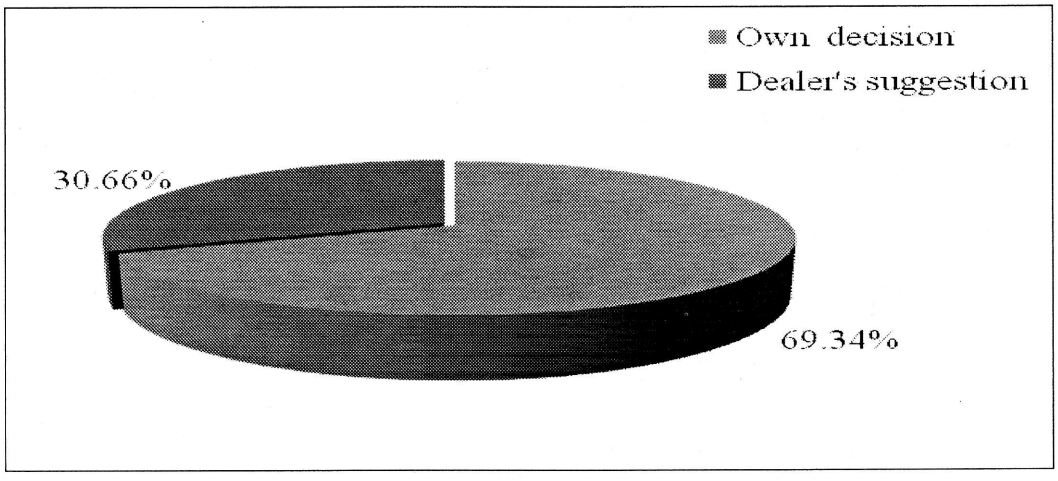

Figure 2. Method of selecting time to spray insecticides by the farmers in Jessore district during October to December, 2009.

Frequency of Insecticide Application

The sample farmers applied insecticides indiscriminately and never followed any instruction of judicial insecticide application. Farmers applied insecticides ranging from 31 to 150 times on the country bean during a single growing season (Table 3). The frequencies of insecticide application were grouped into four ranges such as 31-60, 61-90, 91-120 and 121-150 times. Around 35.63 per cent of farmers of twelve locations sprayed insecticides within the frequency range of 61-90 times in which Kismatpur, Churamonkati, Dakatia, Kutilaokhali and Mominnagar had maximum frequency of insecticide application. On an average, 31.67 per cent farmers applied insecticides in the range of 31-60 times while a maximum of 75.00 per cent farmers represented from Daulatdihi and minimum 10.00 per cent farmers represented from Pultadanga. An average of 19.17 and 13.13 per cent farmers sprayed insecticides in the range of 91-120 and 121-150 times, respectively.

Table 3. Frequency ranges (%) of application of insecticide followed by country bean growers in twelve survey areas of Jessore district during October to December, 2009.

Name of the survey area	Frequency range			
	31- 60	61- 90	91- 120	121- 150
Daulatdihi	75.00	12.50	25.00	12.50
Abdulpur	25.00	12.50	12.50	12.50
Mominnagar	62.50	37.50	37.50	25.00
Churamonkati	12.50	75.00	12.50	12.50
Shahbajpur	37.50	25.00	25.00	12.50
Bagdanga	12.50	12.50	25.00	12.50
Dakatia	12.50	62.50	12.50	12.50
Shantola	37.50	12.50	12.50	12.50
Kismatpur	37.50	87.50	12.50	12.50
Kutilaokhali	37.50	50.00	25.00	12.50
Pultadanga	10.00	30.00	20.00	10.00
Chaugachi	20.00	10.00	10.00	10.00
Mean (%)	31.67	35.63	19.17	13.13

The present results more or less agreed with the observation of Ahmed (2002). He found that the farmers of both the villages of north Edilpur and south Mohadebpur have reported to be very much concern about the pest attack,

which is also evident from very frequent application of insecticides. The frequency of insecticide application in north Edilpur and south Mohadebpur was 9- 15 days and 6- 12 days during flowering stage to harvest, respectively.

Interval of Insecticide Application

In all locations of study area 10.00 to 50.00 per cent farmers applied different insecticides every day and in some cases even twice in a day on country bean. Application of insecticides at an interval of 3-4 days was mostly common in all locations. At an interval of 1-2 days, 12.50 to 50.00 per cent farmers preferred insecticides application on country bean at twelve different locations (Table 4). In some locations, 12.50 to 25.00 per cent farmers sprayed insecticides at an interval of 5-7 days during the peak season due to their poor economic condition. The interval of insecticide application also depends on the season. The interval of insecticide application in rainy season was the lowest and it was almost every day in all locations. The interval of insecticide application was much higher and ranging from 1-15 days in winter season. Closer spray intervals were also related to the higher market price of the country bean because it was believed that the country bean pods become glossy and attractive after spraying of insecticides.

Harvesting of Country Bean after Insecticide Application

In the all selected locations of Jessore, 10.00 to 20.00 per cent farmers harvested and sold country bean immediately after (0 day interval) insecticide spray. Majority of the interviewed farmers indicated that they did not aware about the residual effects. They sprayed insecticides in the afternoon and pick the country bean pods next day early in the morning for selling in the market. Of the twelve locations, 50.00 per cent farmers of Daulatdihi, Shahbajpur, Shantola and Pultadanga, 37.50 per cent farmers of Abdulpur, Churamonkati, Dakatia and Kutilaokhali, 25.00 per cent farmers of Mominnagar, Bagdanga and Kismatpur and 30.00 per cent farmers of Chaugachi harvested country bean after 3-4 days of insecticides application (Table 5). Among twelve selected locations, 25.00 per cent farmers of Daulatdihi, Abdulpur, Churamonkati, Shahbajpur, Shantola and Kutilaokhali, 50.00 per cent farmers of Mominnagar, Bagdanga, Dakatia and Kismatpur, 30.00 per cent farmers of Pultadanga and 40.00 per cent farmers of Chaugachi sold their harvested country bean after 1-2 days of insecticides application. Only 10.00 to 25.00 per cent farmers sold country bean after 5-7 days of insecticides application, which was also not safe for consumers because of the residue persistency of insecticide in country bean.

Table 4. Interval of insecticide spray on country bean field at twelve different locations in Jessore district during October to December, 2009.

Interval of insecticides spray (days)	Percentage of farmers spraying insecticides											
	Name of the survey locations											
	Daulatdihi	Abdulpur	Mominnagar	Churamonkati	Shahbajpur	Bagdanga	Dakatia	Shantola	Kismatpur	Kutilaokhali	Pultadanga	Chaugachi
0	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	10.00	20.00
1- 2	25.00	25.00	50.00	25.00	25.00	50.00	50.00	25.00	50.00	25.00	30.00	40.00
3- 4	50.00	37.50	25.00	37.50	50.00	25.00	37.50	50.00	25.00	37.50	50.00	30.00
5- 7	12.50	25.00	12.50	25.00	12.50	12.50	12.50	12.50	12.50	25.00	10.00	10.00

Table 5. Harvesting of country bean after insecticide spray from farmers field at twelve different locations of Jessore district during October to December, 2009.

Days after insecticide application	Farmers harvested country bean after spraying insecticides (%)											
	Name of the survey locations											
	Daulatdihi	Abdulpur	Mominnagar	Churamonkati	Shahbajpur	Bagdanga	Dakatia	Shantola	Kismatpur	Kutilaokhali	Pultadanga	Chaugachi
0	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	10.00	20.00
1- 2	25.00	25.00	50.00	25.00	25.00	50.00	50.00	25.00	50.00	25.00	30.00	40.00
3- 4	50.00	37.50	25.00	37.50	50.00	25.00	37.50	50.00	25.00	37.50	50.00	30.00
5- 7	12.50	25.00	12.50	25.00	12.50	12.50	12.50	12.50	12.50	25.00	10.00	10.00

Similar findings were also reported by Ahmed (2002). According to his findings, the farmers were not that much cautious about the waiting period or the Pre Harvest Interval (PHI) of insecticide application. The waiting period before harvesting of pods after insecticide application ranged from only 3- 20 days and 3- 25 days in north Edilpur and south Mohadebpur, respectively irrespective of the insecticides used.

Safety Measures Taken by the Farmers during Spraying Insecticides

On an average, only 7.66 per cent farmers' used mask, 17.34 per cent farmers covered their head and face during insecticides spray, 63.76 per cent farmers washed their hands, faces and body with soap after spray and 11.24 per cent farmers took all these safety measures in twelve selected locations of Jessore district. Only 1.94 per cent farmers used spectacles during spraying insecticides. In those study areas, 10.56 per cent farmers did not take any safety measure during insecticide spraying (Figure 3). Majority of the respondent farmers reported that they felt dizziness and sometimes vomiting, headache, sneezing, nausea, skin and eye irritations, weakness, acidity, stomach pain and chest discomfort after spraying insecticides without having protective measures.

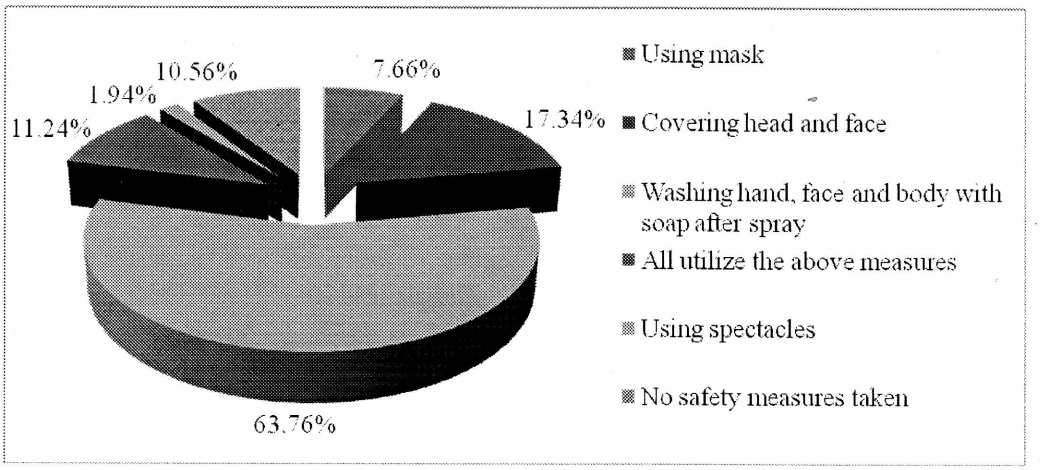

Figure 3. Safety measures taken by the farmers during spraying insecticides in Jessore district during October to December, 2009.

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