Environmental degradation due to tobacco cultivation in Bangladesh: A case study of Doulathpur, Kushtia

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Abstract

Tobacco plant is diseases prone and requires much chemical fertilizers, pesticides and enormous care. Yet, since the liberation tobacco cultivation has become an important part of agriculture in Bangladesh thanks to its promotion by the British American Tobacco Company. Kushtia is one of the major tobacco growing areas of Bangladesh. This paper aims to find out the negative environmental impacts of tobacco cultivation and how environmental degradation causes reduction of soil fertility and increase water pollution, biodiversity damages and deforestation in Kushtia. Research findings revealed that tobacco cultivation had indeed incurred widespread negative impacts on agro-biodiversity, water and soil quality, biodiversity and traditional agro-practices in the study area. Soil and water in the study area were found to be contaminated with toxic pesticides and chemical components that reduced the soil fertility and increased water pollution. The pH levels of both soil and water was found to be less than the minimum acceptable level. Soil was more acidic and water had less dissolved oxygen that indicated severe pollution. Flora and fauna species in the study area were also adversely impacted by the excessive use of agrochemicals in tobacco cultivation. As the drive for profit converted more arable land to tobacco cultivation environmental degradation was enhanced in the study area.

Keywords: chemical fertilizers, deforestation, environmental degradation, pesticides, soil pollution, water pollution

Introduction

Tobacco cultivation has many negative impacts both on the environment and tobacco growers, but these adverse impact is experienced differently by developed, developing and underdeveloped countries in the world (Champaign for Tobacco Free Kids, 2001; Arcury et al, 2006). Developed countries have shifted their tobacco cultivation into developing and underdeveloped countries during last 4 decades. Tobacco production share of developed countries increased from 57% in 1961 to 86% in 2006 and worldwide tobacco cultivated land is increased from 70% in 1961 to 90% in 2006 in the developing and underdeveloped countries (Geist et al., 2009). These tobacco cultivation has more stressed on the ecosystem of developing and poor countries of the world.

Energy and fuel wood crisis concerns caused by tobacco cultivation increasing, which was started after 1970s (Muller, 1978; Goodland et al., 1984). Tobacco cultivation causes the huge soil nutrient depletion and more usage of wood for fuel that caused deforestation in a considerable rate (Goodland et al., 1984). But the tobacco industries stated that, deforestation associated with tobacco cultivation is not a current considerable negative issues for environment (ITGA, 1996). High rate of tobacco growing areas of developing countries lie in the part, which are referred by Food and Agricultural Organization (FAO) as wood deficit areas. According to Fraser a prominent scientist, all kinds of forest areas in Asia and Africa is now below the capability level from which they can fulfill the demand of people. These continual deforestation can cause significant ecological damages (Fraser, 1986).

Tobacco cultivation is associated with the destruction of groundwater resource, river sedimentation systems, over exploitation of groundwater, biodiversity destruction, soil infertility and species extinction due to the exploitation and habitat fragmentation. These environmental impacts causes huge loss to the human livelihood and health. Tobacco plants need more chemical fertilizer and pesticides. Tobacco plants absorbs phosphorus, potassium and nitrogen more than any other crops, which decrease soil fertility than any other cultivating crops. Topping and suckering are two types of specific cultivation methods use to gain high level of nicotine and more leaves that also reduce the soil fertility a lot (Geist, 1999). Tobacco related deforestation in some certain producing countries and developing countries is felt rapidly (Geist, 1999). A study shown that, deforestation and soil degradation is severe in Tanzania due to the tobacco cultivation (Sauer et al., 2007; Mangora, 2005; Abdallah et al., 2007; Yanda, 2010). Tobacco cultivation is not sustainable and short time deforestation also can threat the recovering capacity of forest and can cause the land cover change from woodland to deforested land (Mangora, 2005; Abdallah et al., 2007).

Since the mid-1960s, a global shift of tobacco production has occurred which has several socio-ecological consequences. Compared with 1700, when nearly the entire world production of tobacco was concentrated in Brazil, parts of the Caribbean, and in the Chesapeake colonies of northern America with the breakdown of colonial rule from the mid-19th century, tobacco farming spread nearly all over the world including Bangladesh. During the 1960s arable fields in Bangladesh were cultivated with food crops, but after the liberation of 1971, tobacco cultivation was started by American tobacco companies in Teesta, Rangpur (Sarkar & Haque, 2001). Tobacco production in Bangladesh has mainly been pushed by big multinationals such as British American Tobacco Company through local contract growers.

The specific objectives of the research are to evaluate tobacco cultivation scenario and to investigate the environmental impacts of tobacco cultivation in the study area.

Methods and materials

The current research is an empirical study to investigate the environmental impact and recent trend of tobacco cultivation in Kushtia (Figure 1). The methodology adopted for the study is a combination of primary and secondary data sources. A questionnaire survey has been conducted in the study area to obtain the impacts of tobacco cultivation on environment from upazilla headquarter complex, other institutions and tobacco cultivating were gathered to validate the information gathered through questionnaire survey. Soil sample were collected from 0-15 centimeters and water sample collected from near pond, canal and tube well etc. pH values from soil and water measured by pH meter and Dissolved Oxygen (DO) from water measured by DO meter. Phosphorous, Potassium, Aldicard, Chlorpyrifos and 1,3-D (1,3-dichloropropene also known as Telone) were measured from the Environmental Lab with the help of Lab Assistance Akhi Akter of Department of Geography and Environment, University of Dhaka.

A total number of 80 questionnaires were conducted in the field for collecting information related to the impact on environment and others. The questionnaires covered information related to household information, environmental impact of tobacco cultivation and other information related with tobacco cultivation.

Total population of Daulatpur is 457000 (BBS, 2012). The selected survey spots are Aria union (Chokghuga, Aaria and Kalidashpur village), Kholishakundi Union (Kholishakundi, Mobaria and Shampur village), Boalia Union (Boalia, Modhugari and Shehala), Rifathpur Union (Rifatpur, Horingasi and Kaghati), Philipnagar Union (Philipnagar) and Doulathpur Union (Bazudanga, Doulathkhali). After preparing the questionnaires field study has been conducted from 18 December 2013 for questionnaire survey to collect the information farmers. After completing the questioner survey the data were analyzed by using SPSS, Microsoft word, and Microsoft Excel and Arc GIS software.

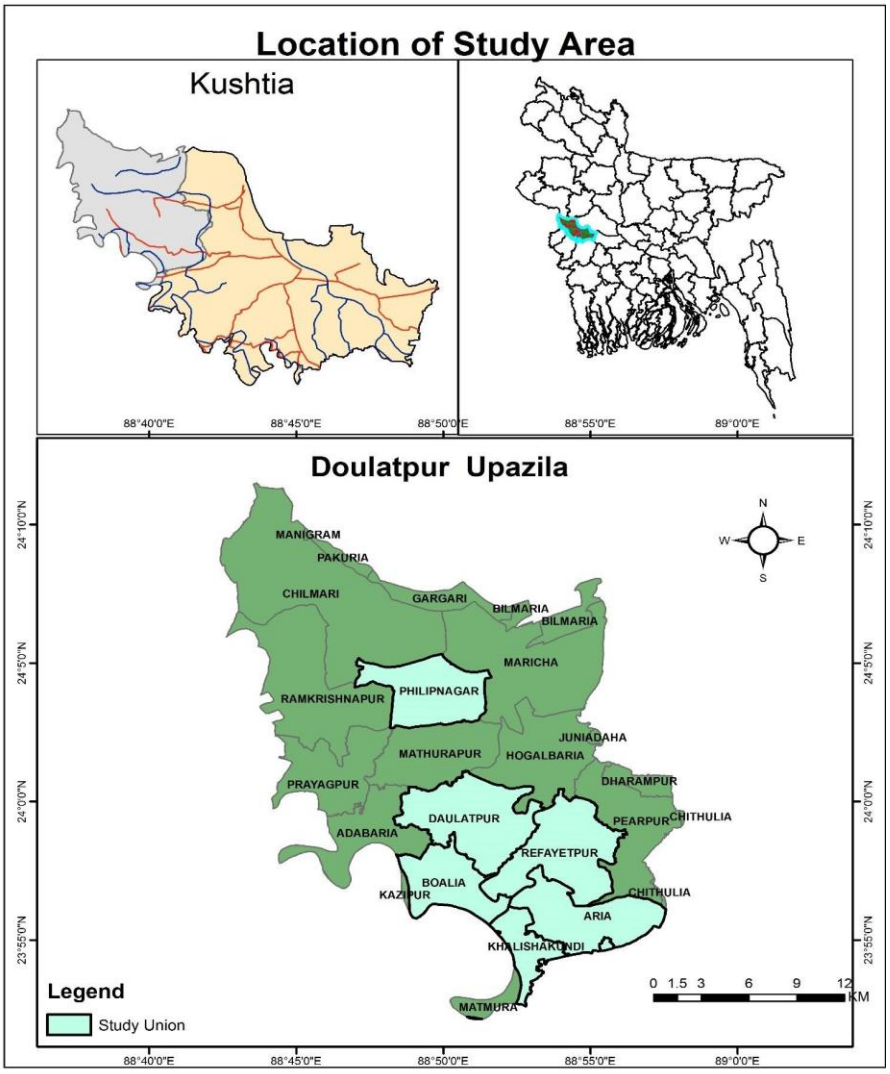

Figure 1. *Location of the study area*

Findings and discussion

Farida Akhter, Executive Director, UBINIG (2005) published a report on Tobacco Cultivation and its Impact on Food Production, the report emphasized that Tobacco as a `crop' is harmful in many ways. For example, it has direct impact on soil depletion, pollution of soil and water from excessive use of chemical fertilizers, pesticide and irrigation water and worst of all is the damage to forest, homestead trees, road side trees etc.

Tobacco farmers of Doulathpur, Kushtia uses huge pesticides and chemical fertilizer as well as irrigation to produce maximum tobacco leaves (Figure 2). Common pesticides used in tobacco fields are Aldicarb, Chlorpurifos and 1,3-dichloropropene to protect the tobacco plants from diseases. These pesticides are mostly acute toxic peptides registered in USA and mostly banned from the market, but they were used intensively in Doulathpur, Kushtiya. It causes air pollution, water pollution, soil pollution, biodiversity destruction, deforestation and other environmental degradation (Lecours et al., 2014). Farmers also used huge amount of chemical fertilizer like potassium, phosphorous and urea etc to get more tobacco production.

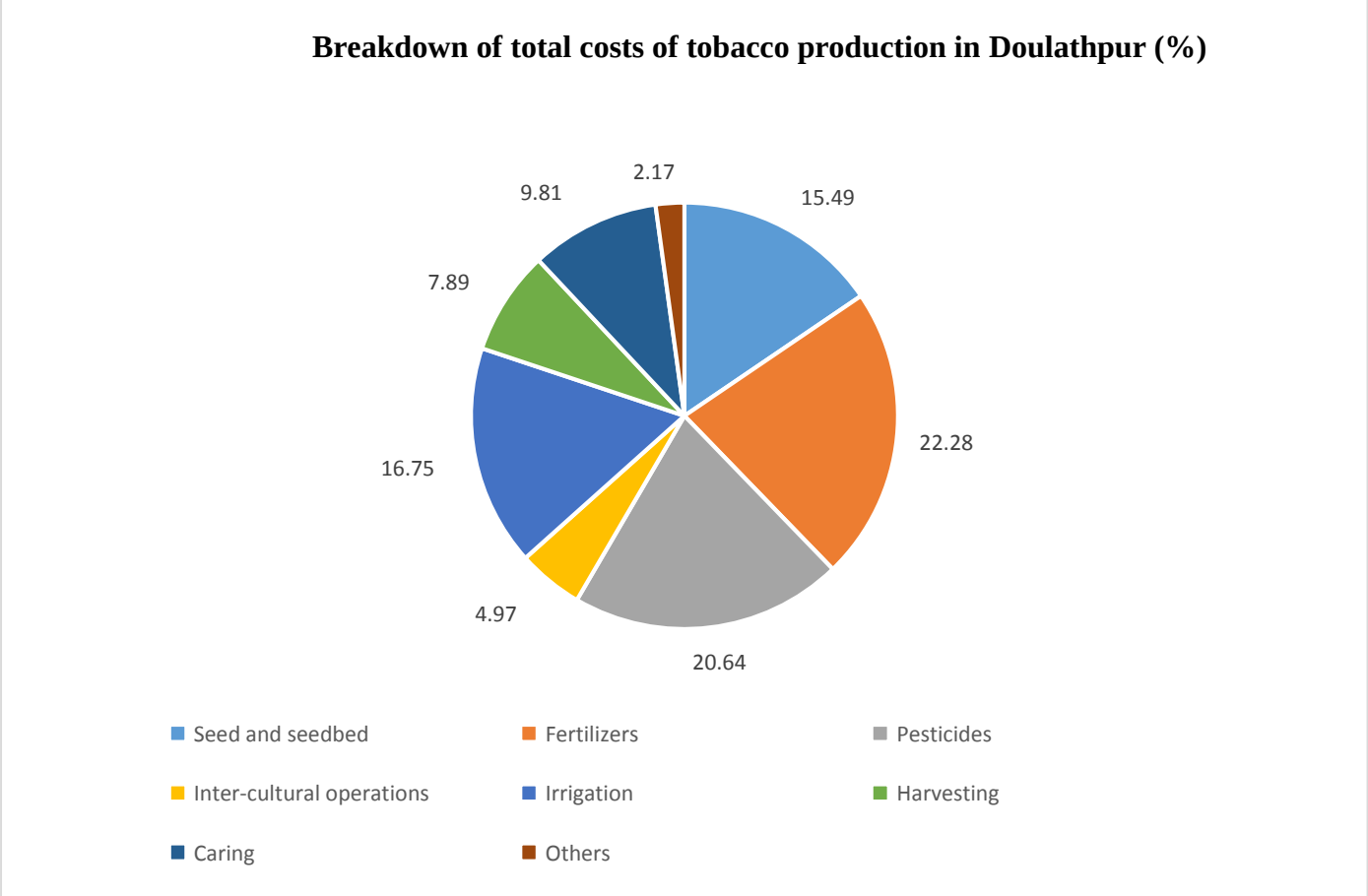

Figure 2. *Tobacco production needs more fertilizer and pesticides*

Table 1. Farmers perception about the environmental impact of tobacco cultivation

Responses of Farmers about the environmental and health impact of Tobacco cultivation in study area	Yes (%)	No (%)	Don't know (%)
Do you think Tobacco cultivation has a bad impact on environment?	34	8	58
Do you think Tobacco cultivation reduces soil fertility?	62	7	31
Do you think Tobacco cultivation causes deforestation in the area?	9	22	69
Do you think Tobacco cultivation pollutes the water in the area?	27	16	57
Do you think Tobacco cultivation destroying traditional food cultivation?	54	15	31
Do you think Tobacco cultivation causes biodiversity damages in the area?	39	32	29
Do you need to provide more chemical fertilizer, irrigation and pesticides each year for production?	98	2	0
Do you think fish species in the near water surface is reducing day by day after starting Tobacco cultivation?	63	14	23
Do you think Tobacco cultivation has bad impact on health?	89	5	6
Do you think farmers are suffering by different diseases due to Tobacco cultivation?	94	2	4

Soil pollution

Tobacco farmers in the study area explained that they had to apply more and more pesticides and chemical fertilizers to the land because soil productivity was diminishing. Chlopyrifos persists long time in soil and causes harm to the organism (Racke et al., 1998; Fang et al., 2006; Fang et al., 2008; Vischetti et al., 2007; Sing et al., 2003; Vejares et al., 2010). Less than 0.1% of the pesticides used reached the targeted pest ; the rest affected the environment (Ardley, 1999). Repeated application into the soil of chlorpyrifos did not help to degrade pesticide by developing microbial population (Sing et al., 2003).

Table 2. Soil condition of land in study area

Parameters	In Tobacco land (0 to 15 centimeter) ppm or µg g^{-1}	In other crop land (0 to 15 centimeter)
pH	5	6
Nitrate (NO_3)	40.25	……
Phosphorus concentration (P)	51.89	17.24
Potassium concentration (K)	4.25	……
Aldicard	more than 0.010	……
Chlorpyrifos	more than 0.09	……
1,3-D (1,3-dichloropropene also known as Telone)	more than 0.08	……

Aldicard presence in the soil of the study area denotes that the soil had become toxic and 48% of the parent compound was converted to sulfoxide , another type of toxic which was harmful to soil after seven days of aldicarb application to the soil (USEPA, 2006/2009/2011). The acceptable maximum level of aldicard is 0.03 mg/L but aldicard levels in the soil of the study area exceeded the minimum level which indicates the soil pollution. 1,3Dichloropropene may lead to both hydrolysis and microbial degradation of the soil and its high mobility in the soil may lead it to migrate to the shallow groundwater (USEPA, 2006/2009/2011). PH level is 5, which indicates the soil is more acidic and it is reducing its fertility. Phosphorous and potassium are toxic elements that come from phosphate and potash fertilizers. Chemical fertilizers reduced and changed the pH of the soil (Williams, 1964). For this reason farmers in the study area needed more and more fertilizers each year.

Water pollution

1,3-Dichloropropene enters into water due to the application of broad spectrum soil fumigant for controlling nematode in the soil. This impacted negatively on the health of those who used the water due to the inhibition of cholinesterase activities which rendered the water more toxic. Aldicarb sulfoxide and aldicarb sulfonic toxic elements entered into drainage aquifer and surface water and made the water toxic.

Table 3. Water quality in the study area

Parameters	Near Tobacco land Water ppm	Near other crop land Water ppm
pH	6	7.02
Nitrate (NO_3)	38	……
Dissolve Oxygen (DO)	3.01	6.22
Phosphorus concentration (P)	55.88	17
Potassium concentration (K)	3.04	7.5
Aldicard	more than 0.008	……
Chlorpyrifos	more than 0.06	……
1,3-D (1,3-dichloropropene also known as Telone)	more than 0.07	……

Chlorpyrifos in the water of the study area was found to have exceeded the acceptable limits and rendered the water toxic and hazardous to human health.

Nitrate, Phosphorous and Dissolve Oxygen in the soil of study area mainly came from using chemical fertilizers which exceeded the acceptable Nitrate level of 10 ppm and Phosphorous level of 10 ppm as determined by the Bangladeshi Department of Environment (DOE). These chemicals polluted the water and created eutrophication of water in the study area with negative impact on the environment. The PH levels also denoted the acidity of the water.

Biodiversity degradation and deforestration

Tobacco land in study area had increased from 5,500 hectares in 2007-08 to 9,600 hectares in 2014 thanks to the frantic forest clearing and tobacco replanting activities of local farmers. At the same time the forest area had decreased by 5% (Upazila Agricultural Extension Office, 2014). This led to deforestation as the same people also chopped wood for fuel. The average amount of deforestation in developing countries due to tobacco cultivation is 5% of total deforestation (Geist, 1999). A study found that in Bangladesh 31% of total deforestation occurred due to tobacco cultivation (Tobacco atlas, 1999). It also reported that birds were not seen in the field like it used to be previously while fish species decreased at exponential rates in the study area. Aldicard is toxic to birds, fish, earthworms and honeybees that causes genetic damages. Chlorpyrifos is highly toxic when it contaminates river, lakes, rainwater and groundwater up to 25 km from its point of application. It also causes genetic damages of male reproduction system in mammals, insects, and aquatic invertebrates within the vicinity of the application area (the tobacco fields in this case).

Conclusion

Multinational tobacco companies expand their business and production in the underdeveloped and developing countries like Bangladesh due to the abundant availability of labour and less restrictive environmental laws. This study has shown that tobacco cultivation in the study area causes environmental degradation and ecosystems disruption through intensive use of toxic pesticides and chemical fertilizers. To increase their production in order to generate more income poor farmers in the study area resorted to using excessive agrochemicals that damaged not only the soil, water and biodiversity of the tobacco area but also the very health of tobacco farmers. To mitigate this situation, close monitoring and evaluation are needed to measure and provide national data about tobacco activities that cause environmental degradation and deforestation.

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