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Pesticide using pattern in the adjacent area of wetlands of Dhamrai Upazila of Bangladesh; Farmers' perceptions about the effects on agriculture and aquatic environment

Mohammad Sohidul Islam[*] and Md. Mansurul Haque
Department of Zoology, Jahangirnagar University, Savar, Dhaka, Bangladesh
sohidul_ju@yahoo.com

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Abstract

In this report, farmers of five separate unions in Dhamrai Upazila under Dhaka district, Bangladesh, were questioned about pesticide use patterns. The findings indicate that various pesticides are commonly used in cropland to increase yield. Pesticides were used by farmers to prevent and manage insects, pests and diseases in their field crops. Pesticides used extensively and excessively poisoned the aquatic ecosystem (wetlands) and harmed aquatic species in their health and reproduction. Lack of knowledge about pesticides, their use, and toxicity was recognized to a lack of education and awareness. As a result, farmers' has no a vast knowledge about pesticide using patterns in the adjacent area of wetlands that must be improved. In the above research area, the current study could aid in the development of strategies for preventing pesticide hazards and raising farmer awareness of environmental concerns, including health impacts on aquatic species.

Keywords: Pesticides, wetlands, biosafety, aquatic creatures, perceptions.

Introduction

The present study has conducted in five different unions of Dhamraiupazila (Dhamrai, Suapur, Sutipara, Kalampur and Balia) of Dhaka district to find out different pesticides used in agricultural activities and farmers' perceptions of that's hazardous impact. Water sources of the studied area are at high risk of contamination with pesticides. Organochlorine, Organophosphate (malathion, chloropyrifosdiazinon etc.) and carbamate pesticide (furadan) residues were existence in water of various sources[1,2]. However, some pesticides have the potential to cause serious health and/or environmental degradation. Most of the cases, organophosphates and carbamates residues contaminates and polluted the fresh water ecosystem, as well as having a significant effect on the health of aquatic organisms including fish[3]. Physiological changes in fish health (gills, liver, kidney etc.) have been observed on account of different pesticides as well as environmental pollutants[4]. Pesticides have been documented as environmental contaminants that toxicological concern for fisheries sector as identified by their acute toxicities[5,6].

In Bangladesh, about 40% significant loss of agricultural products can be attributed to attack by pests and insects[7]. At present time, chlorinated hydrocarbons, organophosphates and carbonates are widely used in the country. Among them chlorinated hydrocarbons are known to be highly toxic to aquatic life. Excessively used pesticides in the agricultural crops, which easily entered to the aquatic environment and lead toxic effects on aquatic organisms and alters physiological changes in aquatic organisms[3]. In the agricultural and household activities, organophosphate and carbamate pesticides are roughly used as insecticides and fungicides. In recent years, organophosphate compounds are increasing to use drustically[8,9]. Though the residues of sub-lethal concentrations of any pesticides do not kill the fish but may harm their development and reproduction activity[6]. These toxic chemicals have changed the quality of water that affect the fish and other aquatic organisms[1]. The study revealed that Organochlorine, organophosphate and carbamate pesticide residues were detected in water samples of paddy and vegetable fields of the Savar and Dhamrai area in Bangladesh[10].

Pesticides residues may contaminants to the aquatic environment through surface run off, direct deposition, spray drift, ground water leaching, rain water, flood etc. The contamination of pesticides in aquatic environment from agricultural and indoor activities may create potential toxicological risks to aquatic organisms and their different trophic level of the food chain[11,12]. Malathion and Furadan are the insecticides having a gradual degradation in the aquatic ecosystem[13]. At high level concentration of pesticides reduce defended the development, growth, fitness and reproduction of aquatic organisms including fish[14]. Now a days, in the residential and agricultural applications, Crabofuran, furadan, malathion, diazinon etc. are commonly used in developed and developing countries[15]. The insecticide carbofuran (furadan) extensively used by rice, sugarcane and vegetable for protect from pest and insects. Considering the above facts, the present study was conducted to know about insecticides applied in

agricultural activities in experimental area and perceptions of farmers' about the toxic effect on agriculture and environment.

Materials and methods

Study area: The study was considered with five unions of Dhamrai Upazila (Dhamrai, Suapur, Sutipara, Kalampur and Balia) under Dhaka district where the farmers are widely used different pesticides for crop production in the adjacent area of aquatic environment (wetlands).

Interview and questionnaire: The interview with farmers was done to know about the extent of exposure to different types of pesticides, chemical fertilizers, cultivated crops and perceptions on pesticides usage etc. Questionnaire was prepared to know the details. Also, details were collected on crop wise pattern of cultivation, pesticides availability, types of pesticides used, frequency of pesticide application and pesticide practices adopted in the study area etc. The storage pattern of pesticides followed by the farmers were also investigated. The details collected were as self-reported by the farmers and all the information elicited only from such farmers who are actively involved in the cultivation profession. The collected data were entered in the MS-Excel worksheet, classified and used in for further analysis. The analyzed data were used to prepare result graphs and tables.

Results and discussion

In this study randomly selected farmers from five unions of Dhamraiupazila voluntarily participated. All the farmers reported that the growth of different types of crops each year (Table -1).

Questionnaire survey: Farmers and land workers are questioned individually. A set of preliminary questionnaire based on the objectives of the study was prepared. By the questionnaire drew the name of pesticides used, name of fertilizer used, purpose of using, application procedure, cultivated crops, effects on environment etc. Random sampling methods were followed during the farmers' interview. The total respondents was 25 farmers: 05 farmers were randomly selected from each of the adjacent area of beel/lakes of above stated five union of Dhamraiupazilla, Dhaka district of Bangladesh. Data was collected through face to face interviews. The interview with farmers was done to know about cultivated crops, pesticides/ insecticides, fertilizers used and application to their land as well as their views about the effects on agriculture and environment.

The details information collected from such farmers who are actively involved in the cultivation profession. The collected data were entered in the MS-Excel worksheet, classified and used in for further analysis. The final data were used to prepare results, graphs and tables.

Present status of cultivated crops, vegetables and use of fertilizer: In this study all the farmers gave the details information of cultivated crops and vegetables in the adjacent area of aquatic environment (wetlands) of the studied area in each year (Table-1). All of the respondents informed that paddy is their main crops other than jute, maize, sugarcane, wheat, potato, pulse, chilli, groundnut and vegetables were also cultivated in the selected area. For their cultivation and more production, they frequently used various organic and inorganic fertilizers in their land (Table-2).

Table-1: Types of crops grown in the adjacent area of beels/ lakes of the study area.

Dhamrai,	Suapur	Sutipara	Kalampur	Balia
Paddy (Buru)	Paddy (Buru)	Paddy (Buru)	Paddy (Buru)	Paddy (Buru)
Paddy (IRRI)	Paddy (IRRI)	Paddy (IRRI)	Paddy (IRRI)	Paddy (IRRI)
Maize	Maize	Maize	Maize	Maize
Jute	Jute	Jute	Jute	Jute
Potato	Sugarcane	Potato	Wheat	Groundnut
Pulses	Pulses	Pulses	Pulses	Pulses
Chilli	--	Chilli	--	Chilli
Vegetables	Vegetables	Vegetables	Vegetables	Vegetables

Table-2: Used fertilizers in the chosen experimental area.

Dhamrai	Suapur	Sutipara	Kalampur	Balia
Urea	Urea	Urea	Urea	Urea
TSP	TSP	TSP	TSP	TSP
Potasium per menganite	Potasium per menganite	Potasium per menganite	Potasium per menganite	Potasium per menganite
Cowdung	Cowdung	--	--	Cowdung
Compost	Compost	Compost	Compost	Compost
--	Sobuj Sar*	--	Sobuj Sar	--
Khoil*	Khoil	Khoil	Khoil	Khoil

* Sobuj Sar- Leguminous plants e.g. Dhoincha, Soya, Orhor etc. leveled by leveler in early stage of the plants. * Khoil- Oil cake, Bran of mastered, Soya, Orhor, Til etc.

Pesticide application and practices: All the farmers reported the use of sprayers for pesticide application. Most of the formers indicated preventive spraying of pesticides once or twice per season. Few farmers reported spraying of pesticides depending on pest manifestation. With regard to time between spraying of pesticides, some farmers sprayed once or twice per month, few farmers from experimental area followed instructions in the labels on pesticide containers, and others followed the instructions/directions from the agrochemical shops where they purchased pesticides. Thus the spraying was not uniform. Most of the farmers used personal protection while spraying pesticides. They covered mouth and nose and wore hand gloves. None of the farmers completely protected their body as per the requirements of personal protection. This was because of lack of awareness about pesticides, its usage and hazards. Majority of the farmers in these study areas informed that they are using different types of pesticide formulations (Table-3) as crop protection from various pests and insects. Most of the formulations were used at various stages of crop production were recognized by their trade names and were not aware about the chemical name and their mode of action. As per the GoB and MoEF, Among 141 active ingredients 48 are recorded as public health pesticides with 122 trade names and 93 chemical compounds that are registered as agricultural pesticides with 303 trade names[16]. About 80 different types of pesticides are used in the rice field to protect from harmful pest and insects[17]. In Bangladesh, pesticide consumption upturned from 11610.66 to 40882.94 metric tons (MT) between the year of 1998 and 2012 that was insecticides, herbicides, fungicides, rodenticides and public hygiene[18]. Like other parts of the country, Dhamraiupazilla has got a huge amount and types of pesticides that legally and/or illegally applied by the farmer and land owners that easily contaminate water and can quickly pollute water supplies[12]. Farmers reported that most of the pesticides were obtained from more than one sources and those were readily available for purchase by the farmers. The primary source of pesticides for purchase by farmers in the study area was the Agro-chemical shops (authorized dealer) in the local markets.

During survey with the individual farmers it was found that most of them frequently used different types of pesticides in their land for more yielding variety of crops though they knew there are harmful effects of the pesticides on environment. Among 25 informants stated that different pesticides Organophosphetes (Malathion, Hilthion, Diazinon) and Carbamates (Furadan) are mostly used in the adjacent area of aquatic environment (wetlands) of the studied area (Figure-1). Histological changes in vital organs such as rupture of blood vessels with hemorrhagic locations, vacuolar deterioration were recorded in the liver with exposure to 50% EC of malathion in *Clarias batrachus*[19].

Farmers' perceptions about the effects on agriculture and aquatic environment: The farmers who are actively involved in the pesticide usage in adjacent area of water body were asked whether they experience any incidence about aquatic organisms including fish regarding pesticides usage, adverse effects of pesticides on health (skin diseases, low production, death etc.) of fishes including other aquatic organisms. This survey points the need for a comprehensive intervention and awareness amongst farmers on environmental issues including health impacts on fishes due to usage of pesticides in above study areas. Farmers thinks all time to increase the production in their lands, consequently they pour fertilizers, chemicals, pesticides etc. continuously. As a result, they forget such activities create a negative impact on aquatic environment and decline aquatic fauna including fishes. Application of different pesticides is quite common in the experimental area which pronounced impact on crop production, water pollution, soil fertility, pest control and other environmental elements (Figure-2). Pesticides impact to degradation of the environment through hydrolysis,

solubility, oxidation-reduction and microbial activities[20]. These pesticides may easily contaminates with rivers, ponds and lakes from the fields, due to runoff, household activities and solubility in water and high mobility in soil[21-23]. High mobility in soil of pesticides, existence of half-life (50 days) and potential to contaminate the adjacent water bodies due to rain and flood events[24]. It has been reported that these pesticide residues remain a long time in the plant, soil and water[25].

The aim of the study is to gauge the lack of farmers' knowledge on the safe use of pesticides and bio-safety to keep enthusiastic of the environment and human health. Excessive and inappropriate application of insecticides create negative effects on aquatic creatures including fishes[2]. Awareness build-up on pesticides application is needed to avoid the harmful effects on aquatic environment.

Table-3: List of pesticides used in the study area based on interview with farmers.

Active ingredient name (Trade names)	Commercial name	Application
Carbofuran	Furadan 3GR Furacarb 3G Biesterin 5G Sunfuran 5G	Stem borer Leaf hopper Stem borer Grass hooper
Diazinon	Diazinon 60EC Diazon 60EC	Hopper, Rice hispa Green-leafhopper, stem borer
Fenitrothion	Sumithion 98 Sumithion 50EC	Leaf roller, Rice hispa
Chloropyrifos	Dursban 20EC Classic 20 EC	Rice-bug, Hispa, Mosquitoes
Carbaryl	Sevin 85SP Vitabryl 85 WP	Leaf-roller, Caseworm Thrips, Hispa, Rice-bug, Hairy-caterpillar
Malathion	Hilthion 57EC Razthion 57EC Semtox 57 EC Hithion 50 EC	Leaf-roller, Caseworm, GLH Thrips, Hispa, Rice-bug, Aphids

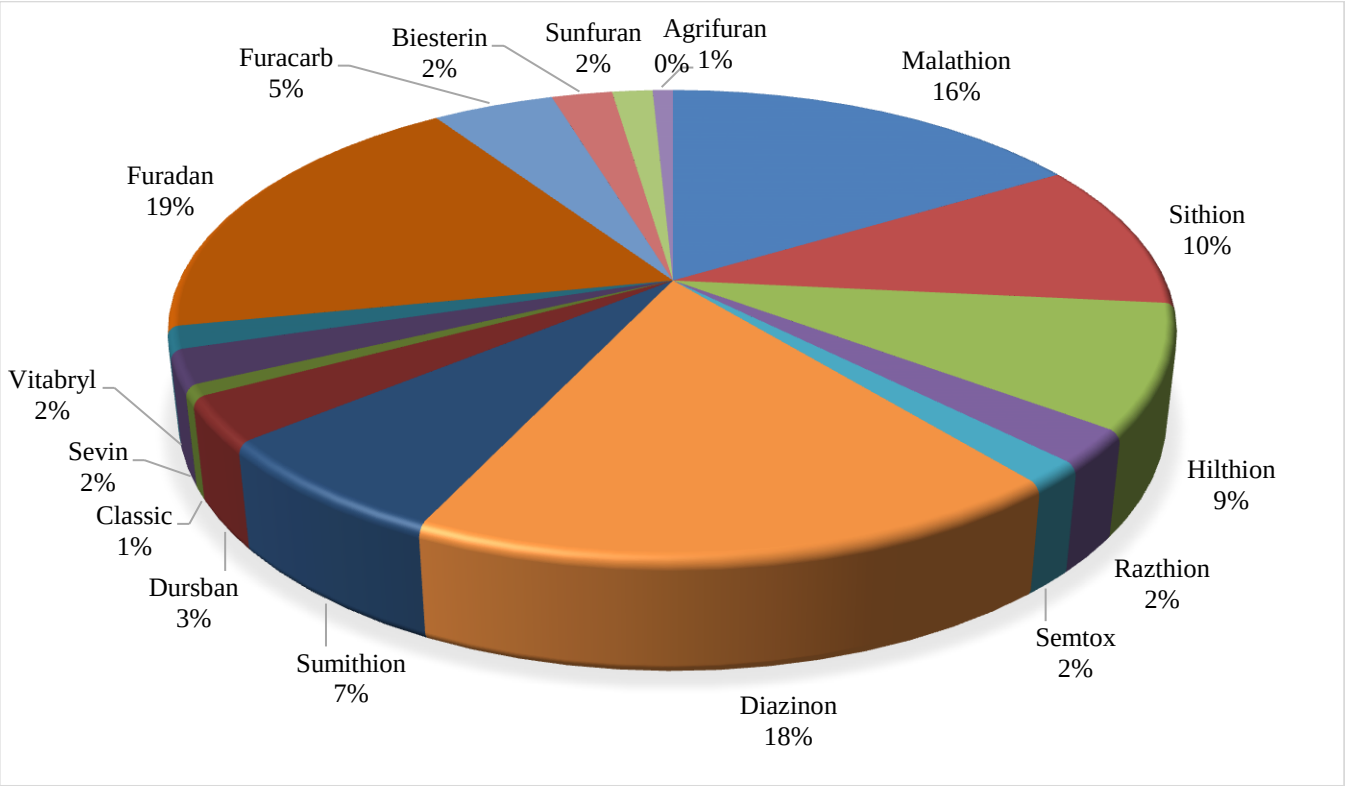

Figure-1: Percentage of using pesticides in the experimental area.

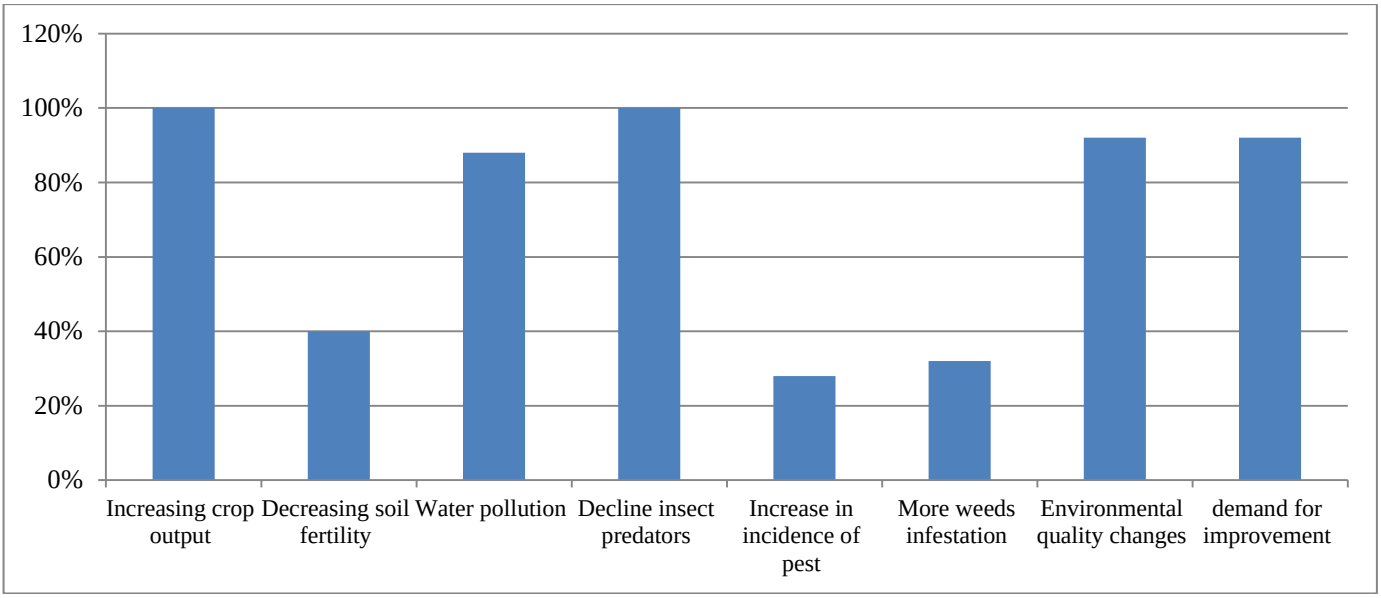

Figure-2: Perceptions of farmers' about the effect of pesticides on agricultural lands and environment.

Conclusion

The farmers who are actively involved in the pesticide usage in adjacent area of water body were asked whether they experience any incidence about fish regarding pesticides usage, adverse effects of pesticides on health (skin diseases, low production, death etc.) of fishes including other aquatic organisms. This research highlights a need for a holistic action and greater awareness amongst farmers on climate impacts, including the health effects of fertilizer use on aquatic ecosystems in the study areas. This study indicates that the farmers do not heed the agricultural extension department's guideline or the directions written on pesticides packet/ bottles/ containers. Based on the findings of the study, it is suggested that to assist farmers to improving their awareness on toxicological effects of pesticides and skills development on application and encouraging them to preserve aquatic creatures.

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