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## **Pesticides use in crop production and rules and regulations for agrochemical business in Bangladesh**

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### **Abstract**

*This is an explanatory type of research work focus on pesticides use status in crop production and rules and regulations for pesticides business in Bangladesh. Pesticides have been a major contributor to the growth of crop productivity and food supply. Crops yields strongly depend on crop protection measures. The main purpose of pesticide use is to increase food security, with a secondary goal being increased standard of living. More than 90% farmers of Bangladesh use pesticide unnecessarily, indiscriminately and excessively due to their ignorance and unconsciousness about the use. As a result, cost of production increase, crop yields decrease, farmers' face different types of physical problems and ultimately farmers become physically and financially looser. The use of toxic pesticides by Bangladeshi farmers increased by 328 percent during the past 10 years, posing a serious hazards on human health due to its long-term residual effect. Pesticides business in Bangladesh is controlled by the Pesticides Ordinance, 1971 (II of 1971), Government of The People's Republic of Bangladesh, Ministry of Agriculture and it is called the Pesticide Rules, 1985. For better health and environment, and best utilization of resources for sustainable crop production there is no alternative of safe and judicious use of pesticides.*

**Keywords:** *Pesticides, Crop Yield, Rules and Regulations, Business, Safe and Judicious Use.*

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**Introduction:** In Bangladesh, as in most developing countries, agriculture plays a key role in the overall economic performance of the country contributing 15.1% GDP (Global Finance, June 10, 2016). Owing to its rapid population growth and food security needs, land scarcity and agricultural intensification are quickly becoming issues of pressing importance. As a direct consequence of these difficult conditions, agriculture has been highly susceptible to crop pest attacks and diseases. To overcome these conditions and increase the productivity, farmers have begun to use more toxic chemicals for pest control. Bangladesh started agrochemical use mainly in 1960s as food security for a vast number of populations. At that time the use of those chemical inputs was in normal stage— farmers used to follow

the global guidelines in application process. Productivity was increased along with maintaining and preserving the land soil and adjacent water. Pesticides have been a major contributor to the growth of crop productivity and food supply. Crops yields strongly depend on crop protection measures. The main purpose of pesticide use is to increase food security, with a secondary goal being increased standard of living (Delcour *et al.*, 2015). In vegetable value chain, farmers use pesticides in different stages for different purposes like seed treatment to prevent seed borne disease dispersal, soil treatment to control soil borne pest and diseases and foliar application in crop field to control different types of pests and disease. In the process of checking and killing pests over the years, pesticide application in Bangladesh has increased manifold from 758 metric tons in 1960 and 3028 metric tons in 1980 to over 19000 metric tons in 2000 (Kabir *et al.*, 2008) and in 2008, the amount of pesticide applied in fields across the country rose to 48690 metric tons (BBS 2009). In Bangladesh, pesticides business is controlled under the rules and regulations of Plant Protection Wing, Department of Agricultural Extension (DAE) under Ministry of Agriculture. Plant Protection Wing provides registration certificate and licenses for different types of agricultural pesticide (AP) and public health products (PHP) as well as its production and marketing. They are also ensuring quality production and distribution of pesticides for judicial use of pesticide in farmer's level. Besides, Bangladesh Crop Protection Association (BCPA) plays an important role in creating favorable environment for business enterprises who are involved in import/formulation /marketing of plant protection chemicals.

**Objectives of the Study:** General objective of the study is to explain the effect of pesticides in crop production and related rules and regulations for operating pesticides business. Besides, there are some specific objectives and these are:

- a) To describe the status of pesticides use for crop production in Bangladesh.
- b) To present government rules and regulations for pesticides business in Bangladesh.
- c) To explain the role of association in pesticides business and safe and judicious use of pesticides.

**Methods:** The research work is an explanatory type of study focus on pesticides use status in crop production and rules and regulations for pesticides business in Bangladesh. Mainly, secondary sources have been used for data collection for this research. Data have been collected through library work, book review and online resources. The sources include academic books, journal articles, media report, census report, organizational records, encyclopedia, workshop paper etc. Moreover, some data have been gathered from empirical observation of related government officials, Pesticides Company and association representatives and pesticide retailers.

### **Discussions:**

**i) Status of pesticides use for crop production in Bangladesh:** Farmers of Bangladesh use pesticides in their fields to protect plants and crops from harmful pests, particularly in vegetable such as red amaranth, spinach, cabbage, okra, potato, tomato, eggplant,

cauliflower and cucumber which are affected more than rice or other crops. Farmers also use pesticides for seed treatment to control seed borne diseases. More than 90% farmers of Bangladesh use pesticide unnecessarily, indiscriminately and excessively due to their ignorance and unconsciousness about the use (Daily Prothom Alo July 20-21, 2008). As a result, cost of production increase, crop yields decrease, farmers' face different types of physical problems and ultimately farmers become physically and financially looser. Farmers and workers of Bangladesh spraying pesticides in crop fields are highly vulnerable to various diseases as the spraying is most often done without taking any safety measures. In a multi-year survey covering more than 8500 smallholder farmers in 26 countries, Matthews (2008) found that the highest proportion of those applying pesticides but declining to use some elements of Personal Protection Equipment (PPE) was in Asian countries, with Bangladesh being the highest. Even, many farmers often blow air from the mouth through the spraying pipe to make sprayer nozzle clear (Daily Star, January 5, 2010).

Pesticides have both positive and negative impacts on agriculture value chain and environment. Pesticides are used to overcome the pest problem in various crops. When the pest problem is managed at the proper time, it improves the crop productivity. Therefore, pesticide use definitely helps in improving the crop productivity and quality if right type of pesticide is used at right time with the right dose (Khan *et al.*, 2010). Worldwide, 40 % of the agricultural produce is lost due to plant diseases, weeds and pests collectively. If there would have been no pesticides, crop losses would have been many folds greater. Moreover, these crop saving substances not only protect the crops from damage rendered by pests, but they also increase the yields of crops considerably. Excessive uses of chemical pesticides have many consequences on agriculture and environment, such as increased production costs, pest resistance to pesticides, and dangerous diseases to human. For reducing disease and pests and increase income from crop activities, farmers resorted using more pesticides (Nazarian *et al.*, 2013). The effects of pesticides depend on exposure and toxicity, as well as on different factors like life history, characteristics, timing of application, population structure and landscape structure (Schmolke *et al.*, 2010). Crop production would decline if crops are not protected by the disastrous effects of pests. The invention of pesticides is a blessing for modern agriculture because to ensure food production its application must be needed. They contribute to a stable supply of affordable agricultural products with uniform quality (Nikolinka and Uwe 2009) Pesticides also prevent disease outbreaks through the control of rodent and insect vectors hence they contribute to improved human health. But, the untrained or undertrained farmers don't know the adverse effects of agrochemical use on human health and environment. Farmers are not much aware of pesticide toxicity and protective measures which must be taken at the time of and after handling, carrying, mixing, storing. Most of the farmers of Bangladesh use pesticide unnecessarily, indiscriminately and excessively due to their ignorance and unconsciousness about the use. As a result cost of production increases, yield decreases and farmers become financially looser. However, the majority of pesticides is not specifically targeting the pest only and during their application they also affect non-target plants and animals. Many pesticides are not easily degradable, they persist in soil, leach to groundwater and surface water and contaminate wide

environment. Besides, application of same pesticide for long time creates resistant power of the targeted pests and after sometimes the pesticides cannot control pests. Depending on their chemical properties pesticides can enter the organism, bio-accumulate in food chains and consequently influence also human health. Very few farmers use protective measures or safety measures during pesticide application (Mohiuddin *et. al.*, 2009). Moreover, pesticides farmers are smoking, drinking and consuming something during application resulting suffering from pesticide related both acute and chronic health hazards.

Pesticide exposure can cause a variety of human health problems, both chronic and acute in both farmers and consumers. Chronic effects are typically the result of low levels of exposure over a long period of time even if there are no acute or immediate effects. As a result of pesticide application, farmers face different types of health problems such as difficulty in breathing, fever, headache, and nausea (Adhikary 2012). The threats in environment associated with the uncontrolled use of pesticides cannot be overlooked. Pesticides enter the water via drift, by runoff, leaching through the soil or they may be applied directly into surface water in some cases such as for mosquitoes' control. Pesticide-contaminated water poses a great threat to aquatic form of life. It can affect aquatic plants, decrease dissolved oxygen in the water and can cause physiological and behavioural changes in fish populations (Scholz *et al.*, 2012). Populations of beneficial insects such as bees and beetles can significantly decline by the use of broad-spectrum insecticides such as carbamates, organophosphates and pyrethroids. Pesticide creates the environment and health vulnerable. The use of toxic pesticides by Bangladeshi farmers increased by 328 percent during the past 10 years, posing a serious hazards on human health due to its long-term residual effect (BARI 2010).

**ii) Government rules and regulations for pesticides business in Bangladesh:** Pesticides business in Bangladesh is controlled by the Pesticides Ordinance, 1971 (II of 1971), Government of The People's Republic of Bangladesh, Ministry of Agriculture and it is called the Pesticide Rules, 1985. There are many rules and regulations for operating pesticides business in Bangladesh. Some major rules are:

### **A. Registration of Pesticides:**

**R 4. Registration of pesticide:** (1) On receipt of an application for registration of a brand of a pesticide, the Registration Authority shall send the application together with a sample of pesticide to the laboratory for test or analysis and to ascertain whether the sample is in accordance with the information provided along with the application. (2) On receipt of the result of the test or analysis under sub-rule (1) the Registration Authority shall submit the result to the sub-committee for approval and after getting approval of the sub-committee the Registration Authority shall send the sample of the pesticide to the respective specialized institutes or organization authorized by the Advisory Committee to conduct biological test and trial for both the new molecule and Me-too product under field condition as may be required. (3) Both for Me-too Product & New Molecule, two different locations and two crop season trials are required and after field trial, report should be made available within

1(one) month. (4) The respective specialized institutes or organization shall conduct such biological and field efficacy tests following standard Bioefficacy Test Protocols either available with the respective specialized institutes or organization or prescribed by the Advisory Committee. (5) The specialized institute or organization will send the test result to the Registration Authority and on receipt of the test result, the Registration Authority will send the result to the next meeting of the sub-Committee of the Advisory Committee. (6) On receipt of the result the Sub-Committee will examine the test result with the list of protocols and shall send its recommendations to the Registration Authority within 15 (fifteen) days. (7) On receipt of the recommendations under sub-rule (6) the Registration Authority will forward the recommendations to the advisory committee and if advisory committee approves and recommends that the brand of pesticide conforms to the requirement of the Ordinance and rules then the Registration Authority will give registration to the brand of pesticide in form 2 in such condition as may be specified in the registration certificate. (8) A certificate of registration granted under sub-rule (7) shall apply only to the pesticide described in the application to which the certificate relates. (9) The Registration Authority shall issue the registration certificate within 15 (fifteen) working days of Advisory Committee's approval. (10) Pesticides registered as aforesaid shall be published by the Registration Authority in the Official Gazette within 30 (thirty) days from the date of granting registration certificate. (11) The registration of a brand of pesticide shall be effective from the date of its registration until the thirtieth day of June of the third year following the year of registration.

**R 5. Rejection of application for registration:** (1) If it appears to the Registration Authority that the result of the test or analysis under provisions of these rules do not corroborate with the information supplied by the applicant or the labels and containers intended to be used do not conform to the requirements in this behalf, he may reject the application for registration and shall inform the applicant of the reasons for the rejection and supply him full particulars of the tests. (2) The rejection of an application for registration of an application for registration of a pesticide shall, however, not debar the applicant from making a fresh application for registration.

**R 6. Renewal of registration certificate:** (1) An application induplicate for renewal of registration shall be made in Form 3 to the Registration Authority. (2) The registration of a pesticide shall be deemed to have been cancelled if not applied under sub-rule (1). (3) A certificate of renewal of registration shall be issued in Form 4 within 90 (ninety) days after receiving the application. (4) On receipt of application with fee the Registration Authority may approve the changes in address and country of origin of a registered brand of a pesticide. (5) In case of change of country of origin, the sample of the product should be tested and should comply with the original product.

**R 7. Fees:** (1) A fee of Tk. 20,000.00 (Taka twenty thousand) shall be paid with each application for a Registration Certificate and a fee of Tk. 5,000.00 (Taka five thousand) for renewal of certificate of registration, which shall, in no case, be refunded to the applicant.

(2) A fee of Tk. 2000.00 (Taka two thousand) shall be paid for a duplicate copy of the registration certificate if the original one is defaced, destroyed or lost.

**R 8. Cancellation of the certificate of registration:** Cancellation of the certificate of registration of a brand of pesticide shall be published in any leading daily newspaper and in the journal of the Agriculture Information Service.

## **B. Manufacture and Formulation of Pesticides:**

**R 10. Conditions to be fulfilled after registration of pesticide for manufacture and formulation, etc.-**A person who intends to manufacture and formulate pesticides registered under these rules shall- (a) Provide and maintain adequately qualified staff and suitable premises and plant for the proper manufacture, formulation, repacking or storage of pesticide in respect of which the certificate of registration has been granted; (b) Maintain a laboratory for carrying out quality control tests of the pesticide; (c) Keep records of the details of manufacture and formulation of each batch of the pesticide which is issued for sale or distribution; (d) Allow any person authorized by the Government in this behalf to enter into any premises where the manufacture, formulation or packing of pesticide is being carried on; (e) Allow to inspect the premises and the means employed for testing of pesticides; (f) From time to time, report to the Government any change in the expert staff responsible for manufacture, formulation or repacking of pesticides; (g) Observe the conditions for the storage of pesticides as laid down in these rules; (h) Provide such protective clothing, as may be required, to the workers and take all necessary precautions for their health as may be specified by these rules or by the Registration Authority; (i) Arrange medical checkup of the workers as often as required or at least twice a year, and provide medical treatment free of cost.

## **C. Import of Pesticides:**

**R 11. Import of pesticides:** (1) No pesticide shall be imported into Bangladesh unless- (a) It has been registered and it complies strictly with the application for registration; (b) It is packed and labeled in conformity with these rules; (c) The importer has proper facilities for its storage. (2) No pesticide shall be imported through a route other than the recognized custom frontier stations of Bangladesh. (3) These rules shall not apply in case of pesticides imported for experimental or research purposes in reasonable quantity. (4) Pesticide shall be importable only from the manufacturer or formulator as mentioned in the Registration Certificate.

## **D. Licences:**

**R 12. Licence for manufacture/formulation, stock, repacking, sale, etc., of pesticides:** (1) Application for grant of licence of pesticides for the purposes specified below shall be made to the licensing authority in the Form specified against each purpose: (a) Import: Form 5, (b) Manufacture or formulation: Form 6, (c) Holding in stock for wholesale: Form 7, (d) Retail sale: Form 8, (e) Re-packing: Form 9, (f) Pest control operation on commercial basis: Form 10, (g) Advertisement: Form 11. (2) Licences for the purposes mentioned in

sub-rule (1) shall be made by the licensing authority in Form 12, Form 13, Form 14, Form 15, Form 16, Form 17, Form 18 respectively. (3) An application for grant of licence and renewal thereof under this rule shall be accompanied by a fee specified below:

Licence type	Licence fee (Taka)	Renewal fee (Taka)
Import	Two thousand	One thousand
Manufacture or formulation	Five thousand	One thousand
Holding in stock for wholesale	One thousand	Five hundred
Retail sale	Three hundred	Two hundred
Repacking	Two thousand	One thousand
Pest control operation on commercial basis	Two thousand	Five hundred
Advertisement	One thousand	Five hundred

(4) Licences issued under this rule shall be subject to the conditions specified on the face of the licence. (5) If any pesticide is proposed to be manufactured, stocked, sold, formulated, repacked or operated on commercial basis at more than one place, separate application shall be made for each such place and separate licence shall be issued in respect of every such place. (6) Environmental certificate is required from Department of Environment for Pesticide repacker, formulation factory or manufacturer following Environmental conservation Act 1995 and Environmental Conservation Rules 1997.

**R 13. Refusal to grant licence:** The licensing authority may, after giving reasonable opportunity of being heard to the applicant for a licence, refuse to grant or renew any licence under this chapter and on such refusal the fee paid shall be refunded to the applicant.

**R 14. Duplicate licence:** A fee of Tk. 100 (one hundred) shall be paid for duplicate copy of a licence issued under this chapter if the original one is defaced, damaged or lost.

**R 15. Duration of licences:** (1) Any licence issued or renewed under this chapter shall, unless sooner suspended or cancelled, be in force for a period of two years from the date of issue or from the date of renewal, as the case may be. (2) An application in duplicate for renewal of license shall be made to the Registration Authority within 30 (thirty) days of such expiry of the date of its effectiveness and if the application is not made so, a penalty of Tk. 300.00 (three hundred) for each month up to 3(three) months from the date of expiry, shall accompany the application along with usual renewal fee and the license of a pesticide shall be deemed to have been cancelled, if the renewal is not applied for within 90 (ninety) days from the date of expiry. (3) The licence shall continue to be in force until it is renewed accordance with these rules, suspended or revoked or, where an appeal preferred until the appeal is disposed of.

**R 18. Amending a licence:** The licensing authority may, either on an application made by the licensee or if he is satisfied that the conditions under which a licensee has been granted under this chapter have been changed that it is so necessary to do, amend a licence after giving an opportunity of being heard to the person holding the licence.

**R 19. Transfer of licence:** (1) The holder of a licence may, at any time before expiry of the licence apply for permission to transfer the licence to any other person. (2) The application under sub-rule (1) shall be accompanied by a fee which shall be the half of the original licence fee. (3) The licensing authority may, after such inspection finds all terms and conditions paid down under Rule 17 and/or which is applicable or fulfilled by the person to whom the license is proposed to be transferred, accord permission to transfer the license and on such permission being given, an endorsement to the that effect shall be made in the license.

**R 20. Procedure on disability of licensee:** (1) If any person in whose name a licence has been issued under this chapter dies or is incapable of carrying on the business for which licence is given, his legal representative interested in carrying on the business may apply in accordance with the provisions of these rules to the licensing authority for transfer of the licence in his name. (2) If an application is made under sub-rule (1) for the transfer of licence, it shall be lawful for the applicant to carry on the business of the licence until it is refused by the licensing authority.

## **E. Packaging and Labelling:**

**R 30. Prohibition of sale or distribution unless packed and labelled:** No person shall stock or exhibit for sale or distribute any pesticide unless it is packed and labelled in accordance with the provisions of this Chapter.

**R 31. Packing of pesticides:** Every package containing pesticides shall be of a type approved by the Director and a sample container in which the pesticide is proposed to be packed shall be supplied to the Director separately.

**R 32. Leaflet to be contained in a package:** The manufacturer, formulator or distributor shall provide wholesale and retail dealers with leaflet containing the following details, namely:

(a) the plant pests for which the pesticide is to be applied, the adequate direction including the manner in which the pesticide is to be used at the time of application; (b) particulars regarding chemicals harmful to human beings, animals and wild life; (c) warning and cautionary statements including the symptoms of poisoning, suitable and adequate safety measure and emergency first aid treatment, where necessary; (d) caution regarding storage shall be exclusive; (e) instructions concerning the decontamination or safe disposal of used containers; (f) statement showing the antidote for the poison shall be included in the leaflet and the label; (g) if the pesticide is irritating to the skin, nose, throat or eyes, a statement shall be included to that effect.

**R 33. Manner of labeling:** (1) The following particulars shall be either printed or written in indelible ink on the label of the innermost container of any pesticide and on the outermost covering in which the container is packed or repacked- (a) name of the manufacturer, formulator or repacker (if the manufacturer, formulator or repacker is not the person in whose name the pesticide is registered, the relationship between the person in whose name



the pesticide has been registered and the person who manufactures, formulates or packs or repacks, distributes or sells shall be stated); (b) name of the pesticide (brand name or trade mark under which the pesticide is sold); (c) registration number of the pesticide; (d) net content of volume (the net content shall exclusive of wrapper or other materials); (e) batch number or lot number; (f) expiry date, i.e. up to the date the pesticide will retain its efficacy and safety; (g) Antidote statement. (2) The label shall so affixed to the container that it cannot be ordinarily removed. (3) The label shall contain in a prominent place and occupying not less than the one-sixteenth of the total area of the face of the label, and square set at an angle of 45 degree (diamond shape). The dimension of the said square shall depend on the size of the package on which the label is to be fixed. The said square shall be divided by horizontal lines into two equal parts. The upper part shall contain the symbol and signal word specified in sub-rule (4) and the lower part shall contain the colour specified in the sub-rule (5). (4) The upper part of the square referred to in sub-rule (3) shall contain the following symbol and warning statement, namely:

(i) pesticide belonging to 1a and 1b (extremely and highly hazardous) contain a symbol of a skull and cross bones and the word "POISON" printed in red; (ii) the words "KEEP OUT OF THE REACH OF CHILDREN" shall appear on the label at suitable place outside the square; (iii) pesticides in category II (moderately hazardous) shall bear the word "Poison" "DANGER" printed in bright yellow and the statement "KEEP OUT OF THE REACH OF CHILDREN" shall appear on the label at suitable outside the square; (iv) pesticides in category III (slightly hazardous) shall bear the word "Poison" "CAUTION" and the word "CAUTION" printed in bright green and the statement "KEEP OUT OF THE REACH OF CHILDREN" shall appear on the label at suitable place outside the square. (5) The lower part of the square referred to in sub-rule (3) shall contain the colour specified in column 5 of the Table below depending on the classification of the pesticide specified in the corresponding entry in column (1):

Class		LD 50 for the rat(mg/kg body weight)based on formulations				
		Oral		Dermal		Color of identification band on the label
		Solids	Liquids	Solids	Liquids	
1a	Extremely hazardous	5 or less	20 or less	10 or less	40 or less	Red
1b	Highly hazardous	5-50	20-200	10-100	40-400	Red
II	Moderately hazardous	50-500	200-2000	100-1000	400-4000	Bright yellow
III	Slightly hazardous	Over 500	200-2000	Over 1000	Over 4000	Bright green

(6) The label, leaflets affixed or attached to the package or repacking containing pesticides shall be printed in Bengali. (7) Labelling of pesticides must not bear any unwarranted

claims for the safety, efficacy of the pesticide or its ingredients like “safe”, “non-injurious”, “nonpoisonous”, etc.

**iii) Role of Bangladesh Crop Protection Association (BCPA) in pesticides business and safe and judicious use of pesticides:** Bangladesh Crop Protection Association is the representative organization of the business enterprises who are involved in import/formulation/marketing of plant protection chemicals. The vision of BCPA is to safeguard the interest and developing the plant protection chemical business in the country complying the local and international rules and regulations for achieving food security livelihood through protecting the environmental pollution and reducing the health hazard. BCPA as a representative of pesticide industry negotiate with different ministry of Bangladesh. Government has made BCPA membership compulsory for any pesticide company for better monitoring of their performance. BCPA is dignitary of Pesticide Technical Advisory Committee (PTAC) of DAE, which is an apex committee for pesticide rules and regulation of Bangladesh. BCPA conducts Training of Trainers program and organized training programs regularly for male & female farmers, dealers & retailers, spray men, field officials of member companies, warehouse staff, sub-assistant agricultural officers of DAE, and school students regularly on safe and judicious use of pesticides.

**Conclusion:** The effects of pesticides depend on exposure and toxicity, as well as on different factors like life history, characteristics, timing of application, population structure and landscape structure. Excessive uses of chemical pesticides have many consequences on agriculture and environment, such as increased production costs, pest resistance to pesticides, and dangerous diseases to human. Pesticides have both positive and negative impacts on vegetable value chain and environment. Pesticides are used to overcome the pest problem in various crops. When the pest problem is managed at the proper time it improves the crop productivity. Therefore, pesticide use definitely helps in improving the crop productivity and quality if right type of pesticide is used at right time with the right dose. For supplying quality pesticides and better crop production, Government rules and regulations should be strictly followed.

## References:

1. Adhikary, S. (2012) Study on farmers’ awareness on the impact of using pesticides on environmental pollution. MS Thesis, Department of Environmental Science, Bangladesh Agricultural University, Mymensingh, Bangladesh.
2. Bangladesh Rice Research Institute (BRRI) (2010). Survey Report on Pesticides, Gazipur: BRRI.
3. BBS (2009). Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics, Planning division, Ministry of Planning, Government of the People’s Republic of Bangladesh, Dhaka.2008 and 2009.
4. Daily Star, Pesticides may also kill ignorant farmers, Jan 5, 2010. Available at: <http://www.bd64.com/today1.php?id=9525>.

5. Delcour, I., Spanoghe, P., & Uyttendaele, M. (2015). Literature Review: Impact of Climate Change on Pesticide Use. *Food Research International*, 68, 7–15.
6. Global Finance (June 10, 2016). Bangladesh GDP and Economic Data.
7. Kabir, K.H., Rahman, M.A., Ahmed, M.S., Prodhan, M.D.H., & Akon, M.W. (2008). Pesticide analytical research at BARI related to quality, residue and maximum residue limit. Proceedings of Workshop on Maximum Residue Limits of Pesticides in Agricultural Commodities and Food in Bangladesh, (Bangladesh Agricultural Research Council, Dhaka).
8. Khan, M.J., Zia, M.S., & Qasim, M. (2010). Use of Pesticides and Their Role in Environmental Pollution. *International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering*, 4(12), 621-627.
9. Mohiuddin, M., Hossain, M. M. A., Rahman, K. M. M., & Palash M. S. (2009). Socio-economic study of insecticide use on vegetable cultivation at farm level in Chittagong region. *J. Bangladesh Agril. Univ.* 7(2), 343–350.
10. Nazarian, M., Ajili, A. A., Akbari, M., & Rostami, F. (2013). Knowledge, Attitude and Environmental Safety Behaviours of Vegetable Farmers in use of Pesticides in South West of Iran. *International Journal of Agronomy & Plant Production*, 4(8), 1844-1854.
11. Nikolinka, G.K., & Uwe, A.S. (2009). The impact of climate change on the external cost of pesticide application in US agriculture. *International Journal of Agricultural Sustainability*, 7(3), 203-216.
12. Schmolke, A., Thorbek, P., Chapman, P., & Grimm, V. (2010). Ecological models and pesticide risk assessment: current modeling practice. *Environ Toxicol Chem* 29(4), 1006–1012.
13. Scholz, N.L., Fleishman, E., Brown, L., Werner, I., Johnson, M.L., Brooks, M.L., & Mitchelmore, C.L., (2012). A perspective on modern pesticides, pelagic fish declines, and unknown ecological resilience in highly managed ecosystems. *Bioscience* 62(4), 428–434.