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AGRONOMIC AND PEST MANAGEMENT PRACTICES IN MAIZE UNDER BARIND AREA OF BANGLADESH

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ABSTRACT

A case study was conducted in four districts viz., Rajshahi, Noagaon, Chapainawabganj and Natore under Barind areas of Bangladesh through pre-tested questionnaire survey among the target farmers, i.e. 30 maize cultivating farmers per district to gather information on their existing socio-economic aspects as well as their opinion on agronomic and pest management practices in maize cultivation. Most of the farmers are middle to old aged (46.67% and 33.33%, respectively) with primary to secondary level of education (50.83% and 33.33%, respectively), small to medium farm size (18.33% and 55.83%, respectively), small to medium family size (59.17% and 37.50%, respectively) with good farming experiences and medium to high level of annual income. Maize-T. Aman rice was the major cropping pattern (71.67%), followed by Maize-Jute (14.17%) and Maize-Black gram (9.17%). Around 90.00% of the farmers cultivated hybrid maize following line sowing (88.33%) using mechanical tillage practices (97.50%) and chemical fertilizers (57.50%). There were irrigation facilities for maize cultivation using ground water by deep and shallow tube wells. Mechanical weeding was the most common weed management strategy corresponded to 61.67% of the farmers. Chemical insecticides were used by 62.50% respondents, followed by the application of IPM and botanical insecticides (20.00% and 13.33%, respectively). For disease control, 62.50% respondents adopted no management practice. The survey conclusively showed that still now IPM is not a popular pest management option over chemical control in Barind areas.

Keywords: Barind tract, cropping pattern, cropping systems, pesticide use pattern, survey

Introduction

In Bangladesh, Rajshahi region especially the Barind tract is different from other parts of the country due to its undulating topography having compact and low fertile soils. The High Barind Tract, lying in Rajshahi, Chapai Nawabganj and Naogaon districts, is one of the distinct areas of Barind, occupying 160.0 thousand ha, roughly 21.0% of the region. The region experienced high temperature with limited soil moisture storage along with low and erratic rainfall (Ali 2000). The maximum temperature can exceed 40°C in May and minimum temperature can fall to 6°C in January. Most of the rainfall occurs from June to September and moisture depletion starts from October and in December no residual moisture is available for crop emergence (Idris and Huq 1987). Land in the high Barind tract exhibits grey terrace soil, silty loam to silty clay in texture, and is poorly drained, with a 6-8-cm thick plow pan and low organic matter content (0.8-1.2%). These situations make the area drought prone along with poor crop productivity.

Maize (*Zea mays* L.) is the third most important cereal crop in Bangladesh, after rice and wheat. It is a high valued exhaust crop, popularly grown in Northern regions of Bangladesh. A total of 62.3 thousand hectares of land of Rajshahi region were cultivated with maize having an annual production of 439.9 thousand tons in the year of 2018-19 (BBS 2020). Maize is a good source of food and fodder, and also used in manufacturing corn oil, corn flakes, corn syrup etc. It could be a good source of protein, carbohydrate and lipids for the malnourished population (Alam *et al.* 2019). Every year huge amount of maize is utilized in Bangladesh of which only 42% is produced by the country and remaining imported from other country (BBS 2016). In spite of increasing in the area under this

crop, the productivity is still very low which may be due to several reasons, viz. environmental factors, low mechanization, pest and diseases etc. (Reddy and Trivedi 2008). The socioeconomic condition of farmers directly influences cropping system, production technology and management strategy against pests (Mohiuddin *et al*. 2009). Adaptive measures to climate change must be taken as a main concern in crop management with considering socioeconomic condition of farmers for ensuring the food security of the drought prone areas of Bangladesh. Therefore, the survey was designed to explore the agronomic and pest management strategies adopted by maize cultivators of Barind area.

Materials and Methods

The study was conducted in four districts viz., Rajshahi, Noagaon, Chapainawabganj and Natore during November-December 2020 among the target farmers to gather knowledge on existing socio-economic aspects of maize cultivators as well as their opinion on agronomic and pest management practices in maize cultivation. Pre-designed and pre tested interview schedule was used for data collection. The data were collected by interviewing 120 farmers using a structured questionnaire. Face-to-face interviews using structured questionnaires were conducted. The interviewers were supervised by supervisor teams and co-supervisor also participated to take interview. The questionnaires were developed by the research team and also piloted before being used in the field. The farmers were selected randomly from four to five villages of two different upazilas of each of the above mentioned districts with the consultations of Department of Agricultural Extension (DAE), Bangladesh. The collected data were coded, edited for processing through tabular method calculating average, percentage, ratio, etc. using SPSS 20.0 software.

Results and Discussion

Socioeconomic and demographic profile of the farmer: The socioeconomic and demographic profile of the respondents is presented in table 1. The mean age of total respondents was 45.44 years where the most of the farmers were middle aged (46.67%) and old aged (33.33%), whereas 20.00% farmer was found under young aged. The education level of most of the respondents was limited to primary school (50.83), and 33.33% respondents went up to secondary school, but higher secondary (5.00%) but the number of illiterate farmers (10.83%) were competitively

Table 1. Socio-economic and demographic profile of the respondents in Barind area of Bangladesh

Character	Measuring unit	Categories	No. of respondents	Percent	Mean
Age	Actual year	Young aged (up to 35)	24	20.00	45.44
		Middle aged (36-50)	56	46.67	
		Old (>50)	40	33.33	
Education	Year of schooling	Illiterate (0)	13	10.83	5.77
		Primary (1-5)	61	50.83	
		Secondary (6-10)	40	33.33	
		Higher (>10)	6	5.00	
Family size	Number	Small (up to 4)	22	18.33	5.30
		Medium (5 to 6)	67	55.83	
		Large (7 and above)	31	25.83	
Farm size	Actual (Acre)	Marginal (<.02)	0	0.00	2.38
		Small (>.02 to 0.99)	71	59.17	
		Medium(1 to 2.99)	45	37.50	
		Large (3 and above)	04	3.33	
Annual income	Actual (taka)	Low (up to BDT 50000)	30	25.00	84,600.00
		Medium (BDT 50001 to 75000)	49	40.83	
		High (above BDT 75000)	41	34.17	
Farming experience	No. of years	Poor (up to 15)	23	19.17	18.43
		Moderate (16 to 20)	64	53.33	
		High (above 20)	33	27.50	

less. The average family size (no. of family member) of the respondents was 5.30 with dominating medium family size (55.83%). The average farm size (acre land area) of the respondents was 2.38 with dominating small farm (59.17%) and medium farm size (37.50%) but no farmer was found as landless. The average annual income (BDT) of the respondents was 84,600.00 with dominating medium to high income compared to low income generating farmer. The average farming experience (no. of year of farming) of the respondents was 18.43 years with dominating moderate (53.33%) to high level (27.50%) of farming experience compared to poor farming experience (19.17%).

The study revealed that the literacy percentage (about 90.0%) of the farmers in the study area were quite high than that of national average (51.6%) (Krishi diary 2009). The average size of the household was 4.9, which was more or less similar to the national average (5.0) (BBS 2016).

Agronomic practices of maize cultivation in Barind area: The maize cultivation practices by the farmers in Barind areas are presented in table 2. Most of the respondents (71.67%) followed Maize-T. Aman rice cropping pattern in their field. Only 5.00% respondents followed Maize-T. Aman rice-Black gram cropping pattern. Power tillers were used by most of the farmers (60.00%) for tillage, whereas only 2.50% respondents carried out manual tillage for land preparation. Hybrid maize seeds obtained from seed companies were the most popular among the farmers and about 89.17% of the respondents cultivated hybrid varieties. Only 3.33% of respondents used their own seeds. Most of the respondents (88.33%) preferred line sowing for maize cultivation, and only 1.67% respondents followed broadcasting for seed sowing. The use of only chemical fertilizers was observed in most of the cases (57.50%) and only manure was used by 5.00% respondents but about 37.5% of the total respondents used both chemical fertilizer and manures. Ground water by shallow tube well was used for irrigation by most of the respondents (60.00%), conversely, only 0.83% respondents depended on rainfed condition for water. Multiple time of harvesting of maize was done by

Table 2. Agronomic practices of maize cultivation under Barind area of Bangladesh during 2020

Component	Categories	No. of respondents	Percent
Cropping pattern	Maize-T. Aman Rice	86	71.67
	Maize-Jute	17	14.17
	Maize-Black gram	11	9.17
	Maize-T. Aman Rice-Black gram	6	5.00
Tillage	Power tillers	72	60.00
	Tractors	45	37.50
	Manual tillage	3	2.50
Variety	Inbreed (BADC)	9	7.50
	Hybrid (Seed company)	107	89.17
	Own seed	4	3.33
Seed sowing	Line sowing	106	88.33
	Broadcasting	2	1.67
	Intercropping	12	10.00
Fertilizer used	Only manure	6	5.00
	Only chemical	69	57.50
	Both manure and chemical	45	37.50
Source of irrigation	Ground water by deep tube well	29	24.17
	Ground water by shallow tube well	72	60.00
	River water by shallow tube well	18	15.00
	Rainfed condition	1	0.83
Harvesting	One time	32	26.67
	Multiple time	88	73.33

(*Multiple-answer considered).

73.33% respondents, whereas only 26.67% respondents harvested at a time from their field.

Rashid *et al.* (2017) reported that the most predominating crop in this area was rice where exclusive rice based patterns occupied 40.48% of net cropped area (NCA) of Rajshahi region. Boro-Fallow-T. Aman was the dominant cropping pattern, occupied 22.83% of NCA in 27 upazilas out of 32. Hybrid varieties were mostly cultivated by the farmers in Barind areas. In case of maize cultivation, Karim (2006) reported the same that more than 98% maize areas of Bangladesh are covered by hybrids.

Appropriate cropping patterns may facilitate maximum possible land utilization as well as efficient use of other scarce resources in a sustainable manner. Diversified cropping pattern may be an option for the farmers as a cropping strategy against risks (Mandal and Bezbaruah 2013). Typology of different cropping systems is the base for the managers of these systems to intensify production (Shriar 2000).

According to the reports of Bangladesh Bureau of Statistics (BBS), almost 15% households in Bangladesh were affected by drought between the year of 2009 and 2014, while one household in every four is affected by drought in Rajshahi division (BBS 2016). Farmers are the most direct sufferer from drought as they face difficulties to irrigate their cropland due to scarcity of water resulted from drought (Shahid 2010). By dint of its gradually increasing demand and lucrative market price, scores of growers have become happy over the maize farming both in rainy and winter seasons in Rajshahi region, especially Barind tract and Chalan beel areas. Farmers are switching to maize cultivation in increasing numbers because of better prices of the cereal and high demand by feed and flour mills. More than 12.58 lakh community people of 2.66 lakh households are being motivated and encouraged towards farming of various less-irrigation consuming crops including maize to reduce the pressure on underground water in the Barind area with intervention of the 'Integrated Water Resource Management (IWRM)' project. Agricultural scientists and researchers have urged the farmers to promote white maize farming in the high Barind tract as the cereal crop has been proved as drought tolerant and less-irrigation consuming (Hossain *et al.* 2002).

After cultivation of maize, total household income of rural people increased significantly which enabled them to spend more on the basic items such as food, education, clothing, health care and housing compared to before. It indicates that livelihood and standard of living of maize farmers improved to some extent. If modern inputs and production technology can be made available to the farmers in time, yield and production of maize may be increased which can help the farmers to increase income and improve livelihood conditions (Hossain *et al.* 2002).

Cost and return analysis revealed that maize is a profitable crop for all categories of farmers (Ferdausi *et al.* 2014). On an average per hectare total cost of maize production was estimated at Tk. 46278.0 for all farmers and Tk. 41263.0, 53554.0 and 48715.0 for small, medium and large farmers, respectively. Again, gross margins from maize production were estimated at Tk. 67592.0, 64694.0 and 74089.0 for small, medium and large farmers, respectively. However, net returns for the farm size groups of small, medium and large were calculated at Tk. 57823.0, 53895.0 and 64138.0 per hectare, respectively. BCR was the highest (2.40) for the small farmers followed by medium (2.01) and large (2.32) farmers, respectively (Ferdausi *et al.* 2014).

Pest management practices of maize cultivation in Barind area: Table 3 represents the pest management practices of maize cultivation by the farmers in Barind areas. Four weeds namely helencha, mutha, shama and durba occurring in the maize field were taken into consideration. Mechanical weeding is the most practiced strategy to control weeds among the respondents which comprised 61.67% of the total respondents. The application of chemical herbicides and IPM were also found to be adopted by the farmers in small cases comprising of 15.83% and 12.50% respectively. Only a little number of respondents (4.17%) was found with no weed management practice in their maize field. Among the insect pests of maize, cutworm, fall armyworm, stem borer and cob borer were taken into consideration by the farmers. The use of chemical insecticide was frequently done (62.5%). The application of IPM and botanical insecticides were also done by the farmers (20.00% and 13.33%, respectively). The notable thing was that there were not any respondents (0.00%) who did not adopt any management strategy against insect pests. On the contrary, for disease management, 62.50% respondents adopted no management practice against leaf blight, seedling blight and ear rot diseases. No respondents (0.00%) adopted mechanical control for disease management.

Table 3. Pest management practices of maize cultivation under Barind area of Bangladesh during 2020

Pest categories	Management practices	No. of respondents	Percent
Weeds (helencha, mutha, shama and durba)	No management practice	5	4.17
	Hand weeding	7	5.83
	Mechanical weeding	74	61.67
	Chemical herbicides	19	15.83
	IPM	15	12.50
Insect pests (cutworm, fall armyworm, stem borers, cob borer)	No management practice	0	0.00
	Mechanical control	5	4.17
	Botanical insecticides	16	13.33
	Chemical insecticides	75	62.50
	IPM	24	20.00
Diseases (leaf blight, seedling blight, Ear rot)	No management practice	75	62.50
	Seed treatment	14	11.67
	Mechanical control	0	0.00
	Chemical fungicides	19	15.83
	IPM	12	10.00

(*Multiple-answer considered).

In a survey by Hosssain *et al.* (2019), cutworm was detected as severe, while fall armyworm, stem borer, pink stem borer and cob borer were the major, and aphid was found as minor insect pests of maize in Barind areas. For combating those insect pests, farmers mainly use Chlorpyrifos (50%) + Cypermethrin (5%) against cutworm and fall armyworm, and Thiamethoxam (20%) + Chlorantraniliprole (20%) against stem borer, pink stem borer and cob borer.

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