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Research Article

Exploitation of agro-chemicals and its effect on health of farmers and environment on south-eastern coast of Bangladesh

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The study attempts to investigate the abuse of pesticides and its impacts on health of farmers and environment on South-Eastern Coast of Bangladesh. Quantitative and some of qualitative techniques were used for data compilation and data collection methods were primary and secondary. Primary data were collected through questionnaire survey and participatory observation method. In 150 samples and simple random techniques were administrated. Necessary data were analyzed in a sequential manner; coding, editing, tabulation and data processing have been done by manual and digital ways. Current study reveals that, farmers were used both types of fertilizers; organic and inorganic and simultaneously they were used different types of pesticides especially insecticides, herbicides and fungicides. Farmers unconsciously and unmeasured used of fertilizers and pesticides without used any safety measures. Consequently, they were affected different health problems such as skin disease, gastrointestinal tract, dental, borne, respiratory and methemoglobinemia problems. As well as degraded environmental quality particularly soil, water and soil microorganisms and destroyed environment friendly pest, insects and earthworms in cultivated areas. In order to, cultivate native high yielding variety, provide good seeds from Upazila agricultural office, used organic fertilizer, applied Integrated Pest Management (IPM), use suitable preventive measures during apply pesticides and applied top-bottom approach for sustainable pest management and increase production in the study area.

Key words: Pesticides, organic fertilizer, integrated pest management

INTRODUCTION

Bangladesh is agriculture based country and economy of Bangladesh is relying on agriculture production and sustainable value chain in the market. Agriculture plays a key role in the overall economic performance of the country, not only in terms of its contribution to GDP (20.16%), but also as a major source of foreign exchange earnings, and in providing employment (48.4%) to a large segment of the population, particularly the poor (Barua et al. 2021). Agricultural sector is one of the most impacted by climate factors in Bangladesh and rural margnizalied people livelihoods are mainly based on natural resource-based activities.

In Bangladesh, 54500 metric ton pesticides consumed in 2020 led to high production cost as well as increased consumption cost (BBS, 2021). It's not only hike the prices of vegetables but also has degraded the physical environment and human health. Pesticide exposure can cause a variety of human health problems, both chronic and acute. Chronic effects are typically the result of low levels of exposure over a long period of time. These can occur even if there are no acute or immediate effects. Major health impacts from chronic exposure include cancers, reproductive and endocrine disruption, neurological damage, and immune system dysfunction (Sanborn et al. 2004; Moses 1999). The World Health Organization (WHO) estimates that nearly 4.0 million people suffer from acute pesticide poisoning and at least 20,000 die in each year in the world (Sarker et al. 2002).

In this viewpoint, pesticides were introduced in Bangladesh as early as in 1965 and were distributed to the farmers free of cost up to 1972 (Karim, 1994). In Bangladesh, 25466.43 metric ton pesticides consumed in 2005 led to high production cost as well as increased consumption cost (BBS, 2009). Farmers were affected different types of health impacts from chronic exposure include cancers, reproductive and endocrine disruption, neurological damage, and immune system dysfunction (Sanborn

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et al. 2004; Moses 1999). The World Health Organization (WHO) estimates that nearly 4.0 million people suffer from acute pesticide poisoning and at least 20,000 die in each year. Pesticides have contaminated almost every part of environment. Pesticide residues are found in soil and air and in surface and ground water across the nation. Pesticide contamination poses significant risks to the environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds (Silver and Riley, 2001). So, it is essential to assess the abuse of agro-chemicals and its impact on heath of farmers and environment. Study area were selected on after consideration such as maximum people were farmers, they were intensively used agro-chemicals on paddy land, coastal cultivated land in Cox's bazar. The results of the study may be helpful to the policy makers and planners in formulating plan for safe use of pesticides on the respect of environmental components and human health.

MATERIALS AND METHODS

Selection of the study area

Chittagong is a coastal district and Banskhali sub-district is one of the commercial and agriculture depended upazilas of the district which has 14 Unions, 120 villages and 50 Mahallas, Khankhanabad union is one of them (District Statistics, 2011 and BBS, 2013). The study area lies between 21º28' and 21º30' N latitudes and between 91º58' and 92º02' E longitudes (Figure 1). They are cultivate paddy, potato, pulse, onion, garlic, ginger, betel leaf, betel nut, wheat, sugarcane, ground nut, tobacco, rubber and vegetables, (Municipal Manuel, 2013 and BBS, 2001).

Basically, current study were done by primary data based and as well as few secondary data were used for depicted the past scenarios of a particular problems. Primary data were collected through questionnaire survey and participatory observation method. Questionnaire was constructed both type of open and closed questions along with pre-coded and coded manner. In all 150 sample framers were randomly selected and questionnaire survey were operated on farmer household's level. Participatory observation were used for directly knowing their daily life style, agricultural practices, uses of chemical fertilizers and pesticides on the their cultivated land and perceived health and environmental conditions. Secondary data were gathered from Upazila Agricultural Adidoptor (UAA), local representative (delar) of chemical fertilizers and pesticides, review papers, journals, articles, books, magazines, newspaper, and other recent publications. Required data were analyzed by manual and digital ways and data were presented by the help of statistical tools like, diagrams, tables and charts and study area map were prepared by Are GIS-9.1 software.

Characteristics of the respondents

Respondents characteristics is the precondition of any perception based research because a researcher get decision on the respects on respondent opinions. For present study researchers were selected respondents on the basis of especial criteria such as, those people were 34 up age limit, male farmers and few women respondents considered absence of male households during survey, two occupational particularly those who are farmers and involved at agro-chemical business and those people were settling at list twenty years (Table 1).

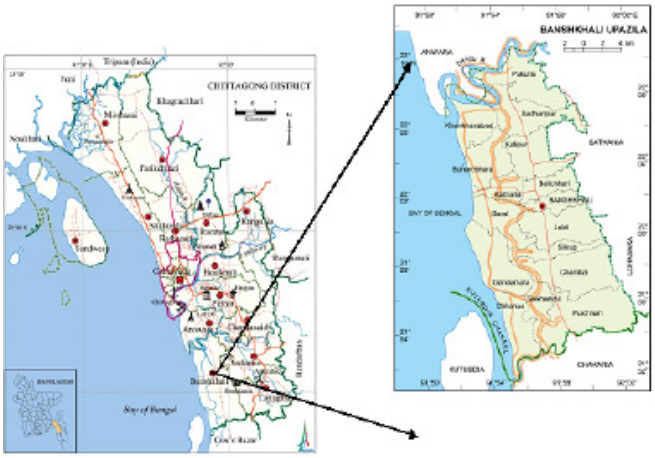

Figure 1. Geographical location of the study area.

Table 1. Characteristics of the respondents.

X		Gender		Types of occupation		Duration of living	
Age	**%**	**Sex**	**%**	**Occupation**	**%**	**Years**	**%**
>34	14	Male	96.67	Business (Pesticides and fertilizers delar)	35.33	>20	10.67
35-44	22	Female	3.33	Farmers Labor	64.67	20-25	54
45-54	46.66					>25	35.33
55-64	6.66						
65-74	9						
<75	1.6						
Total	**100.0**		**100.0**		**100.0**		**100.0**

RESULTS AND DISCUSSION

Farmers of the coastal area of Bangladesh now familiar with using some mechanical vehicles and instrument like tractor, power tiller, pleader and plough techniques for agriculture field to produce the crops in the field and easy crop harvesting from the field. In the study, most of the farmers utilized mechanical support (85.00%) at the moment of crop cultivation and they were applied various equipment's like tractor, power tiller, plough process and use of pleader. This was noteworthy that, 15% farmers not utilized any types of mechanical assistance during the time of the production period.

There are two categories of water sources utilized for agricultural activities which are natural or man-made sources. Generally, rain water, canals, rivers, lake, pond are natural sources and irrigation process are artificial sources. Besides, Irrigated water are utilized as two categories which are water irrigated from the inland fresh water bodies and ground water sources which utilized through the submerged tube well, power engine and digging.

According to BBS (2021), total application of the different pesticide in Bangladesh was 54500 metric ton in 2020 of which 20895.6 metric ton was insecticide in the form of granules, liquid and powder. In the study area, the authors found 3 categories of pesticides in agricultural fields used by the farmers which are insecticides (60%), fungicides (9%) and herbicides (31%) (Table 2).

Using level of pesticides is represented the violence of pest and their intensity in an area. Using level of pesticides in agricultural field were classified into five categories respect on farmers opinion such as very low, low, medium, high and very high (Figure 2). About 58.82% farmers were said using level of pesticides is medium, 29.41% said that high, 5.88% said that very high and small portions said that very low and low in the study area. Level of using pesticides was significant here because maximum portion of the farmers were opined that medium and high.

There are 2 types of fertilizers are used by the farmers of Bangladesh which are organic fertilizers and inorganic in the study area, agriculture farmers were familiar for utilized used inorganic fertilizers in their agricultural fields (Table 3).

In the study, the authors found that maximum farmers (58%) utilized organic manure such as ash, cow dung and leaves wastage. This is also mentionable that 42% farmers not utilized organic fertilizers in their agricultural fields.

Pesticides can enter the body through inhalation of aerosols, dust and vapor that contain pesticides; through oral exposure by consuming food/water; and through skin exposure by direct contact (CDPR, 2008). The farmers (49%) of Bangladesh has suffered frequent health symptoms commonly associated with acute pesticide poisoning such as eye irritation, headaches, dizziness, vomiting and skin effects (Dasgupta et al. 2005). Impact of pesticides on applicators health such as poor vision of eye (35.5%), respiratory tract problem (35.2%) and skin problem (63.2%) were to be found in agricultural region of Bangladesh (Muhibbullah et al. 2005). Following Figure 2 reveals that current scenario of the uses of pesticides and health impacts of farmers in Jhilwanja union.

Farmers were affected different types of health problems especially skin disease, eye, respiratory, gastrointestinal tract, dental, bones and methemoglobinemia problems due to unsafe use of pesticides in the cultivated fields (Figure 3). Usually farmers were affected skin disease (28.26%), gastrointestinal tract (20.0%) and dental problems (17.39%). Somewhat were affected eye and bones problems and little portion were affected on respiratory and methemoglobinemia problems. Although, percentage level were different but affecting farmers affected for longtime and day by day they were permanent disease victors in the study area.

Table 2. Categories of pesticides use in agricultural land in the study area.

Using pesticides	Categories of pesticides	% of pesticides	Chemical group	% of users
Thiodin	Insecticides	60	Endosulfan	4
Furadin	Insecticides		Chlorinated Hydrocarbons/ Organochlorine	5
Aldrin	Insecticides		Chlorinated Hydrocarbons/ Organochlorine	3
chlordane	Insecticides		Chlordance	15
Ripkord	Insecticides		Cypermelhrin	1
Basodin	Insecticides		Organophosphates	13
Endrin	Insecticides		Chlorinated Hydrocarbons/ Organochlorine	13
Diuron	Herbicides	31	Phenylureas	6
Sobicron	Herbicides			26
Diafrom	Herbicides		Chlorotrizine	5
Copper sulphate	Fungicides	9	Others	9
Total				**100.00**

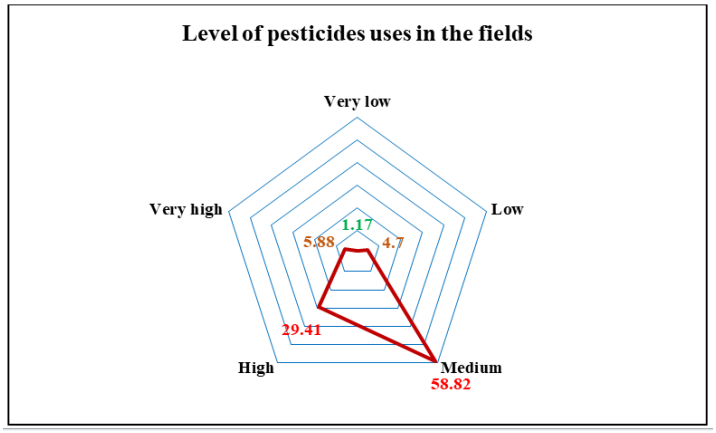

Figure 2. Level of pesticides uses in the fields.

Table 3. Major chemical fertilizers used in paddy land with their chemical bond, nutrients status, % of nutrients, physical structure and impurities.

Name of Chemical Fertilizers	Chemical Bond	Nutrients for crops	% of Nutrients	Physical structure	% of Field users	Impurities
Urea	$CO(NH_2)_2$	Nitrogen	N-46	Granular	27.17	----------
Single Super Phosphate (SSP)	$Ca(H_2PO_4)_2$ + $CaSO_4.2H_2O$	Phosphorus Sulphur	P-8 S-12 Ca-20	Granular	6.74	Fungicides
Triple Super Phosphate (TSP)	$Ca(H_2PO_4)_2$	Phosphorus	S-1.3	Granular	23.54	Cadmium, fluoride compounds and other heavy metals (Chromium, manganese, nickel and zine)
Hyper Phosphate (HP)	----------	Phosphorus	----------	----------	7.70	
Murate of Potash (MP)	KCl	Potassium	K-50	Granular and Powder	20.42	
Zinc Sulphate	$ZnSO_4.H_2O$	Zinc	Zn-36 S-18	Granular and Powder	7.93	Chromium lead and arsenic
Gypsum	$CaSO_4.H_2O$	Sulphur	S-18 Ca-18	Powder	Powder	
Total					100	Cadmium

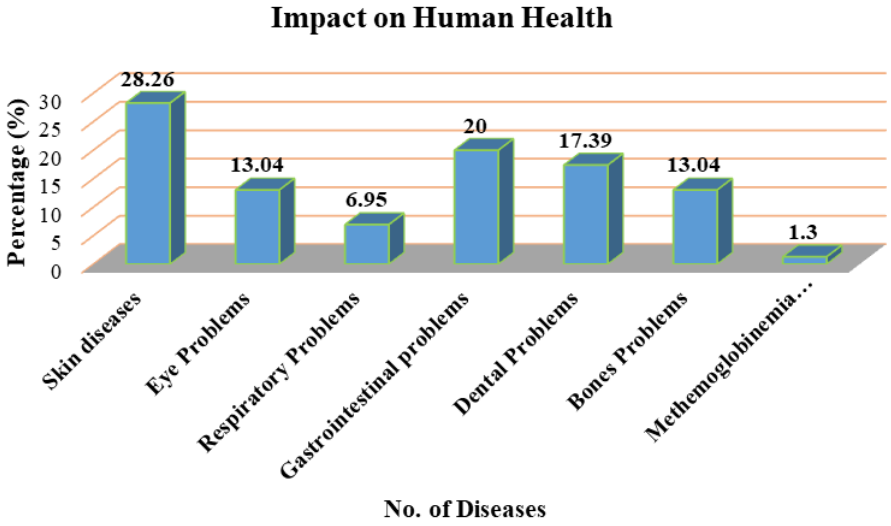

Figure 3. Impact on human health's due to unsafe used of pesticides.

The eye is main and major sensor in the human body. These sensors are directly affected when liquid pesticides are spry in agricultural field by pump machine. That time farmers are feels eye irritation, eye burn, pterygium, encroached membrane of pupil, poor vision and others problems. In present study farmers were affected three types of problems such as pterygium, poor vision and eye irritation and most of them were affected poor vision and eye irritation. It was noticeable that, 41-50 and 51-60 age structures farmers were severely affected than 31-40 and over 60 age structure.

Respiratory system is the main sucking body organ in human body. These are easily affected when liquid pesticides are spry in agricultural field by pump machine. Farmers were affected four types of respiratory problems such as cold, cough, bronchial asthma and others types of diseases. Bronchial asthma is the main problem than other respiratory problems of farmers. 41-50, 51-60 and 21-30 age farmers were highly affected due to use of pesticides and fertilizers.

About 20.0 % of total respondent suffered from gastrointestinal diseases (Figure 2). Gastrointestinal diseases were classified into gastritis, diarrhoea, chronic dysentery and others types of problem. In the study area, farmers were affected different types of gastrointestinal problems such as gastritis, diarrhoea, chronic dysentery and others. Maximum farmers were affected at gastritis problems (78.26%), diarrhoea (18.84%) and chronic dysentery (2.90%) in the study area. 41-50, 31-40 and over 60 age structured farmers were badly affected gastrointestinal problems due to unsafe and unmeasured used of pesticides and chemical fertilizers in the study area.

Farmers were affected by different types of bones problems such as brittle of bones, stiff joint, loss of weight and weakness. About 13.04 % of the total farmers were affected borne problems (Figure 2). These problems were categories on the respect on farmer's opinion such as 50.00% farmers were affected at brittle of bones, 33.33% were affected weakness and 17.67% were affected stiff joint problems respectively. It was remarkable that, every age structure were equally affected at these diseases and while maximum respondents were male and those who were engaged in farming activities in the study area. Almost 1.30% farmers were affected at methemoglobinemia problem in Jhilwanja union (Figure 2). Methemoglobinemia problem created different types of symptoms on human health such as headache, weakness, blue sports and breathlessness. Farmers were affected blue sport, breathlessness and others types of problems respectively.

Pesticides have their impact on all three components of the earth, i.e. lithosphere, hydrosphere and atmosphere. Continuous use of pesticides has many negative effects on the environment such as-killing non-targeted organisms, accumulation in the food chain, building of immunities by the targeted pests, lower reproductive potential, synergetic effects, toxic effects on water, pesticide residue in food and tissues, effects on vegetation and milk and direct pesticide poisoning (Saxena, 1999). The persistence of pesticides in soils is a summation of all the reactions, movements and degradations affecting these chemicals (Khan, 1980). Chemically-polluted runoff from fields has contaminated surface and ground waters, damaged fisheries, destroyed freshwater ecosystems and created growing "dead zones" in ocean areas proximate to the mouths of rivers that drain agricultural regions (Pimental and Lehman, 1993; Tardiff, 1992). In the study area, Farmers were argued that (56.0%) abused or unmeasured of pesticides and chemical fertilizers had been changed the environmental conditions on the other hand significant portion (44.0%) of the farmers were opined that used of pesticides and chemical fertilizers on agricultural field did not changes environmental conditions (Figure 4).

Farmers opined that, soil fertility was decreased due to use of pesticides and chemical fertilizers on paddy land (Table 4). Significant portions of the farmers said that, increase soil fertility due to use of pesticides and chemical fertilizers and little portion understood that unchanged condition of fertility status of soil due to use of pesticides and chemical fertilizers on paddy land. Simultaneously they were assumed that, use of pesticides and chemical fertilizers on paddy land were the reasons of soil pollution and its substantial level were medium and low. Although, only 10.20% farmers pronounced that, use of pesticides and chemical fertilizers on paddy land were the highly reasons of soil pollution. Those farmers were opined that increase soil fertility due to use of pesticides and chemical fertilizers they also believed that amount of pesticides and chemical fertilizers using the land this proportion gradually increases in year to year. If reduces the proposition than pesticides and chemical fertilizers did not controlled of pest and change of fertility status here. This scenario was big concern for future generation and farmers permanently depend on the use of pesticides and chemical fertilizers on paddy land.

Water is the most important element in the biosphere because on one hand it is vital for the maintenance of all forms of life and on the other hand it helps in the movement, circulation and cycling of nutrients in the biosphere. However, farmers often use chemicals to hinder bug infestations or other diseases from damaging or ruining their crops. Agricultural pollution is the non-point pollution. It degraded the whole environment by surface runoff from sheet wash to rill, gully and stream to river. Present study illustrate that, decrease of water quality due to use of pesticides and level of pollution is medium (46.24%) and low (37.63%) However, 11.83% farmers argued that the pollution level were high, although this proposition is low but its severity were too much sever for whole environment. Downward moment is the general criteria of water for this reason this polluting water spread of whole environment by the general criteria of water.

Microorganisms play a key role in helping plants utilize soil nutrients needed to grow and thrive. Microorganisms also help soil store water and nutrients, regulate water flow, and filter pollutants (Marx et al. 1999). In the study area, farmers were assessed that, continuous use of chemical was the significant negative impacts on soil microorganisms (Figures 5 and 6). They were noticed that agricultural or environment friendly pest, insects and earthworms were died due to use of highly toxic and long persistence substances on cultivated fields and instantaneously produced or increased the violence of different unwanted type of pests, insects and earthworms adjoining areas of cultivated fields.

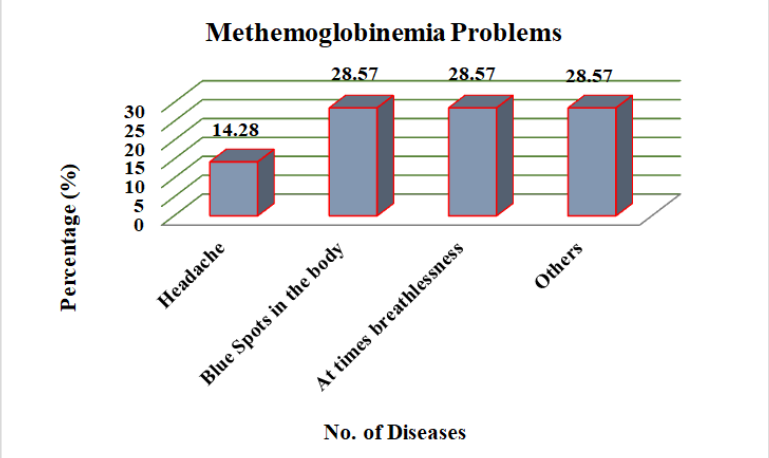

Figure 4. Methemoglobinemia problems.

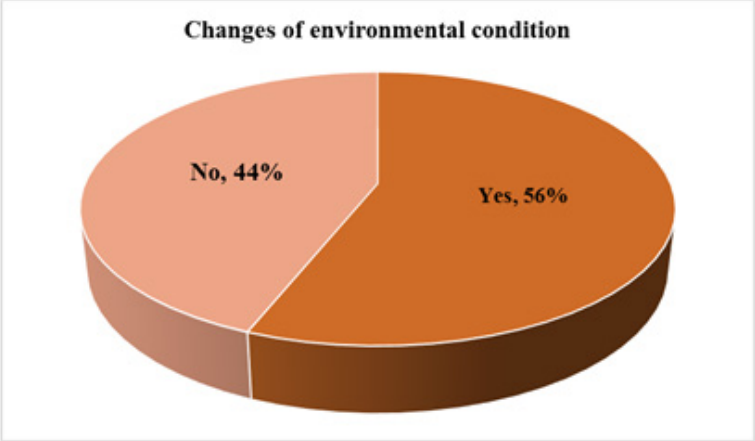

Figure 5. Changes of environmental condition.

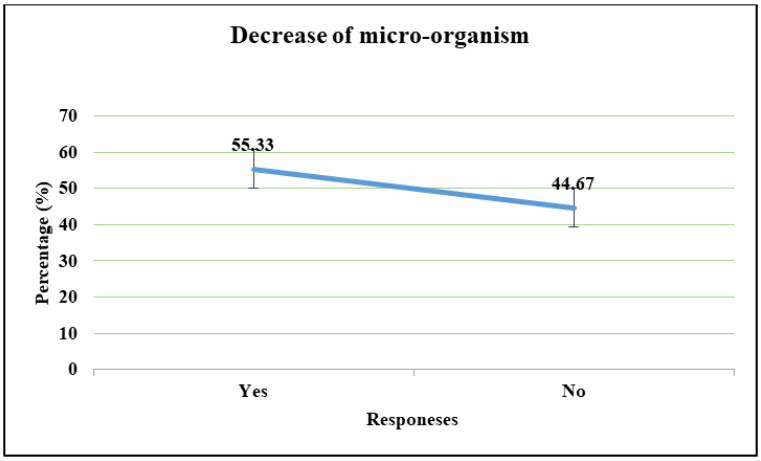

Figure 6. Decrease of micro-organism.

Table 4. Impacts of soil quality.

Types	**%**	**Impact on agriculture field**	**%**	**Level of soil pollution**	**%**
Yes	78.6	Decreased soil fertility	57.01	Very low	8.16
		Increased soil fertility	37.71	Low	37.76
		Unchanged	5.26	Medium	43.88
				High	10.20
No	21.33				
Total	**100**		**100.00**		**100.00**

The effect of chemical substances use in the control measures of pest and increase agricultural production involves with soil, water, biodiversity, public health and the economy of farmer. For proper management of chemical substances and seed, authors strongly suggested top-bottom managemental approach. This approach operate on the Ministry of agriculture to district and Upazila Krishi Odidoptor (UKO), UKO properly operated on union and village level. Ministerial body is the prime unit and village is the last unit of this approach. Top-bottom approach follows six-step processes in two sides. First side is sustainable agro-chemical management and second side is seed management.

First side including following steps:

• Government should be ban highly toxic and long persistence pesticides and innovate alternate pesticides those are low toxic and persistence in environment,

• UKO should arrange monthly tanning programme about, How to use pesticides?, When used pesticides? How much use of pesticides per acor/hector/decimal? What types of pesticides use for what type of pest? How to safe agro-environment friendly pest, insects and earthworms? and carefully concern about the instruction given in the pesticide safety manual,

• Thana Krishi officer should going to field and directly conversation with farmers and concern about Integrated Pest Management systems,

• Thana Krishi officer should introduce of farmers about 3rd and 4th generation pesticides, biological control and use bio-pesticides on paddy lands,

• Thana Krishi officer should awareness of farmers and encouraging of farmers for using organic fertilizer such as-cow dung, manure, ash, composed and green manures, and

• Marginal dealers should help to selection of pesticide, dosage and mode of application based on guidelines available in the respective sector.

Second side comprises following steps:

• Government should involvedness of the representativeness of farmers for every agricultural related planning processes,

• Government should provide good seeds and High Yielding Varieties (HYV),

• Upazila Odidoptor should collected good seed from local varieties,

• Agricultural research organizations should innovate rain fed, salt tolerate and pest resist seed,

• Farmers should crop diversification and rotation it may discourage the production of unwanted pests, insects and earthworms, and

• Thana Krishi officer should awareness of farmers about 'Bio-pesticides' and 'Feromen Trap' this used instead of chemical pesticides to protect crops and useful insects.

Actually this approach refer to the link-up relationship between central agricultural authorities to marginal farmers about every planning process, training programme, seed distribution campaign, agricultural awareness or encouraging programme and providing dealership at marginal level.

CONCLUSION AND RECOMMENDATIONS

The use of pesticides is essential for protecting agricultural products from pest damages; however their adverse effects are inevitable almost on all habitats. Environmentally, intensive agricultural practices appear to pose much less of a threat than is sometimes feared with the important exception of pesticide use on agriculture. In today's world with high population growth the use of chemical fertilizers and pesticides in an attempt of growing high amount of crops is very logical. The current study reflects this attitude of farmers of Jhilwanja Union. The farmers here use high amounts of pesticides and chemical fertilizers and low amount of organic fertilizers in agricultural fields. This is creating different health impacts on people, especially the applicator farmers. The environment is also affected, especially the soil. It is having deficiency of two major micro-nutrients, nitrogen and potassium. If the present chemical fertilizer and pesticide using patterns exist the study area may experience some serious hazards in the long run. The most pressing need for action is in agriculture, where numerous factors indicate a high risk of damage to the health of farmers and consumers and to the environment more generally. Creating a register of common pesticides in each region for rapid identification of nature of the pesticide is recommended.

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