



**Government of the People's Republic of Bangladesh**

**Ministry of Housing and Public Works**

**Urban Development Directorate (UDD)**

**Preparation of Development Plan for Fourteen Upazilas**

**Package-04**

(Saghata Upazila, District: Gaibandha; Sariakandi Upazila and  
Sonatala Upazila, District: Bogra)

**FINAL SURVEY REPORT**

**AGRICULTURE SURVEY**

**Of**

**Sonatala Upazila, Bogra**

**June, 2017**



**Modern Engineers Planners & Consultants Ltd.**

## Letter of Transmittal

Ref No.: MEPC/UDD/2017/45

Date: 04.06.2017

To

The Project Director

“Preparation of Development Plan for Fourteen Upazilas” Project

Urban Development Directorate (UDD)

82 Segun Bagicha, Dhaka-1000.

**Subject: Submission of the Final Agriculture Survey Report of Sonatala Upazila, Bogra.**

Dear Sir,

I have the pleasure to submit herewith the Final Agriculture Survey Report of Sonatala Upazila, Bogra District under “**Preparation of Development Plan for Fourteen Upazilas Project**” Package No: 04 (Saghata Upazila, District- Gaibandha; Sonatala Upazila and Sariakandi Upazila, District- Bogra) for your kind information and further action.

Thanking you and assuring you of our best services.

Best Regards

.....  
(Engr. A. Sobahan)

Managing Director of MEPC

.....  
(Shamim Mahabubul Haque)

Team Leader, Package-4

## Executive Summary

Sonatala Upazila is a flood prone area located at Bogra district under Rajshahi Division. The land of this Upazila is intensively used for agricultural purposes. Wide ranges of crops grow here in Rabi and kharif season. Land resources of this Upazila have been brought into orchard and poultry farms as commercial basis. The study is to determine the present scenario of agriculture practices and assessment of the potential sustainable future development of the sector. Both the primary and secondary data were reviewed for preparing the survey report. The proposed Preparation of Development Plan for Fourteen Upazilas, Package 04 is expected to contribute to achieving the objectives of the National Agriculture Policy.

The major rivers of the area are Jamuna and Bangali. Jamuna River runs along the eastern part of the Upazila adjoining to Tekani Chukainagar, Pakulla and Jorgacha Union from north to south. The AEZ of the Upazila has been identified as (a) Tista River Meander Floodplain (AEZ-3, and (b) Active Brahmaputra-Jamuna Flood plain (AEZ-7). The Upazila has 331.61 acre khas land. It consists of 1 Municipality and 7 Unions. Number of mouzas and villages in the Upazila are 101 and 131 respectively.

The land & ecology of Sonatala Upazila is suitable for diversified crops cultivation round the year. The highest percentage of land in Sonatala Upazila is double cropped area (49%) followed by triple cropped area (46%). Single cropped area constitutes only 5% of the land area of the Upazila. The cropping intensity of Sonatala Upazila is 244% which is less than Bogra district cropping intensity (260%) and higher than national average cropping intensity (190).

Lands, which are above normal inundation level, can provide a wide range of opportunities for growing both of perennial and year round annual crops in the area. Total 11 different cropping patterns are practiced by Sonatala Upazila farmers. Currently in Sonatala Upazila major cropping pattern area is Boro (HYV/Hybrid) → Fallow→T. Aman (HYV) which is practiced 48.75% of the Net Cultivable Area (NCA). Potato→ Boro→ T. Aman is the cropping pattern covering about 11.09% of the NCA. Mustard→Boro→T. Aman (HYV/LV) is covering about 9.65 % of the NCA. Further, Wheat/Maize→ Jute→ T. Aman which is practiced about 5.77% of the Net Cultivable Area (NCA). Boro (HYV)→ Jute→ T. Aman which is practiced about 8.25 of the NCA. Similarly, Boro (HYV/Hybrid) → Fallow→ Fallow which is practiced 4.69% of the Net Cultivable Area (NCA). Both winter and summer vegetables cropping pattern covering about 2.62% of the NET Cultivable Area.

Diversification of crop cultivation area largely depends on land types, crop variety and irrigation facilities. At present total different cultivated cropped area is 30433 ha of which rice

cropped area are 19550 ha and the rest 10883 ha is covered by non-rice crops (Jute, Potato, Chili, W & S. vegetables, pulses, and oilseeds and Fruits etc.). The rice and non-rice cropped area are about 64% and 36% respectively of the total cropped area.

Crops yield depends on variety, balanced use of fertilizer, pest control, irrigation and other management. Total crop production is 155745.8 metric tons of which rice production is 65156.4 metric tons and non-rice production is 90589.4 metric tons. Among the rice crops the contributions of T. Aus, T. Aman (LV), T. Aman (HYV) and Boro (HYV) and Boro (Hybrid) are about 7%, 1%, 30%, 57% and 4% respectively. The highest contribution among the non-rice crops are potato (41%) followed by jute (22%), winter vegetables (14%) and spices (8%) respectively

In Rabi season mechanized irrigation can help to increase crop diversification. During Rabi season 70-100 % land area covered by irrigation. It is reported that farmers of Sonatala Upazila resort to supplementary irrigation to rain fed crops when needed or during drought period. The main source of water is both surface and ground water. Total of 6887 different machines are used for irrigation in Sonatala Upazila. A total of 60 DTW, 6815 STW and 12LLP along with other indigenous irrigation tools are used for lifting water. All DTW and 60 STW has electricity connection but 6577 STW and 7 LLP has no electricity connection. Farmers want nonstop electricity supply during Boro season. Majority of the farmers reported that irrigation drainage system of DTW is katcha (75-100%) but 100% STW and LLP drains are katcha which is the cause of wastage of irrigation water. Farmers wanted pucca drainage system.

The present study assessed financial profitability of Brinjal, Tomato, Potato and Cabbage/cauliflower vegetables production under Sonatala Upazila. Tomato cultivation was found to be most profitable (Tk. 377485 per ha) followed by Brinjal (Tk. 370226.1 per ha), Cabbage/Cauliflower (Tk. 373500) and potato production (Tk. 227308.9 per ha).

Rice production cost of Boro and Aus are Tk.18.65 and Tk.18.64 per kg, and Aman rice production cost is Tk.17.61 per kg which is less than Boro and Aus. Department of Agriculture Marketing estimated production cost for Boro rice Tk.18.20per kg, Aman rice Tk.18.08 per kg and Wheat Tk.23.50 per kg in the year 2015-16. On this basis Government has declared buying rate of Boro rice Tk.20.70, Aman rice Tk18.50 per kg and Wheat 27.02 per kg respectively.

Remarkable changes in land coverage of cultivated crops have been noticed over last 10 years in Sonatola Upazila. Highest increase occurred in Maize (133%) followed by tuber crops (107%), winter vegetables (74%) and oilseeds. But on the other hand, highest decrease occurred in sugarcane (-80%) followed by local paddy (-68%) and spices crops cultivation (-12%). Among the other purposes remarkable significant change occurred in Brick field (133%) and

followed by poultry farm (120%), Gardening (26%), fish cultivation (13%) and Housing (27%) respectively. This finding clearly indicated crop land day by day has gradually decreased which will be reflected on overall agriculture crop production.

The major problems in agriculture sector of Sonatala identified are: Sudden flood & water Logging, Less availability of different quality HYV crop seeds, River erosion, siltation of canals and river, katcha drainage system, indiscriminate use of water resources by setting up irrigation pump, lack of seed store for high value crops, lack of cold storage and vegetable cool-chamber, and lack of vegetables and fruits whole sale market infrastructure, less availability of agriculture machineries (power tiller/tractor, harvester, sprayer and foot pump) and high price, post-harvest loss of litchi, mango and potato and other vegetables is high. There is no agro processing center and industries at Unions level.

For the development of agricultural sector in the Upazila issues identified are: Ensure availability of good quality crop seeds and cultivation machineries. katcha drains need to be made pucca drains, improvement road communication at union level, agro-processing and marketing infrastructure development, re-excavation of canals and irrigation facilities need to be improved for mitigating impacts of crop production related vulnerabilities and climate change.

Specific recommendations made for the improvement of agriculture sector are, in each union one wholesale market infrastructure need to be constructed in each Union one seed store infrastructure and cold storage and food godown/warehouse need to be established, and finally establishment of potato and vegetables & fruits processing, grading and packaging industry/facility in each Union of the Upazila

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## **List of Abbreviations/Acronyms**

AEO	Agriculture Extension Officer
AEZ	Agro-Ecological Zone
AVRDC	Asian Vegetable Research and Development Center
BARI	Bangladesh Agriculture Research Institute
BCR	Benefit Cost Ratio
BINA	Bangladesh Institute of Nuclear Agriculture
BRRI	Bangladesh Rice Research Institute
BSRI	Bangladesh Sugarcane Research Institute
CC	Climate Change
DAE	Department of Agricultural Extension
DTW	Deep Tube well
DS/m	Deci-Siemens/meter
FAO	Food and Agricultural Organization
GO-	Government Organization
GoB	Government of Bangladesh
Ha	Hectare
HL	High Land
HQ	Head Quarter
HYV	High Yielding Variety
HHS	Household Survey
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan (IPMP)
KII	Key informant Interview
LIV	Local Improved Variety
LV	Local Variety
LL	Low Land
LLP	Low Lift Pump
MoL	Ministry of Land
MHL	Medium High Land
MLL	Medium Low Land
NCA	Net Cultivable Area
NIPM	National Integrated Pest Management
NLUP	National Land Use Policy
NWP	National Water Policy

NWMP	National Water Management Plan
p <sup>H</sup>	Negative Logarithm of Hydrogen Ion Concentration
SAAO	Sub-Assistant Agricultural Officer
SRDI	Soil Resource Development Institute
SPSS	Statistical Package for the Social Sciences
STW	Shallow Tube Well
T. Aman	Transplanted Aman
T. Aus	Transplanted Aus
ToT	Training of Trainers
UAO	Upazila Agricultural Officer
UDD	Urban Development Director
VLL	Very Low Land
ULO	Upazila Livestock Officer
UFO	Upazila Fisheries Officers
WARPO	Water Resources Planning Organization
W&S	Winter & Summer

## CHAPTER ONE: INTRODUCTION

### 1.1 Background of the Study

Agriculture is a life supporting system to improve human civilization. Bangladesh is one of the world's largest agriculture based country. It contributes about 15.96 percent to the GDP (Krishi Diary 2016). About 50 percent of the labor forces are employed in agricultural sector. About two million people are adding per year to the population. On the other hand, rapid urbanization, industrialization and infrastructural development reduce agricultural land. Furthermore, agricultural land is degrading day by day for many reasons. So, Bangladesh is likely to face food security problem within a very short time. To cope-up with this problem, cultivable area needs to cover under single crop to double crop, double crop to triple crop and introducing of modern technology. Subsistence agriculture is transforming into commercial agriculture as well.

Area of Sonatala Upazila is 156.73 sq.km located in between and 24°54' and 25°04' North latitudes and in between 98°26' and 89°36' East longitudes. Sonatala Upazila is a flood prone area located at Bogra district under Rajshahi Division. It borders Rangpur Division to the north, Sariakandi Upazila to the east and south, Gabtali Upazila to the south and west, and Shibganj Upazila, Bogra to the west. The major rivers of the area are Jamuna and Bangali. Jamuna River runs along the eastern part of the Upazila adjoining to Tekani Chukainagar, Pakulla and Jorgacha Union from north to south. The AEZ of the Upazila has been identified as (a) Tista River Meander Floodplain AEZ-3, and (b) Active Brahmaputra-Jamuna Flood plain AEZ-7 (BARC 1997). The Upazila has 331.61 acre khas land. It consists of 1 Municipality and 7 Unions. Number of mouzas and villages in the Upazila are 101 and 131 respectively.

Land is a finite resource for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, and water catchment and storage. Bangladesh is a densely populated country. Increased population imposes high pressure on land resources for agricultural production. Additionally, rapid population growth causes conversion of agriculture land into settlement, industrial area and urban zone. Conversions of agricultural land are necessary, but very often are avoidable. Improper land use causes various forms of land degradation as a result Sonatala Upazila under Bogra District agriculture production is being reduced. Indiscriminate land conversion will impose threat to national food security. Furthermore, improper land uses affect habitats of flora and fauna and thus impact ecosystem and biodiversity. Protecting agriculture land and to meet rational needs of other sectors are our great national challenges.

In view of the above mentioned context, a comprehensive study was conducted in all the Unions of Sonatala Upazila to assess present situation of land uses, related problems and potentialities of land for different other uses, and to find out possible coping ways to solve the problems. Therefore, considering all available parameters and characteristics of the area a sustainable land management is thought to develop better crop production.

## **1.2 Objectives of the Study**

The main objective of the study is to assess the present cropping pattern and cropping intensities (single, double and triple crop area), land utilization and flood level. The main study questions are to determine the growth or decline of agricultural land during last ten years (from 2005-2016) and to find out causes for growth or decline considering possible quality of existing and future agricultural land in the project area. The study has also been commissioned to determine the present scenario in agriculture practices and assessment of potentials for sustainable future development of the sector.

## **1.3 Approach and Methodology**

A multi-disciplinary, participatory and interactive method has been followed in carrying out the study. Both primary and secondary data were reviewed. The primary data were collected through KII (Key Informant Interview) and field visit. KII information was collected by using survey questionnaire (Annex-1). The secondary data were collected and reviewed on land use from DAE Union and Upazila Office documents. KII information was collected from 20 Sub-Assistant Agriculture Officers under 1 Municipality and 7 Unions through interview. Structured and semi-structured questionnaire was used for data collection (Annex-2). Data collection and consolidation occurred simultaneously. Data consolidation activities, such as editing, coding, classifying and data entry into the computer software for analysis were carried out simultaneously. Frequency tables (one, two or multiple ways) were prepared for interpretations and analyses using SPSS for data analysis.

## **CHAPTER TWO: AGRICULTURE RELEVANT POLICY FRAMEWORK**

This Chapter presents a review of the national policy, legal and regulatory framework relevant to the agriculture aspects of the Project.

### **2.1 National Agriculture Policy, 2013**

The National Agriculture Policy, 2013 approved by the Government of Bangladesh focuses on agriculture production, alleviating poverty through generating jobs and ensuring food security. The Policy outlined nine specific objectives. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture.

The GoB will pursue programme for agro-ecologically disadvantaged regions in the hilly area, drought-prone area, Barind tract, char land, haor-baor and coastal belt with appropriate technological support.

To increase water productivity and enhance irrigation efficiency through optimal use of available water resources the GoB will facilitate dissemination of water management technology. Modern irrigation, drainage and water application systems will be introduced for expanding irrigation coverage including difficult or disadvantaged areas i.e. in char, hilly areas, Barind Tract, drought-prone and saline areas.

The proposed Preparation of Development Plan for Fourteen Upazilas Package: 04 are expected to contribute to achieving the objectives of the agriculture policy.

### **2.2 Master Plan for Agricultural Development in Southern Region of Bangladesh, 2013**

The Master Plan for Agriculture Development in the Southern Region of Bangladesh has been prepared by the Ministry of Agriculture in collaboration with the Ministry of Fisheries & Livestock and Ministry of Water Resources and with technical assistance from the Food and Agriculture Organization of the United Nations (FAO). The Plan covers three hydrological regions- south central, southwest and southeast of the coastal zone covering 14 districts. The objective of the Plan is to provide a road map for integrated agricultural development in the coastal districts of Bangladesh, aiming at sustainable food security, poverty reduction and livelihood development for the poor. The Plan particularly focuses on, among others increasing agricultural production and productivity; improving water management, infrastructure development for surface water irrigation; improving productivity of brackish water shrimp and

capture fisheries; and promoting smallholder poultry and dairy development. The Plan formulated a set of programmes and activities across all branches of agriculture and other related fields. The Plan is for 2013 to 2021.

The proposed Preparation of Development Plan for Fourteen Upazilas Package 04 is expected to contribute to achieving the objectives of the Master Plan for Agriculture Development in the Sonatala Upazila under Northern Region of Bangladesh.

### **2.3 National Water Management Plan, 2001 (Approved in 2004)**

The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, envisions establishing an integrated development, management and use of water resources in Bangladesh over a period of 25 years. WARPO has been assigned to monitor the national water management plan. The major programs in the Plan have been organized under eight sub-sectoral clusters: (i) Institutional development, (ii) Enabling Environment, (iii) Main Rivers, (iv) Towns and rural areas, (v) Major cities; (vi) Disaster Management; (vii) Agriculture and Water Management, and (viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs, and a total of 84 sub-sectoral programs have been identified and presented in the investment portfolio.

Preparation of Development Plan for Fourteen Upazilas Package: 04 have been designed in line with this Plan and address its key objectives for the water resource management in the Sonatala Upazila areas.

### **2.4 The Ground Water Management Ordinance, 1985 (Ordinance No. XXVIT of 1985)**

This is an Ordinance to manage ground water resources for agricultural production. This Act authorizes the Thana Parishad (Police Station) to grant license for installing tube wells under its jurisdiction. The Thana Parishad may grant the license if the Parishad is satisfied that the installation of the tube well applied for complies with the following points;

- will be beneficial to the areas where it is to be installed; or
- will not have any adverse effect upon the surrounding areas, or is otherwise feasible.

Preparation of Development Plan for Fourteen Upazilas Package: 04 have been designed in line with this Plan and address its key objectives for the ground water management ordinance for Sonatala Upazila.

## **2.5 National Land Use Policy (MoL, 2001)**

The National Land Use Policy enacted in 2001, aims at managing land use effectively to support trends in accelerated urbanization, industrialization and diversification of development activities. The NLUP urges that increasing the land area of the country may not be possible through artificial land reclamation process, which is cost-effective only in the long run. Therefore, land use planning should be based on the existing and available land resources. The policy suggests establishing land data-banks where, among others, information on accreted reverie and chars will be maintained. Among the 28 policy statements of NLUP, the following are relevant to the Sonatala Upazila area:

- Forests declared by the Ministry of Environment and Forests will remain as forest lands;
- Reclassification of forest lands will be prevented; and
- Effective green belts will be created all along the Upazila area.

Preparation of Development Plan for Fourteen Upazilas Package: 04 are designed in accordance with this Policy and will comply with the above listed requirements.

## **2.6 National Water Policy, 1999**

Endorsed by the GoB in 1999, the National Water Policy (NWP) aims to provide guidance to the major players in the water sector for ensuring optimal development and management of water. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) are required to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks.

The proposed Preparation of Development Plan for Fourteen Upazilas Package: 04 are expected to contribute to achieving the objectives of the national water policy.

## **2.7 National Integrated Pest Management (NIPM) Policy**

IPM Action Plan supports a strategy that promotes use of biological or environmental pest control methods and reduces reliance on synthetic chemical pesticides. Agriculture, rural development and health sector projects have to avoid using harmful pesticides. Other pesticides can be used, but only as an element of an Integrated Pest Management Plan (IPMP) that emphasizes environmental and biological controls.

The proposed Preparation of Development Plan for Fourteen Upazilas Package: 04 is expected to contribute to achieving the reduces pesticides used in agriculture sector and increases use of other pest control methods under National IPM policy.



## **CHAPTER THREE: PRESENT LAND USE**

### **3.1 Description of the Present Situation**

The land of Sonatala Upazila is intensively used for agriculture, settlements, fisheries & housing, poultry and other infrastructural development. Sonatala Upazila falls into 2 Agro-ecological zones of the Upazila are: a) Tista Meander Floodplain AEZ-3 and b) Active Brahmaputra-Jamuna Flood plain AEZ-7 (BARC1997). The land of this Upazila is intensively used for agricultural purposes. Wide range of crops grow here in Rabi and kharif season like paddy, jute, wheat, maize, sugarcane, potato, spices, oilseeds, vegetables etc. Fruits grow well here are mango, jackfruit, coconut, banana, litchi, papaya, palm etc. Land resources of this upazila have been brought into mango orchard and poultry farms in commercial basis. Most of the people of this Upazila are directly and indirectly dependent on agriculture. It is reported that natural disasters like prolonged drought, decreasing ground water, heavy rain, early rain, erosion, cold, fog and hail-storm damage crops of this upazila. Shifting agricultural land to non-agricultural purposes and land degradation is common phenomena in this Upazila. Protecting agricultural land, minimizing land degradation and introducing modern technology are the basic needs to cope-up with the increasing demand of food for the growing population of this Upazila.

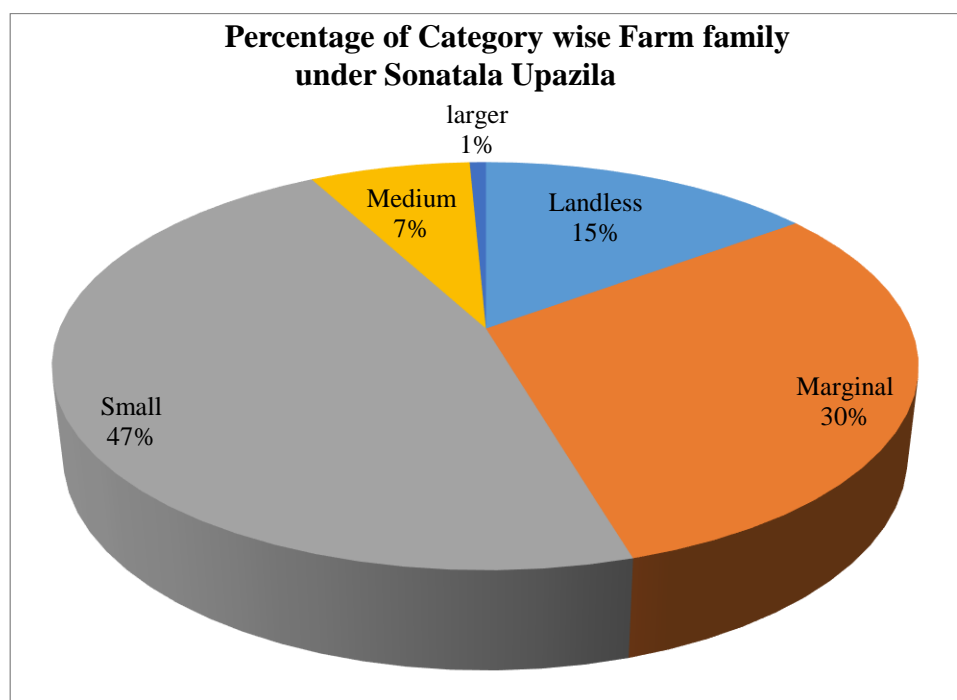
### **3.2 Sonatala Upazila and Union Wise Farm Families**

Farmers in Sonatala Upazila lead their livelihood from agricultural activities. It is the main source of their employment and income. Sonatala Upazila has 7 Unions and 1 municipality. It has 22 agricultural blocks under DAE. It has in total 101 mauza and 131 villages. Farm family is categorized according to farmer holding own land. There are five categories of farm family in Bangladesh. These are: landless (0.05-0.50 acre land), marginal (0.51-1.50 acre land), small (1.51-2.50 acre land), medium (2.51-7.50 acre land) and larger (above 7.50 acre land). Union and category wise farm family under Sonatala Upazila is shown in Table 3.1. On an average there are about 7022 land less, 14585 marginal, 21961 small, 3369 medium large and remaining 340 are larger farm families under Sonatala Upazila. The highest percentage of farm families are small farmers (47%) followed by marginal (30.00%), landless (15%), medium farmers (7%) and remaining 1% larger farmers (Fig3.1). It is evident that most of the farm families' fall in the small and marginal category. With the increasing number of population the pressure on land is increasing day by day. As a result, the number of small, marginal and landless farm families is gradually increasing creating pressure on livelihood in the Upazila.

**Table 3.1: Union and Category Wise Farm Family under Sonatala Upazila**

Name of Union	Landless (%) (0.05-0.50 acre)	Marginal (%) (0.51-1.50 acre)	Small (%) (1.51-2.50 acre)	Medium (%) (2.51-7.50 acre)	Larger (%) (above 7.50 acre)	Total
Balua Union	1520(18.41)	2530(30.64)	2720(32.94)	1352(16.37)	135(1.64)	4257
Sonatala Sadar	584(14.37)	1582 (38.93)	1721(42.35)	177 (4.35)	00 (0.00)	4064
Madhupur Union	590(11.37)	1375(26.51)	3074(59.26)	145(2.80)	3 (0.06)	5187
Tekani Chukainagar	1050 (19.18)	1710 (31.23)	2442 (44.60)	255(4.66)	18 (0.33)	5475
Digdair Union	1310 (16.49)	2460(30.96)	3512 (44.20)	583 (7.34)	80(1.01)	7945
Jorgacha Union	1205 (17.20)	3025(43.17)	2325(33.18)	400(5.71)	52(0.74)	7007
Pakulla Union	405 (7.56)	1365(25.48)	3212(59.95)	364(6.79)	12 (0.22)	5358
Sonatala Municipality	358 (8.99)	538(13.50)	2955 (74.17)	93(2.33)	40 (1.00)	3984
<b>Total</b>	<b>7022 (14.85)</b>	<b>14585 (30.85)</b>	<b>21961 (46.45)</b>	<b>3369 (7.13)</b>	<b>340 (0.72)</b>	<b>47277</b>

Source: SAAOs and UAO Sonatala Upazila, DAE 2016

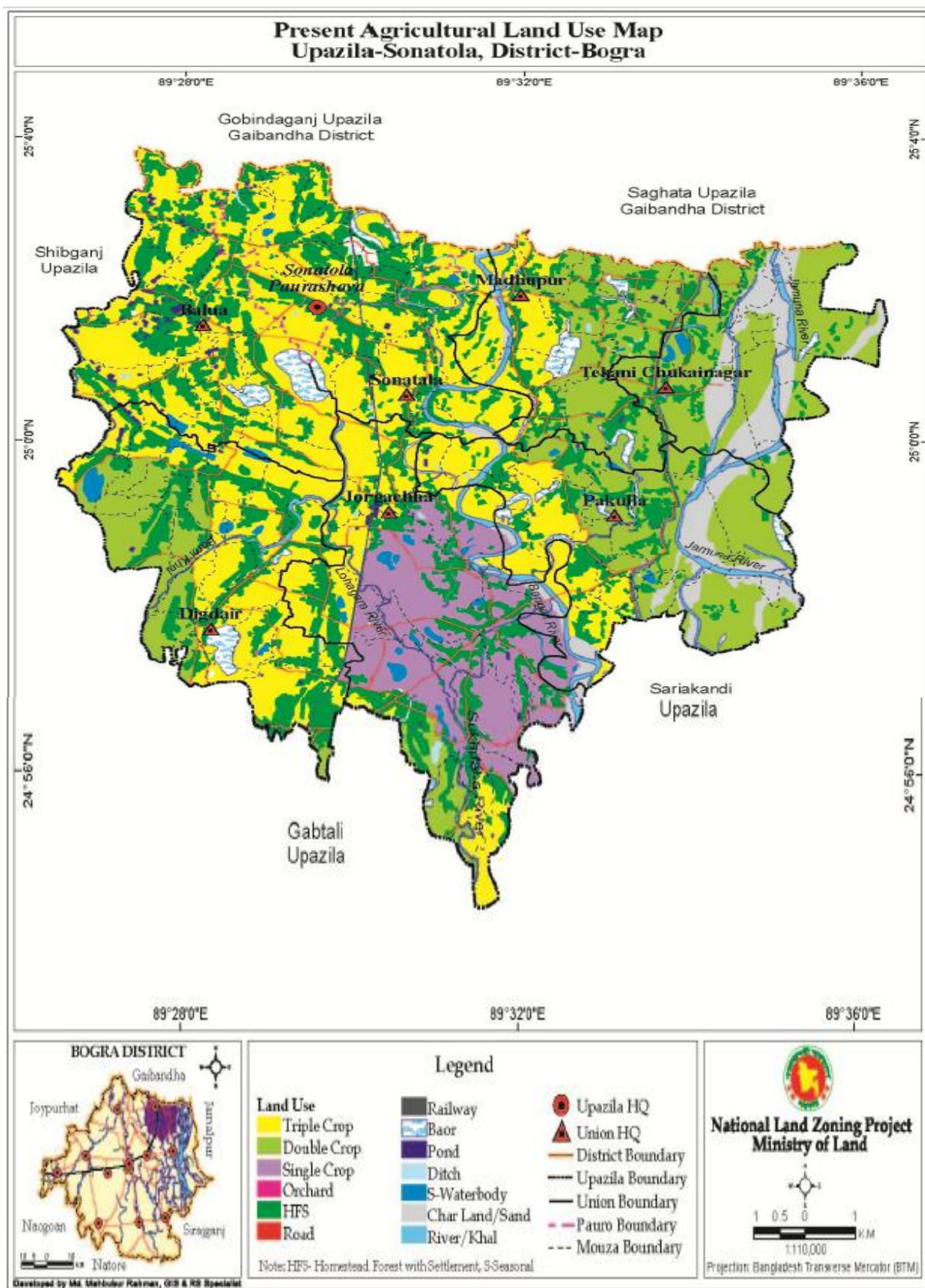


Source: SAAOs and UAO Sonatala Upazila, DAE 2016

**Figure 3.1: Percentage of Category wise Farm family under Sonatala Upazila**

Union-wise Present Agriculture Land Use Information and Identified land Zoning of Sonatala Upazila are shown in Table 3.2. There are four types of land zoning proposed for Sonatala Upazila by National Land Zoning project, July 2016 which is shown in Table 3.3. These are: (1) Agriculture Zone, (2) Agro-Fisheries Zone, (3) Agriculture-Char Land and 4. Paurashava Area and Upazila Land use Map is shown in Map 3.1.

**Map 3.1: Present Agricultural Land use Map of Sonatala Upazila**



**Table 3.2: Present Land Uses and proposed land Zoning of Sonatala Upazila**

Union	Area (Ha)	Top Soil Texture	Cropping Intensity (%)	Land Use (Summarized)	Area (Ha)	Percentage (%)	Recommended Land Zoning
<b>Balua</b>	2178.19	Loam to Silt Loam	233	Agricultural Land	1321.00	60.65	Agro-fisheries Zone
				Brick-field	3.50	0.16	
				Road	17.90	0.82	
				Rural Settlement & HV	654.74	30.06	
				Water Bodies	181.05	8.31	
<b>Digdair</b>	2534.90	Loam to Clay	230	Agricultural Land	1687.28	66.56	Agro-fisheries Zone
				Brick-field	2.13	0.08	
				Road	21.78	0.86	
				Rural Settlement & HV	658.69	25.98	
				Water Bodies	165.03	6.51	
<b>Jorgacha</b>	2967.65	Loam to Sandy Loam	250	Agricultural Land	2084.68	70.25	Agriculture Zone
				Char Land/Sand	33.88	1.14	
				Brick-field	1.23	0.04	
				Road	37.29	1.26	
				Rural Settlement & HV	608.73	20.51	
				Water Bodies	201.84	6.80	
<b>Madhupur</b>	1719.58	Loam to Clay Loam	245	Agricultural Land	1187.20	69.04	Agro-fisheries Zone
				Char Land/Sand	11.45	0.67	
				Road	17.88	1.04	
				Rural Settlement & HV	343.23	19.96	
				Water Bodies	159.83	9.29	
<b>Pakulla</b>	2658.46	Loam to Silt Loam	218	Agricultural Land	1703.32	64.07	Agriculture-Char Land Zone
				Char Land/Sand	348.71	13.12	
				Road	9.43	0.35	
				Rural Settlement & HV	358.31	13.48	
				Water Bodies	238.69	8.98	
<b>Sonatala</b>	1128.28	Loam to Clay	242	Agricultural Land	728.06	64.53	Agriculture Zone
				Char Land/Sand	14.58	1.29	

Union	Area (Ha)	Top Soil Texture	Cropping Intensity (%)	Land Use (Summarized)	Area (Ha)	Percentage (%)	Recommended Land Zoning
				Road	14.12	1.25	
				Rural Settlement & HV	283.14	25.09	
				Water Bodies	88.38	7.83	
<b>Tekani Chukainagar</b>	1665.49	Loam to Clay Loam	233	Agricultural Land	981.94	58.96	Agriculture-Char Land Zone
				Char Land/Sand	428.25	25.71	
				Road	5.15	0.31	
				Rural Settlement & HV	133.76	8.03	
				Water Bodies	116.38	6.99	
<b>Sonatala Paurashava</b>	1177.60	Loam to Clay Loam	261	Agricultural Land	651.66	55.34	Agriculture Zone
				Road	16.02	1.36	
				Rural Settlement & HV	425.14	36.10	
				Urban Built-up Area	24.08	2.04	
				Water Bodies	60.70	5.15	

**Table 3.3: Proposed land Zoning for Sonatala Upazila**

Name of Zone	Union	Remarks
<b>Agriculture Zone</b>	Jorgacha and Sonatala	Considering present agriculture land use, land suitability analysis and as per opinion of local people these unions are identified as agriculture zone.
<b>Agro-Fisheries Zone</b>	Balua, Digdair and Madhupur	There are some beels which are potential for capture fisheries and also famous for high production of culture fisheries.
<b>Agriculture-Char Land Zone</b>	Pakulla and Tekani Chukainagar	This zone is identified due to the fact that the unions are located at the bank of Jamuna river consisting of char land and vulnerable due to river erosion and flood.
<b>Paurashava Zone</b>	Sonatala Paurashava	Paurashava urban development activities should be carried out without degrading fertile agriculture land.

Source: National Land Zoning Project, July 2016

### 3.3 Present Agricultural Land Use

#### 3.3.1 Present Upazila Land Use

Multiplicity of cropping systems has been one of the main features of the Upazila. Farmers are harnessing their livelihood by producing various crops round the year. At the same time, the pressure of population on land and other natural resources along with rapid urbanization is a major factor for changing land-use patterns rapidly which has adverse effect upon Upazila's agricultural land. However, there has been a positive change in adoption of modern technologies like high-yielding varieties of rice and other crops, irrigation and mechanized cultivation in this area. It is recognized that a change has taken place in production of different crops including fruit and vegetable in this region.

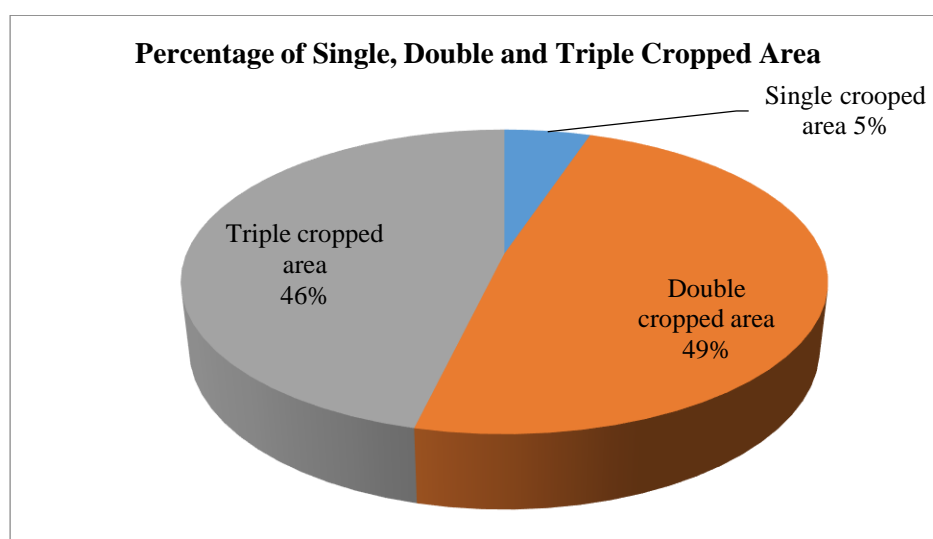
The land of Sonatala Upazila is dominant in agriculture and also intensively used for poultry, fish culture, settlements with homestead forest and other infrastructural activities. Sonatala Upazila gets high potentials for its land and agricultural production. This Upazila holds an important arena in Bogra district with her natural resources and ecosystem. The scenario of Sonatala Upazila present different land utilized is shown in Table 3.4. Types of lands are 3120 ha high land, 7715 ha medium high land, 2360 ha medium low land and 145ha low land respectively. This Upazila has 369 ha permanent fallow land. Land were not fallows in Rabi season but 7850 ha Kharif-1 and 300 ha kharif-11 season were fallows under Sonatala Upazila. The soil P<sup>H</sup> is 5.4---7.9 and soil texture is sand/silt loam K-bearing minerals medium (SRDI February 1997). This Upazila covers 13340 ha of net cropped area of which about cultivated area is 32500 ha. The highest land area is 6380 ha is used as double crop and followed by triple crop of 6075 ha and remaining 675 ha is used as single crops. Other land use: Permanent Fruit Garden 118ha, Forest 90ha and Fish cultivation 782 ha. Percentage of single, double and triple cropped area used in Sonatala Upazila is shown in Figure 3.2. The highest percentage is double cropped area (49%) followed by triple cropped area (46%), single crop area (5%) under Sonatala Upazila. The cropping intensity of Sonatala Upazila is 244%.

**Table 3.4: Present Land Used under Sonatala Upazila**

Sl. No	Upazila Land use	Total Area (ha)
1	Total Agricultural land	13340
2	High Land	3120
3	Medium high land	7715
4	Medium low land	2360
5	Low land	145
6	Permanent fallow land	369
7	Current fallow land (with fallow period) →Rabi fallow	-
8	→Kharif-1,	7850

Sl. No	Upazila Land use	Total Area (ha)
	→Kharf-11	300
9	Net cropped area	13340
10	Single cropped area	675
11	Double cropped area	6380
12	Triple cropped area	6075
13	Total cropped area	32500
14	Cropping Intensity (%)	244
15	Irrigated land area (%)	100
16	Forest area	90
17	Water land (River, Ponds and others)	782
18	Permanent Fruit Garden	118

Source: UAO Sonatala Upazila, DAE 2016



Source: UAO Sonatala Upazila, DAE 2016

**Figure 3.2: Percentage of Single, Double and Triple Cropped Area under Sonatala Upazila**

### 3.4 Union-Wise Present Agriculture Land Use

Sonatala Upazila has 7 Unions and 1 Municipality present lands used are given below.

#### 3.4.1 Balua Union Land Use

##### General Description

Land type is the main factor for choice of crops and cropping pattern of union. Selection of crops or cropping patterns largely depends on the topographic position of land in relation to seasonal inundation depth and its duration. Lands which are above normal inundation level can wide range of opportunities for growing year round crops. Balua Union having agriculture cultivated area of 4970 ha of land of which net cropped area is 1990 ha. The land types of this union are highland (24.37%), medium high land (41.46%), Medium low land (28.89%) and

Low land (5.28%) and soil texture is sandy loam to silt loam which indicates lands are suitable for different Rabi crops and Kharif crops cultivation(SAAO, 2016). Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is ranges from 5.5-7.5. This Union is highly suitable for cultivation of Boro (HYV/Hybrid), T. Aman (HYV), wheat, Mustard, Jute, Potato and vegetables and fruits production. This Union has 35 Mango, 76 Banana, 12 Litchi, 10 Guava and 7 Papaya commercial garden (SAAO, 2016).

### Present Agriculture Land Use

Lands of this union are above normal inundation level can wide range of opportunities for growing year round crops. Balua about 91% lands are used for agriculture. Boro (HYV) is the main irrigated crops cultivated by using ground water and surface water. There are ten cropping pattern are practiced under Balua Union which is shown in Table 3.5. The cropping intensity of this union is 250%. Boro (HYV/Hybrid) and T. Aman (HYV) and T. Aus (HYV) are the principal crops under this Union. Major crops cultivated in this union are: paddy, Jute, Wheat, Chili, Potato, Mustard and Rabi & Kharif different vegetables and different fruits (SAAOs, Balua Union 2016).

**Table 3.5: Present Cropping Patterns of Balua Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	Percentage of NCA
Balua	1990	Boro(HYV)→Fallow→T. Aman(HYV)	250	650	32.66
		Boro (HYV)→Fallow→ Fallow		100	5.03
		Potato→ Jute→ T. Aman		90	4.52
		Wheat→T. Aus/Jute→T. Aman (HYV)		35	1.76
		Mustard→Boro (HYV)→ T. Aman		240	12.06
		Potato→Boro (HYV/Hybrid)→ T. Aman		660	33.17
		Chili→ Jute→T. Aman		45	2.26
		Pulses→Fallow→ T. Aman		5	0.25
		Spices→ Fallow→ T. Aman		15	0.75
		Vegetable→Vegetable→Vegetable		150	7.54
		<b>Total</b>		<b>1990</b>	<b>100.00</b>

Source: SAAOs of Balua Union 2016

### Major Problems on Crop Cultivation

The **major problems** in Balua Union crop cultivation are: (i) Less availability of quality HYV seeds, (ii) River erosion, (iii) Water Logging,(iv) Most of the canals and river silted (v) Katcha irrigation drainage system, (v) Lack of seed store, cold storage and vegetable agro-based



industries (vi) Lack of vegetables and fruits market infrastructure (vii) Less availability of modern power tiller/tractor, harvester, sprayer and foot pump and high price(viii)Essential plant nutrient deficiency in soil and risk of sudden flood (ix) Pests and diseases (x) Low market price of agricultural commodities and (xi) Farmers lack of modern technological knowledge and (xii) The valuable agricultural land is reducing every year due to man-made unplanned various development construction works (SAAOs, Balua Union 2016).

### **Recommendation**

Agricultural productivity is measured in terms of agricultural outputs to agricultural inputs. It will increase agricultural production, generate income, increase purchase capacity and improve rural livelihoods. The suggested management practices for improving crop cultivation are: (1) Ensure improve quality HYV crop seeds, fertilizers, pesticides and machineries (2) Re-excavation of old silted canals/rivers (3) To increase the organic matter contents in soil, leguminous crop cultivation could be suggested in the present cropping pattern. Besides, application of organic manure and bio-fertilizer can improve deficiency of soil nutrients (4) wholesale market infrastructures development and also road communication system at local level (5) Arrangement to sale for produced crops by cooperative system (6) Katcha irrigation drainage system need to converted into pucca or underground pipe system (7) Arrange and allocate sufficient credit without or less interest for poor farmers (8) Technological training for farmers (SAAOs, Balua Union 2016).

### **3.4.2 Sonatala Sadar Union Land Use**

#### **General Description**

The land of Sonatala Sadar union is intensively used for agriculture, housing, settlement, industries, fisheries and other infrastructure). This Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is 5.5-7.5 and soil texture is sandy loam to silt loam. Sonatala Sadar Union having agriculture cultivated area of 2306ha of land of which net cropped area is 923 ha. The land types of this union are highland (16.25%), medium high land (37.92%), Medium low land (37.38%) and Low land (8.45%). High land and medium high land is suitable for diversified crops cultivation including T. Aman, Boro (HYV), wheat, maize, mustard, sugarcane, vegetables etc. Mango and papaya orchard occupied high and medium high land of this Union. Medium high lands to medium low land area are suitable for yielding bumper crops in Rabi season. This Union has 3 Mango, 10 Banana, 3 Litchi and 2 Papaya commercial gardens (SAAOs, 2016).

## Present Agriculture Land Use

There are nine cropping pattern is practiced under Sonatala Sadar Union which is shown in Table 3.6. This Union 86% lands are used for agriculture. The cropping intensity of this union is 249.75%. Lands of this union are above normal inundation level can wide range of opportunities for growing year round crops. Boro (HYV) is the main irrigated crops cultivated by using ground water. Boro (HYV/Hybrid) and T. Aman (HYV) and T. Aus (HYV) are the principal crops under this Union. Major crops cultivated in this union are: paddy, Jute, Wheat, Chili, Potato, Mustard and Rabi & Kharif different vegetables and different fruits (SAAOs of Sonatala Sadar Union, 2016).

**Table 3.6: Present Cropping Patterns of Sonatala Sadar Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	Percentage of NCA
Sonatala sadar	923	Boro(HYV)→Fallow→T.Aman(HYV)	250	315	34.13
		Boro (HYV)→Fallow→ Fallow		78	8.45
		Wheat/Maize→Jute→T.Aman (HYV)		80	8.67
		Chili→ Jute→ T Aman		55	5.96
		Mustard→Boro (HYV)→ T.Aman		230	24.92
		Potato→Boro (HYV/Hybrid)→ T.Aman		30	3.25
		Pulses→Fallow→ T.Aman		32	3.47
		Spices→ Fallow→ T.Aman		63	6.83
		Vegetable→Vegetable→Vegetable		40	4.33
		<b>Total</b>		<b>923</b>	<b>100.00</b>

Source: SAAOs of Sonatala Sadar Union, 2016

## Major Problems on Crop Cultivation

The major problems in this Union are: (i) The potential agricultural land is converted into non-agricultural land rapidly in every year due to unplanned human infrastructural construction activities in this union (ii) Most of the existing canals of the union were found closed or silted up to sedimentation and unplanned development construction which were barriers to natural flow of water and ultimately deteriorating drainage system in most of the areas of the union (iii) Scarcity of water for irrigation due to lack of electricity, higher cost LLPs, STWs and DTWs in the local markets are the main problems for intensive irrigation in the area (iv) Lack of wholesale market infrastructure, seed store and cold storage facilities (v) Sudden flood and water Logging (v) Less availability of power tiller/tractor, harvester, sprayer and foot pump and high price (vi) Farmers lack of modern technological knowledge (vii) Low market price of agricultural commodities and (viii) Deficiencies of essential plant nutrients and soil moisture

deficit during the dry months are the other common problems restricting intensive crop cultivation in the union (SAAOs, Sonatala Union 2016).

### **Recommendation**

The main suggested management practices are: (1) Removal of drainage congestion by re-excavation of old and silted canals (2) Inclusion of new modern variety crops (3) Establishment cold storage for produce crops (4) Reconstruction of water management infrastructures (5).wholesale market infrastructures development and also road communication system at local level, (6 ) Katcha irrigation drainage system need to converted into pucca or underground pipe system (7) Technological training for farmers (8) Introduction of drought tolerant varieties of crops are very important for better yields (9) Ensuring availability of quality both chemical and organic fertilizers and cultivation equipment's and encourage farmers cultivation of leguminous crops (10) Potential agricultural land use for non-agricultural land should be stopped immediately by imposing land zoning law and other regulatory measures by the concerned authority.

### **3.4.3 Madhupur Union Land Use**

#### **General Description**

This Union has got high potential for its land and agricultural production. Farmers in Madhupur Union lead their livelihood from agricultural activities. It is the main source of their employment and income. This Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is 5.5-6.5 and soil texture is sandy loam to silt loam. Madhupur Union having agriculture cultivated area of 3186 ha of land of which net cropped area is 1342 ha. The land types of this union are highland (7.82%), medium high land (36.96%), Medium low land (39.12%), Low land (16.10%) and very low land (0.37%). High land and medium high land is suitable for diversified crops cultivation including T. Aman, Boro (HYV), wheat, maize, mustard, Jute, winter and summer vegetables etc. Mango, Banana, Guava, papaya and orchard occupied high and medium high land of this Union. Medium high lands to medium low land area are suitable for yielding bumper crops in Rabi season. This Union has 4 Mango, 5 Banana, 3 Guava and 2 Papaya commercial gardens (SAAOs, 2016).

#### **Present Agriculture Land Use**

This Union 85% lands and 12.5% are used for agriculture and settlement. Boro (HYV/Hybrid) and T. Aman (HYV) and T. Aus (HYV) are the principal crops under this Union. Other major

crops cultivated in this union are: Jute, Wheat, Maize, Chili, Potato, Mustard and winter & summer different vegetables and different fruits (SAAOs, Madhupur Union 2016). There are 12 cropping pattern is practiced under Madhupur Union which is shown in Table 3.7. Boro (HYV) is the main irrigated crops cultivated by using ground water. The cropping intensity of this union is 234%.

**Table 3.7: Present Cropping Patterns of Madhupur Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area(ha)	% of NCA
Madhupur	1342	Boro(HYV)→Fallow→T. Aman(HYV)	234.13	320	23.85
		Boro (HYV)→Fallow→ Fallow		35	2.61
		Boro (HYV)→ B. Aman→ T.Aman		30	2.24
		Boro (HYV)→Jute→ T.Aman		210	15.65
		Wheat/Maize→Jute→T.Aman (HYV)		25	1.86
		Chili→ Boro→ T Aman		150	11.18
		Mustard→Boro (HYV)→ T.Aman		250	18.63
		Potato→Boro (HYV/Hybrid)→ T.Aman		240	17.88
		Sweet Potato→Fallow→ T. Aman		5	0.37
		Spices→ Fallow→ T. Aman		13	0.97
		Vegetable→Vegetable→Vegetable		30	2.24
		Orchard→Orchard→Orchard		34	2.53
		Total		1342	100.00

Source: SAAOs of Madhupur Union, 2016

### Major Problems on Crop Cultivation

The major problems in Madhupur Union crop cultivation are: (i) Most of the canals and river silted (ii) Katcha irrigation drainage system and wastage of water (iii) Flood & Water Logging cause of damage crops (iv) Less supply of HYV/Hybrid different crops seed. (v) Deficiencies of essential plant nutrient and drought in dry season are the acute problems restricting intensive crop cultivation in the union (vi) Lack of electricity are the problems for intensive irrigation in the peak season (vii) Less availability of power tiller/tractor, harvester, sprayer and foot pump and high price (viii) Rapid conversion of potential agricultural lands to non-agriculture uses is a major man-made cause for reducing agricultural lands (ix) Lack of vegetables and fruits whole sale market infrastructure and (x) Farmers lack of modern technological knowledge (SAAOs, Sonatala Union 2016).

### Recommendation

(1) Drainage congestion can be removed by excavating new and re-excavating old canals (2) Development of irrigation facility, uninterrupted electricity supply, proper planned uses of land

as per its physical and chemical characteristics could help to control land degradation and ensure better agricultural crops. The alluvial silt soils suitable for Rabi crops cultivation need modern management practices for their intensive cultivation (3) Extension of fruits and vegetables cultivation area (4) Development and also road communication system at local level (5) Establishment of cold storage for produce crops (6) Construction of wholesale market infrastructures (7) Arrange and allocate sufficient short term credit without or less interest for poor farmers and (8) Technological training for farmers (9) Katcha irrigation drainage system need to be converted into pucca or underground pipe system (10) Appropriate measures with motivation and awareness building program should be taken immediately to control the unplanned land uses and interventions responsible for land degradation.

#### **3.4.4 Tekani Chukainagar Union Land Use**

##### **General Description**

This Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is 5.5-6.5 and soil texture is sandy loam to silt loam. Tekani Chukainagar Union having agriculture cultivated area of 2562 ha of land of which net cropped area is 1250 ha. The land types of this union are highland (1.15%), medium high land (20.17%), Medium low land (27.67%), Low land (42.36%) and very low land (8.65%). High land and medium high land is suitable for diversified crops cultivation including T. Aman, Boro (HYV), wheat, maize, mustard, Jute, winter and summer vegetables etc. Farmers in Tekani Chukainagar Union lead their livelihood from agricultural activities. It is the main source of their employment and income (SAAOs Tekani Chukainagar, 2016).

##### **Present Agriculture Land Use**

Crops and cropping pattern mostly depends on Union land topography and seasonal inundation duration. There are 10 cropping pattern is practiced under Tekani Chukainagar Union which is shown in Table 3.8. The cropping intensity of this union is 205%. Boro (HYV/Hybrid) and T. Aman (HYV) are the principal crops under this Union. Boro (HYV) is the main irrigated crops cultivated by using ground water. Other main crops grown in this union are: Jute, Wheat, Maize, Chili, Potato, Mustard and winter & summer different vegetables (SAAOs, Tekani Chukainagar Union 2016).

**Table 3.8: Present Cropping Patterns of Tekani Chukainagar Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	Percentage of NCA
Tekani Chukainagar	1250	Boro(HYV)→Fallow→T. Aman(HYV)	205	390	31.2
		Boro (HYV)→Fallow→ Fallow		25	2
		Wheat→T. Aus→Fallow		50	4
		Wheat/Maize→Jute→T. Aman (HYV)		150	12
		Pulses→ Fallow→ T Aman		45	3.6
		Mustard→Boro (HYV)→ T. Aman		205	16.4
		Potato→Til→ Fallow		5	0.4
		Sweet Potato→Fallow→ T. Aman		15	1.2
		Spices→ Fallow→ T. Aman		320	25.6
		Vegetable→Vegetable→Vegetable		45	3.6
Total				1250	100

Source: SAAOs of Tekani Chukainagar Union 2016

### Major Problems on Crop Cultivation

The major problems in this Union are: water stagnation and drainage congestion, Low organic matter contents in soil, soil moisture deficit during the Rabi crop season, essential plant nutrient deficiency and risk of flood. Flood occurred frequently and cause degradation of natural vegetation and loss of agricultural crops. Katcha irrigation drainage system and lack of electricity supply during Boro crops season and drought. Rapid conversion of agricultural lands to uses is a major man-made cause for reducing agricultural lands. Lack of vegetables market infrastructure and cold storage and also poor communication. Shortage of labor during harvesting crops and wage rate is high and Farmers lack of modern technological knowledge and capital (SAAOs, Tekani Chukainagar Union 2016).

### Recommendation

Drainage congestion could be removed by excavating and re-excavating the new and old silted canals making connection to the adjacent rivers and khals of the union. Excavated rivers and canals could accommodate huge rain water thus improve the water logging condition, which could facilitate intensive crop cultivation in the area. Katcha irrigation drainage needs to be converted into underground pipe system which will reduce the water loss and increase irrigated crop area. Ensuring availability of both chemical and organic fertilizers, encourage farmers for cultivation of leguminous crops etc. Improvement of farmer's crop production knowledge through crop wise training should be provided in each season. Construction of wholesale market infrastructure which will help producers get a better price.

### 3.4.5 Digdair Union Land Use

#### General Description

Lands which are above normal inundation level can provide wide range of opportunity for growing both perennial and year round crops. Digdair Union having agriculture cultivated area of 4791ha of land of which net cropped area is 2209 ha. The major land types of this union are highland (16.52%), medium high land (50.93%), Medium low land (22.05%), Low land (9.82%) and very low land (0.68%). This Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is 5.5-7.5 and soil texture is sandy loam to silt loam. Farmers in Digdair Union lead their livelihood from agricultural activities. It is the main source of their employment and income (SAAOs Digdair Union, 2016).

#### Present Agriculture Land Use

The Union is dominated by agricultural crop cultivation which is done mainly under irrigated and rain fed condition. The cropping intensity of this union is 217%. There is ten cropping pattern is practiced under Digdair Union which is shown in Table 3.9. Boro (HYV/Hybrid) and T. Aman (HYV) are the principal crops under this Union. Boro (HYV) is the main irrigated crops cultivated by using ground water and surface water. Other main crops grown in this union are: Jute, Wheat, Maize, Chili, Potato, Mustard and winter & summer different vegetables & fruits. There are 45 Mango, 350 Banana, 75 Litchi, 55 Guava and 85 Papaya commercial gardens under this Union (SAAOs, Digdair Union 2016).

**Table 3.9: Present Cropping Patterns of Digdair Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	% of NCA
Digdair Union	2209	Boro(HYV)→Fallow→T. Aman(HYV)	217	836	37.85
		Boro (HYV)→Fallow→ Fallow		60	2.72
		Boro(HYV)→B. Aman-->T. Aman		600	27.16
		Wheat/Maize→Jute→T. Aman (HYV)		200	9.05
		Pulses→ Fallow→ T Aman		30	1.36
		Mustard→Boro (HYV)→ T. Aman		143	6.47
		Potato→Til→ Fallow		50	2.26
		Sweet Potato→Fallow→ T. Aman		40	1.81
		Spices→ Fallow→ T. Aman		150	6.79
		Vegetable→Vegetable→Vegetable		100	4.53
Total				2209	100.00

Source: SAAOs of Digdair Union 2016

## **Major Problems on Crop Cultivation**

The major problems in Digdair Union crop cultivation are: (i) Most of the existing canals of the union were found closed or silted up due to sedimentation and unplanned construction of houses, markets and other infrastructures which were creating barriers to natural flow of water and ultimately deteriorating drainage system in most of the areas of the union. These unfavorable situations impeded intensive cultivation of crops especially in Kharif-11 (ii) less supply of HYV/Hybrid different crops seed. (iii) Lack of agricultural machineries (iv) Risk of flood & water Logging and drought (v) Katcha irrigation drainage system, (vi) Lack of cold storage (vii) Lack of vegetables whole sale market infrastructure (viii) Road katcha & damaged (ix) Shortage of labor during harvesting crops and wage rate is high (x) Low market price of agricultural commodities. (xi) Lack of farmers capital for use of modern crop production technology.

## **Recommendation**

(1) Ensuring availability of quality HYV/Hybrid variety of crop seeds, fertilizers & pesticides in the local market (2) Improvement of drainage system for water logging by re-excavation of old canals/rivers (3) Katcha irrigation drainage system need to converted into pucca or underground pipe system (4) Development and construction of road communication system at local level (5) Establishment cold storage for produce crops (6) Introduction of drought tolerant varieties of crops are very important for higher yields and production (7) Reconstruction of water management infrastructures (8). Development of wholesale market infrastructures, (9) Arrangement for selling produced crops through cooperative system and (10) Technological training for farmers (11) Zoning of land as per existing uses and potentialities and its successful implementation through the enforcement of land zoning law would help to control land degradation as well as to ensure proper uses of agricultural land (SAAOs, Digdair Union, 2016).

### **3.4.6 Jorgacha Union Land Use**

#### **General Description**

About 80% lands are used for agriculture purposes under this Union. Farmers in Jorgacha Union lead their livelihood from agricultural activities. It is the main source of their employment and income This Union having agriculture cultivated area of 6171ha of land of which net cropped area is 2639 ha. Lands which are above normal inundation level can provide wide range of opportunity for growing both perennial and year round crops. The major land types of this union are highland (13.64%), medium high land (40.74%), Medium low land (39.94%), Low land (4.54%) and very low land (1.14%). Jorgacha Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7).



Most of the areas of these unions are developed from transformed alluvial deposit by the Tista river system. The soil  $P^H$  is 5.5-6.5 and soil texture is sandy loam to silt loam (SRDI, SAAOs Jorgacha Union 2016).

### Present Agriculture Land Use

The Union is dominated by diversified agricultural crops which are done mainly under irrigated condition. The land and ecology is suitable for fruits cultivation. There are 3 Mango, 15 Banana, 4 Litchi, 4 Guava and 17 Papaya commercial garden under this Union (SAAOs, Jorgacha Union 2016). Major crops grown in this union are: Paddy, Jute, Wheat, Maize, Chili, Potato, Mustard and winter & summer different vegetables. The cropping intensity of this union is 238%. There is 11 cropping pattern is practiced under Jorgacha Union which is shown in Table 3.10. Boro (HYV/Hybrid) and T. Aman (HYV) are the principal crops under this Union. Boro (HYV) is the main irrigated crops cultivated by using ground water and surface water.

**Table 3.10: Present Cropping Patterns of Jorgacha Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	% of NCA
Jorgacha Union	2639	Boro(HYV)→Fallow→T. Aman(HYV)	238	1410	53.43
		Boro (HYV)→Fallow→ Fallow		75	2.84
		Boro(HYV)→B. Aman-->T. Aman		150	5.68
		Wheat/Maize→Jute→T. Aman (HYV)		35	1.33
		Chili→ Fallow→ T Aman		40	1.52
		Mustard→Boro (HYV)→ T. Aman		255	9.66
		Potato→Jute→ T. Aman		230	8.72
		Sweet Potato→Fallow→ T. Aman		57	2.16
		Spices→ Fallow→ T. Aman		230	8.72
		Vegetable→Vegetable→Vegetable		114	4.32
		Ochard→Orchard→Orchard		43	1.63
Total				2639	100.00

Source: SAAOs of Jorgacha Union, 2016

### Major Problems on Crop Cultivation

The major crop cultivation problems of Jorgacha Union are: (i) Scarcity of water for irrigation due to lack of electricity, higher cost of LLPs, STWs and DTWs in local markets are the major problems for intensive irrigation in the area. (ii) less availability of quality agriculture inputs and price is high (ii) Flood & water stagnation and drainage congestion (iii) Most of the canals and river silted (iv) Katcha irrigation drainage system, (v) Drought (vi) Lack of cold storage and vegetable cool-chamber (vii) Lack of vegetables whole sale market infrastructure (viii) Road katcha & damaged, (ix) Shortage of labor during harvesting crops and wage rate is high, (x) Low market price of agricultural commodities and (xi) Farmers lack of modern technological

knowledge and farmers training budget (SAAOs, Jorgacha Union, 2016).

### **Recommendation**

(1) Removal of drainage congestion by excavating old, silted and closed canals; (2) There is an urgent need to develop and introduce drought tolerant crop varieties and drought mitigating technologies that will ensure maximum uses of the land resources rain fed farming system; (3) Availability of quality HYV/Hybrid variety of crop seeds, fertilizers & pesticides; (4) Katcha irrigation drainage system need to converted into pucca or underground pipe system; (5) Development and construction of road communication system at local level; (6) Establishment cold storage for produce crops; (7) Development of irrigation facilities, uninterrupted electricity supply, proper planned use of land which will ensure better yields of agriculture production; (8). Development of wholesale market infrastructures; (9) Arrangement for selling produced crops through cooperative system (SAAOs, Jorgacha Union, 2016).

### **3.4.7 Pakulla Union Land Use**

#### **General Description**

Land type is the main factor guiding choices of crops cultivation and cropping patterns of union area. Selection of crops and cropping patterns mostly depends on the topographic position of land in relation to seasonal flooding depth and its duration. This Union having agriculture cultivated area of 4225ha of land of which net cropped area is 2025 ha. Lands which are above normal inundation level can provide wide range of opportunity for growing both perennial and year round crops. The major land types of this union are highland (39%), medium high land (37%), Medium low land (20%), Low land (3%) and very low land (1%). Pakulla Union falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). The soil  $P^H$  is 5.5-7.5 and soil texture is sandy loam to silt loam (SRDI, SAAOs Pakulla Union, 2016).

#### **Present Agriculture Land Use**

The land and ecology is suitable for multiple crops cultivation. Major crops grown in this union are: Paddy, Jute, Wheat, Maize, Groundnut, Chili, Potato & Sweet potato, Mustard and winter & summer different vegetables. The Union is dominated by diversified agricultural crops which are done mainly under irrigated condition. Boro (HYV) is the main irrigated crops cultivated by using ground water under this Union There is 10 cropping pattern is practiced under Pakulla Union which is shown in Table 3.11. Boro (HYV/Hybrid) and T. Aman (HYV) are the principal crops under this Union. The cropping intensity of this union is 209% (SAAOs, Pakulla Union 2016).

**Table 3.11: Present Cropping Patterns of Pakulla Union**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	% of NCA
Pakulla Union	2025	Boro(HYV)→Fallow→T. Aman(HYV)	209	695	34.32
		Boro (HYV)→Fallow→ Fallow		350	17.28
		Boro(HYV)→B. Aman-->T. Aman		100	4.94
		Wheat/Maize→Jute→T. Aman (HYV)		250	12.35
		Potato→ Til→ Fallow		60	2.96
		Mustard→Boro (HYV)→ T. Aman		355	17.53
		Pulses→Fallow→ T. Aman		50	2.47
		Sweet Potato→Fallow→ T. Aman		40	1.98
		Spices→ Fallow→ T. Aman (HYV/LV)		80	3.95
		Vegetable→Vegetable→Vegetable		45	2.22
		<b>Total</b>		<b>2025</b>	<b>100.00</b>

Source: SAAOs of Pakulla Union, 2016

### Major Problems on Crop Cultivation

The major crop cultivation problems of Pakulla Union are: (i) Low organic matter in soil, soil moisture deficit during the dry months and also essential plant nutrient deficiency (ii) water stagnation, drainage congestion and also risk of food (iii) Most of the old canals and river silted and Katcha irrigation drainage system (iv) Farmers lack of modern technological knowledge, (v) lack of seed store and cold storage (vi) Lack of vegetables whole sale market infrastructure (viii) Bad communication & damaged road,(ix) Shortage of labor during harvesting crops and wage rate is high, (x) Interrupted electricity supply in Boro season (xi) The potential agriculture land is reducing rapidly in every year due to unplanned construction of various infrastructural development (xi) less availability of quality agricultural inputs (power tiller, Harvester, power sprayers) and price is high (SAAOs, Pakulla Union 2016).

### Recommendation

(1) Availability of quality HYV/Hybrid variety of crop seeds, fertilizers & pesticides and cultivation equipment's (2) Removal of drainage congestion and Katcha irrigation drainage system need to converted into pucca or underground pipe system (4) Development and construction of road communication system at local level (5) Establishment cold storage for produce crops (6) Re-excavation of old silted canals/rivers (7) Reconstruction of water management infrastructures (8). Development of wholesale market infrastructures, (9) Arrangement for selling produced crops through cooperative system (10) Technological training for farmers and financial budget for training (SAAOs, Pakulla Union, 2016).

### 3.4.8 Sonatala Municipality Land Use

#### General Description

The land of Sonatala Municipality of under Bogra district is intensively used for agriculture, housing and settlements, industries, fruit gardening and for other infrastructural development. In addition, unwise, unplanned and illegal human intervention of various natures acts as key factors responsible for degradation of valuable land resources in the long run. This Sonatala Municipality having agriculture cultivated area of 2580 ha of land of which net cropped area is 1020 ha. Lands which are above normal inundation level can provide wide range of opportunity for growing both perennial and year round crops. The major land types of this Municipality are highland (11.76%), medium high land (16.18%), Medium low land (50.98%), Low land (14.71%) and very low land (6.37%). Municipality land 82% are used for agriculture and 17% used for settlement and other purposes. Sonatala Municipality falls into 2 Agro-ecological zones are (i) Tista Meander Floodplain (AEZ-3) and (ii) Active Brahmaputra-Jamuna Floodplain (AEZ-7). The soil P<sup>H</sup> is 5.5-7.5 and soil texture is sandy loam to silt loam (SRDI, SAAOs Sonatala Municipality 2016).

#### Present Agriculture Land Use

The land and ecology is suitable for multiple crops cultivation. The land is suitable for various fruit gardening. There are 7 Mango, 20 Banana, 10 Litchi, 3 Guava and Papaya commercial fruits garden were established. Major crops grown in this union are: Paddy, Jute, Wheat, Maize, Groundnut, Chili, Potato & Sweet potato, Mustard and winter & summer different vegetables. Boro (HYV) is the main irrigated crops cultivated by using ground water under this municipality. There is 10 cropping pattern is practiced under Sonatala Municipality which is shown in Table 3.12. Boro (HYV/Hybrid) and T. Aman (HYV) are the principal crops under this Municipality. The cropping intensity of this union is 253% (SAAOs, Sonatala Municipality 2016).

**Table 3.12: Present Cropping Patterns of Sonatala Municipality**

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	% of NCA
Sonatala Municipality	1020	Boro(HYV)→Fallow→T. Aman(HYV)	253	110	10.78
		Boro (HYV)→Fallow→ Fallow		40	3.92
		Boro(HYV)→B. Aman-->T. Aman		150	14.71
		Wheat/Maize→Jute→T. Aman (HYV)		70	6.86
		Potato→ Boro(HYV)→ T. Aman		215	21.08
		Mustard→Boro (HYV)→ T. Aman		100	9.80
		Chili +Boro→Fallow→ T. Aman		80	7.84

Name of Union	Net Cultivable Area (ha)	Major Cropping Patterns	Cropping Intensity (%)	Area (ha)	% of NCA
		Boro(HYV)→Jute→ T. Aman		180	17.65
		Vegetable→Vegetable→Vegetable		60	5.88
		Orchard→Orchard→Orchard		15	1.47
<b>Total</b>				<b>1020</b>	<b>100</b>

Source: SAAOs of Sonatala Municipality 2016

### Major Problems on Crop Cultivation

The major crop cultivation problems of Sonatala Municipality are: (i) Water stagnation and drainage congestion is acute problem in this union (ii) Due to Katcha irrigation drainage system, irrigation water loss is high (iii) Most canals and river silted (iv) Farmers lack of modern technological knowledge, (v) lack of seed store (vi) Lack of cold storage and vegetable cool-chamber (vii) Lack of vegetables whole sale market infrastructure (viii) Shortage of labor during crops planting and harvesting time and wage rate is high, (ix) Low market price of agricultural commodities and (x) Deficiencies of essential plant nutrients & drought in dry season (xi) The valuable agricultural land is reducing rapidly in every year due to unplanned construction of houses, settlement, brick field and for infrastructural development activities (SAAOs, Pakulla Union 2016).

### Recommendation

(1) Drainage congestion a common problem of the union could be removed by excavating new and old canals making connection to the adjacent rivers and canals of the union; (2) Availability of quality HYV/Hybrid variety of crop seeds, fertilizers & pesticides and cultivation equipment; (3) Katcha irrigation drainage system need to converted into pucca or underground pipe system which will increase the command crops area; (4) Establishment cold storage for produce crops; (5) Development irrigation facility, uninterrupted electricity supply, proper planned uses of land as per its physical and chemical characteristics to help to control land degradation and ensure better yields of agricultural crops; (6) Development of wholesale market infrastructures; (7) Ensuring of quality both chemical and organic fertilizers in the local market and also encouragement of farmers for leguminous crop cultivation; (8) Arrangement for selling produced crops through cooperative system; (9) Technological training for farmers and financial budget for training from different Government organization; (10) The land zoning law and village improvement act should be strictly implemented. The land zoning law will ensure that “under any circumstances nobody will be allowed to use agricultural land for non-agricultural purposes”.

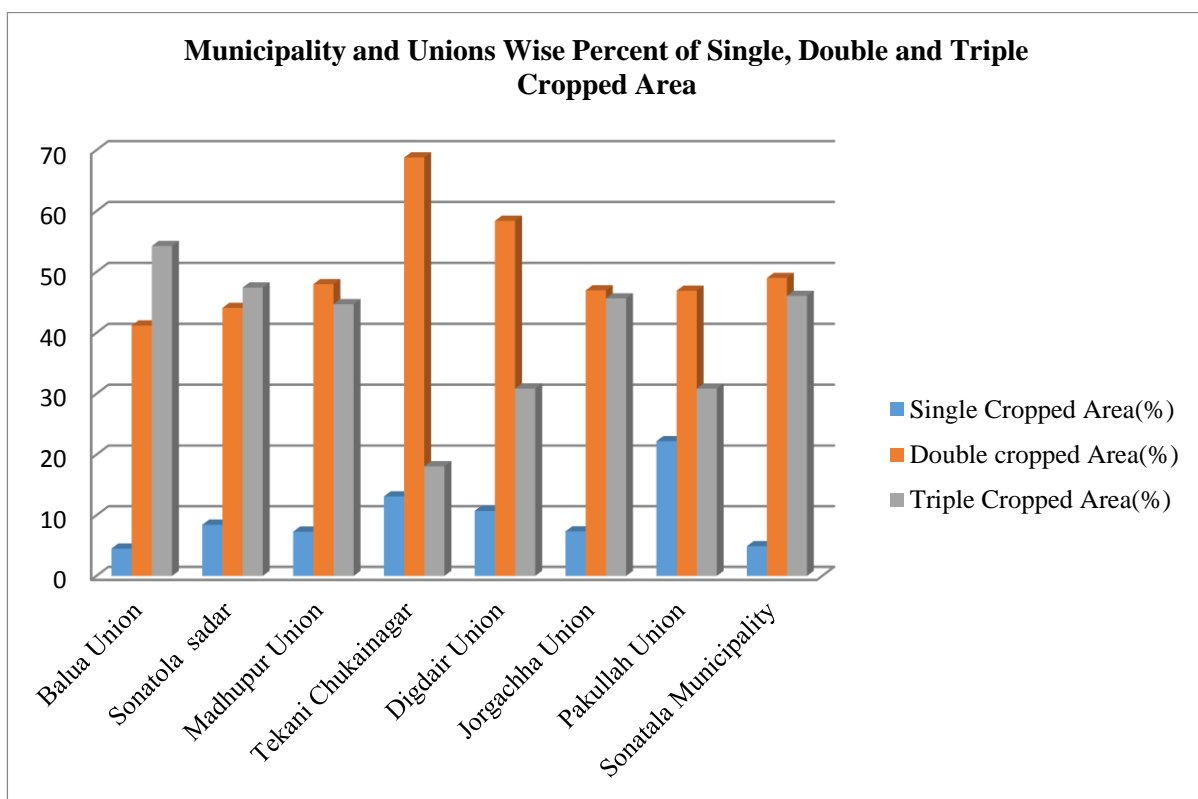
### Single, Double and Triple Cultivated Cropped Area

Cultivation of single, double and triple crops depends on land seasonal flood inundation period. Triple crops cultivated that land above the seasonal flood level and longer period under flood water lands single crops were grown. All 7 Unions & 1 Municipality percent of land used for single, double and triple crops under Sonatala Upazila is shown in Figure 3.3. Figure 3.3 shows that highest percentage of single cropped area were used in Pakulla Union (22%) followed by Tekani Chukainagar (13%) and Digdair (11%), Similarly, the highest percentage of double cropped area were used in Tekani Chukainagar (69%) followed by Digdair Union (58%) and Sonatala Municipality(49%). Further, highest land used for triple crops in Balua Union (54%) followed by Sonatala Sadar (47%) and Jorgacha Union (46%) and Municipality area (46%) under Sonatala Upazila. Union Wise Land Used of Single, Double and Triple Cropped Area and cropping intensities under Sonatala Upazila is shown in Table 3.13.

**Table 3.13: Union Wise Land Used of Single, Double and Triple cropped Area under Sonatala Upazila**

Name of Union	Present Land Used in ha (%)					
	Cultivated Area	Single Cropped Area	Double Cropped Area	Triple Cropped Area	Net Cropped Area (ha)	Cropping Intensity (%)
Balua Union	4970	90 (4.52)	820(41.21)	1080(54.27)	1990	249.75
Sonatala Sadar	2306	78 (8.45)	407(44.10)	402(47.45)	923	249.84
Madhupur Union	3186	98 (7.30)	644(47.99)	600(44.71)	1342	234.13
Tekani Chukainagar	2562	164 (13.12)	860(68.80)	226(18.08)	1250	205
Digdair Union	4791	237 (10.73)	1290(58.40)	682(30.87)	2209	216.88
Jorgacha Union	6171	194 (7.35)	1240(46.99)	1205(45.66)	2639	238.31
Pakulla Union	4225	450 (22.22)	950(46.92)	625(30.86)	2025	208.64
Sonatala Municipality	2580	50 (4.90)	500(49.02)	470(46.08)	1020	252.94

Source: SAAOs and UAO Sonatala Upazila, DAE 2016



Source: SAAOs and UAO Sonatala Upazila, DAE 2016

**Figure 3.3: Municipality and Unions Wise Percent of Single, Double and Triple Cropped Area in Sonatala Upazila.**

## CHAPTER FOUR: CROPPING PATTERN AND CROPPING INTENSITIES

### 4.1 Cropping Pattern

Cropping patterns include mixed farming, multiple cropping, sole cropping, monoculture and crop rotation. The type of cropping pattern used will depend on the crop type as well as soil quality and availability of rainfall. A cropping pattern is the yearly sequence and spatial arrangement of crops and fallow on a given area. Mixed farming involves the raising of crops, animals and trees. Multiple cropping is the growing of more than one crop on the same land in the period of a year, and sole cropping, or solid planting, is when one crop variety is grown at normal density, alone and in pure stands. The repeated growing of the same sole crop on the same land is monoculture, and crop rotation is the repetitive cultivation of an ordered succession of crops or crops and fallow on the same land.

Land types are the dominant factor guiding choice of crops and cropping patterns in Bangladesh as well as in the area. Selection of crops and cropping patterns largely depends on the topographic position of land in relation to seasonal flood depth and its duration. The term 'Cropping pattern' as it applies to the area of reclamation can be defined as the acreage distribution of different crops in any one year in a given farm area such as a water agency, or farm. Thus, a change in a cropping pattern from one year to the next can occur by changing the relative acreage of existing crops, and/or by introducing new crops, and/or by cropping existing crops'. Information that defines a cropping system consists of the number of crops on a given field per year including the accompanying cropping periods from sowing to maturity for each crop cycle and whether each crop is grown under rain fed or irrigated conditions.

Lands, which are above normal inundation level, can provide a wide range of opportunities for growing both of perennial and year round annual crops in the area. The scenario of present cropping pattern under Sonatala Upazila is predominantly Boro (HYV/Hybrid) & T. Aman (HYV/LV) Rice, Jute, potato, Wheat, Maize, Vegetables, Oilseeds, Pulses, Spices, Fruits Garden based. Detailed Upazila cropping patterns by season are presented in Table 4.1. Study finding shows that 11 different cropping pattern are practiced by Sonatala Upazila farmers. Sonatala Upazila present major cropping pattern area is Boro (HYV/Hybrid) → Fallow → T. Aman (HYV) which is practiced 48.75% of the Net Cultivable Area (NCA). Potato → Boro → T. Aman is the cropping pattern covering about 11.09% of the NCA. Mustard → Boro → T. Aman (HYV/LV) is covering about 9.65 % of the NCA. Further, Wheat/Maize → Jute → T. Aman which is practiced about 5.77% of the Net Cultivable Area (NCA). Boro (HYV) → Jute → T. Aman which is practiced



about 8.25 of the NCA. Similarly, Boro (HYV/Hybrid) → Fallow → Fallow which is practiced 4.69% of the Net Cultivable Area (NCA). Both winter and summer vegetables cropping pattern covering about 2.62% of the NET Cultivable Area. This finding clearly indicated that Sonatala Upazila soil is very fertile and principal crop is Boro, T. Aman & potato, Wheat, Maize, jute and farmers also cultivated multiple crops such as vegetables, chili, Pulses and different fruits (Mango, Litchi, Papaya and Guava) production.

**Table 4.1: Present Cropping Pattern under Sonatala Upazila**

Major Cropping Pattern			Area (ha)	Contribution %
Rabi	Kharif-1	Khari-2		
Boro (HYV/Hybrid)	Fallow	T. Aman (HYV)	6500	48.75
Boro (HYV/Hybrid)	Fallow	Fallow	625	4.69
Winter vegetables	Summer vegetables	T. Aman(HYV)	350	2.62
Winter vegetables	Fallow	T. Aman(HYV)	150	1.12
Mustard/groundnut	Boro (HYV/Hybrid)	T. Aman (LIV)	1300	9.75
Pulses	Jute	T. Aman	442	3.31
Wheat/Maize	Fallow	T. Aman (HYV)	770	5.77
Potato	Boro (HYV/Hybrid)	T. Aman	1479	11.09
Boro (HYV/Hybrid)	Jute	T. Aman(HYV)	1100	8.25
Chili /Boro	T. Aus	Fallow	500	3.75
Fruits Garden (Orchard)	Fruits Garden (Orchard)	Fruits Garden (Orchard)	118	0.88
<b>Total</b>			<b>13340</b>	<b>100</b>

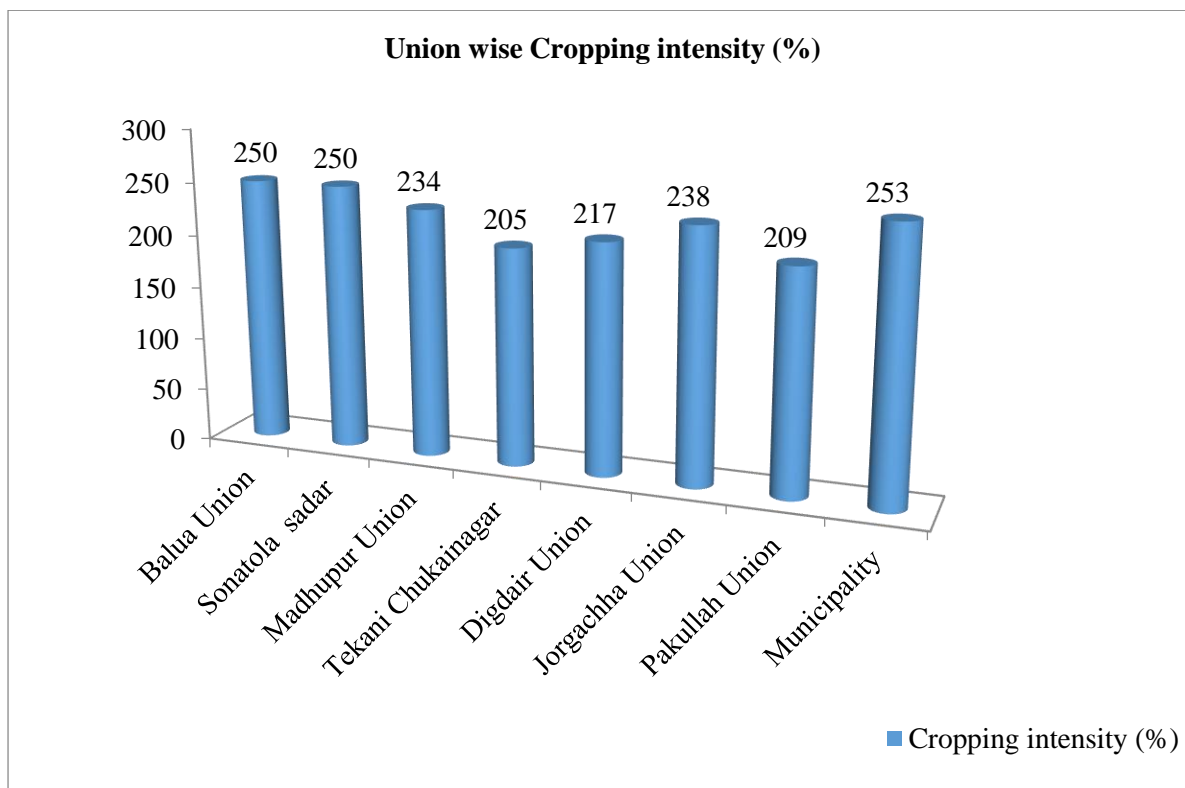
Source: SAOs and UAO Sonatala Upazila, DAE 2016

## 4.2 Cropping Intensity

Cropping Intensity Index refers to the changes in the cropping intensity of crop compared to a given base year. Cropping intensity is the number of times a crop is planted per year in a given agricultural area. It is the ratio of effective crop area harvested to the physical area. Cropping intensity is an important index of utilization of land. Crop intensity index assesses farmers actual land use in area and time relationship for each crop or group of crops compared to the total available land area and time, including land that is temporarily available for cultivation. It is calculated by summing the product of area and duration of each crop divided by the product of farmers total available cultivated land area and time periods plus the sum of the temporarily available land area. For a specific crop, the cropping intensity is the number of times that crop is grown in one year on the same field. It is distinguish single, double and triple cropping systems respectively.

Diversify cropping pattern are practiced in Sonatala Upazila. The present Union wise (7 Unions) and Municipality (1) cropping intensity is shown in Figure 4.1. The average cropping intensity under Sonatala Upazila is 244% which is higher than cropping intensity of 4 Unions

and also less than 2 Unions and Municipality (Figure 4.1). The highest cropping intensities were achieved in Sonatala Municipality (253%), Followed by Balua Union (250%) and Sonatala Sadar Union (250%) and lowest cropping intensity under Tekani Chukainagar (205%). The average cropping intensity under Sonatala Upazila is 244% which is less than Bogra district (260%) and higher than national average cropping intensity (190%) (Krishi Diary 2016. Figure 4 shows all the 7 unions and 1 municipality under Sonatala Upazila cropping intensities is higher than national average cropping intensity (190%).



Source: SAAOs and UAO Sonatala Upazila, DAE 2016

**Figure 4.1: Union wise Cropping Intensities under Sonatala Upazila**

### 4.3 Present Cropped Area

Diversify crop cultivation largely depends on land types, crop variety and irrigation facilities. Paddy, Jute, Wheat, Maize, potato, mustard, groundnut, Chili, onion, winter and summer vegetables, and pulses, and various fruits crops (Banana, Litchi, Mango, Papaya) are grown in 7 Unions and 1 Municipality under Sonatala Upazila. Sonatala Upazila present scenario of diversified cropped area, yield rate and production levels are shown in Table 4.2. The present total different cultivated cropped area is 30433 ha of which rice cropped area are 19550 ha and the rest 10883 ha is covered by non-rice crops (Jute, Potato, Chili, W & S. vegetables, pulses, and oilseeds and Fruits etc.). The rice and non-rice cropped area are about 64% and 36%

respectively of the total cropped area. The highest land area was used for Boro (HYV/Hybrid), T. Aman (HYV) rice, Jute and oilseeds crops cultivation.

#### 4.4 Present Crop Production

Crops yield depends on variety, balance use of fertilizer, pest's control, irrigation and other management. HYV/Hybrid rice or others crops gives higher yield in compared to local variety crops. Total crop production is 155745.8 metric tons of which rice production is 65156.4 metric tons and non-rice production is 90589.4 metric tons (Table 4.2). Among the rice crops the contributions of T. Aus, T. Aman (LV), T. Aman (HYV) and Boro (HYV) & Boro (Hybrid) are about 7%, 1%, 30%, 57% and 4% respectively. The highest contribution among the non-rice crops are potato (41%) followed by jute (22%), winter vegetables (14%) and spices (8%) respectively (Table 4.2).

**Table 4.2: Present Cultivated Area, Yield and Production under Sonatala Upazila**

Crop Grown	Crop Area (ha)	Yield/ha (mt)	Production (mt)	Contribution (%)
T. Aus (HYV)	1660	2.92	4847.2	7.44
T. Aman (LV)	415	1.62	672.3	1.03
T. Aman (HYV)	7130	2.75	19607.5	30.09
Boro (HYV)	9795	3.82	37416.9	57.43
Boro (Hybrid)	550	4.75	2612.5	4.01
<b>Sub Total Rice</b>	<b>19550</b>		<b>65156.4</b>	<b>100.00</b>
S. Vegetables	225	18.5	4162.5	4.59
W. vegetables	540	25	13500	14.90
Wheat	630	2.8	17.64	0.02
Maize	140	8	1120	1.24
Jute	2140	9.52	20372.8	22.49
Potato	2375	15.8	37525	41.42
Spices (Onion, Garlic etc.)	1705	4.22	7195.1	7.94
Oil seeds (Mustard, Til, Groundnut)	2568	1.25	3210	3.54
Pulses	442	1.08	477.36	0.53
Fruits ( Orchard)	118	25.5	3009	3.32
<b>Sub-Total</b>	<b>10883</b>		<b>90589.4</b>	<b>100.00</b>
<b>Total</b>	<b>30433</b>		<b>155745.8</b>	

Source: SAOs and UAO, Sonatala Upazila, DAE 2016

#### 4.5 Irrigation Facilities under Different Unions and Municipality Areas

Irrigation is considered as a basic input for producing cereals and many other crops. Most of the farmers are dependent on irrigation. Good coordination between land and water is required for ensuring food security. In Rabi season mechanized irrigation can help to increase crop

diversification. Status of Union wise irrigation and non-irrigated area covered under Sonatala Upazila is shown in Table 4.3. Table 4.3 data shows that during rabi season 70-100% land area covered by irrigation water. It is reported that farmers of Sonatala upazila has given supplementary irrigation to rain fed crops when needed or during drought period. This indicates that most of the farmers have access to irrigation water which is a good sign for intensive farming. But in the long term, excessive ground water lifting may cause an adverse impact both in agricultural production and in the surrounding environment.

Irrigation facilities assured production of crops in the dry season as well as stabilized production through supplemental irrigation of the rain fed crops and ensured greater productivity. The main source of water is both surface and ground water. For Boro Rice cultivation ground water conservation and proper utilization in this Upazila is very important. This study are assessed the present scenario of irrigation facilities and problems. For irrigation purposes, generally, Deep Tube Wells (DTW), Shallow Tube Well (STW) and Low Lift Pump (LLP) and also traditional instrument are used. Union wise DTW, STW and LLP under Sonatala Upazila is shown in Table 4.4. A total of 6887 machine were used for lifting irrigation water under Sonatala Upazila. A total 60 DTW, 6815 STW and 12 LLP along with other indigenous irrigation tools are used for lifting water. In many cases small and marginal farmers are involved in operation and maintenance of irrigation equipment. All DTW and 60 STW has electricity facilities but 6 577 STW and 7 LLP has no electricity. Electricity user's farmers reported that failed or disruption of electricity supply during Boro season were acute problems under Sonatala Upazila. Framers wanted nonstop electricity supply during Boro season. Majority of the Farmers reported irrigation drainage system DTW is katcha (75-100%) but 100% STW and LLP drain is katcha which is causes wastage of irrigation water. Farmers wanted pucca drainage system.

**Table 4.3: Status of Union wise Irrigated and Non-irrigated Area under Sonatala Upazila**

Sl. No.	Name of Union	Irrigated Area (%)	Non-irrigated Area (%)	Remarks
1	Tekani Chukainagar	100	00	Rain fed crops has given supplementary irrigation during drought period.
2	Balua Union	100	00	
3	Digdair Union	95	05	
4	Pakulla Union	75	25	
5	Sonatala Union	70	30	
6	Sonatala Pourashava	100	00	
7	Jorgacha Union	78	22	
8	Madhupur Union	83	17	

Source: SAOs under Sonatala Upazila DAE 2016

**Table 4.4: Union Wise Irrigation Machine Used under Sonatala Upazila**

Name of Union	DTW		STW		LLP		Remarks	
	Electricity	Diesel	Electricity	Diesel	Electricity	Diesel	%Pucca	% Kutch Drain
Balua Union	08	00	66	980	01	00	DTW=90, STW=10, LLP=80	DTW=10, STW=90, LLP=20
Sonatala Sadar	07	00	15	312	01	04	DTW=25, STW=00, LLP=00	DTW=75, STW=100, LLP=100
Madhupur Union	0	0	12	890	00	00	STW=0	STW=100
Tekani Chukainagar	0	0	0	600	00	00		STW=100
Digdair Union	17	0	30	1540	00	03	DTW=20	DTW=10, STW=100, LLP=100
Jorgacha Union	18	0	55	1135	03	00	DTW=35, STW=00	DTW=65, STW=100
Pakulla Union	02	00	10	710	00	00	DTW=00	DTW=100, STW=100
Sonatala Municipality	08	00	50	410	00	00	DTW=20	DTW=80 STW=100
<b>Total</b>	<b>60</b>	<b>00</b>	<b>238</b>	<b>6577</b>	<b>5</b>	<b>7</b>		

Source: SAAOs under Sonatala Upazila, DAE 2016

## 4.6 Cultivation Practices

Municipality and all the Unions are dominated by diversified agriculture crops are: Boro HYV/Hybrid variety of rice and Transplanted Aman (HYV) rice, T. Aus (HYV), potato, Jute, Mustard, groundnut, Chili and different kinds of winter and summer vegetables, spices (onion), pulses which are cultivated under both rain fed and irrigation condition. Sonatala Upazila was very famous and potential for commercially produced fruits of Banana, Mango, Litchi and papaya. Farmers are cultivated different vegetables such as Brinjal, Potato, chili and Cabbage etc. All the SAAOs and UAO reported that about 90 farmers used power tiller, 2% tractor and 8 % farmers used Bullock during land preparation. Boro and T. Aman rice seedlings grown in seedbed are uprooted when they are about 30-45 days old and transplanted in the main fields. They transplanted Boro and T. Aman rice practiced line sowing. Generally in rice field weeding is done once, about a month after transplanting and this exercise is closely followed by top dressing with urea. Majority of the farmers did not use balance dose of chemical fertilizers due to lack of knowledge. Farmers reported pests are acute problems for crop production. Farmers

used pesticides over and under dose as preventive and curative measures for controlling different pests because of lack of knowledge.

## **4.7 Major Types of Crops Cultivated**

### **Main Crops**

Paddy is a primary crop and a staple food of this area. Here the growth of rice production is much faster. Paddy (Boro rice (HYV/Hybrid), T. Aus (HYV) and T. Aman (HYV/LIV), Jute, Wheat, Maize, Vegetables, Mustard, Groundnut, and Pulses etc. Jute is a primary and one of the main cash crops of this Upazila. It is an eco-friendly fiber. Jute cultivation requires less labor and less input. Despite the relative decline in importance of jute in agriculture, potential still exists for the fiber to increase its contribution to the economy through productivity increases and diversification. Farmers need to cultivate BJRI innovative variety of Jute such as HC-95, HS-14 for better yield. Yield increase, availability of better quality seeds, and improved provision of extension and credit support to grower's for this crop. Jute leaf is a common and favorable vegetable item to the farmer.

### **Maize Cultivation**

Now-a day's Maize is very important cash crops in Bangladesh. Low risk in maize production is another privilege taken by farmers. Marginal and poor farm families are showing interest in maize cultivating. This is possible due to the adaption of modern maize varieties since production has been expanding fast. Its price, demand, and supply are increasing in domestic market. Pop-corn as an alternative food has been getting priority. It has diversified usages in small business and poultry feed production. Farmers can earn more by maize cultivation. For getting better yield farmers need to cultivate BARI Hybrid Bhuta-1, 8, 9, 10, 11 varieties. Lack of capital as well as high price of inputs is a barrier to its higher production.

### **Potato**

It is widely commercially cultivated in winter with huge potential in Sonatala area. The soil and climate conditions of Sonatala area are favorable for potato production. It is one of the cash crops for Sonatala farmers. Sunny land with cool and moisture in soil is appropriate for potato cultivation. Potato, a tuber crop, is cooked and eaten as a vegetable. In the context of nutrient, potato is comparable with rice and wheat. But unavailability of quality inputs (seeds, fertilizer and pesticide), lack of knowledge on proper cultivation techniques and finally low investment capacity of the farmers are some of the major challenges in potato farming.

### **Oilseed Crops**

Farmers of Sonatala Upazila generally cultivate mustard before Boro cultivation. Mustard,

Groundnut, and Til are popularly cultivated in Sonatala Upazila. Mustard as an oilseed crops takes first place in respect of cultivated area in Bangladesh. Mustard oilcake is a nutritious food for cattle. This oilcake also used as organic fertilizer and the dry mustard plants can use as fuel.

### **Vegetables**

The soil and climate conditions of this Sonatala area are favorable for multiple vegetables production. Tomato, Sweet potato, Brinjal,, Radish, Cauliflower, Cabbage, Bean, Chili, Lalshakh, Loncho, Kolmi, Peas, Kochu, Bitter gourd, Pumpkins, Gourd, Rai Shakh, Ladies finger, Palong, Spinach, Cucumber etc. Encouraging homestead level vegetables cultivation could be alternative source of household income generation. It is widely cultivated in winter with huge potential in Sonatala Upazila. But unavailability of quality inputs (seeds, fertilizer and pesticide), lack of knowledge on proper cultivation techniques and finally low investment capacity of the farmers are some of the major challenges in vegetables farming.

### **Spices**

Chili, Turmeric, Ginger, Onion & Garlic etc. The soil and climate conditions of this Sonatala area are favorable for Chili and Onion production.

### **Fruits**

Mango, Jackfruit, Litchi, Banana, Coconut, Betel Nut, Country Goose Berry, Guava, Plum, Kul, Papaya etc. are grown in this Upazila. Many farmers were Established commercial fruit garden of Mango, Litchi, Papaya and Guava etc.

### **Conversion of Agriculture Land to Non-agriculture**

Agricultural land denotes the land suitable for crop production. It is one of the main resources in agriculture. Many high value crops are grown in Sonatala Upazila. “Non-agricultural land” means such land which is used for different purposes and is not connected with agriculture. Such kind of land can be called non-agricultural land, if any developmental activity is carried over on the land and makes land unfit for crop production. In Sonatala a substantial amount of agricultural land had been shifted to a non-agricultural one viz construction of houses, brickfield, sawmill, industry, road, market and other infrastructures. Without proper planning conversion of the arable land to other uses is continuing rapidly. The major components of transforming agricultural land to non-agricultural purposes are as follows:

- Non –agricultural development activities on agricultural land.
- New or existing infrastructure and urban expansion.
- Construction of brick fields and new settlements in agricultural land.
- Acquisition of agricultural land for non-agricultural purposes.





**Plate-1: Farmers Turmeric field at Sonatala** **Plate-2: Farmers Chili field at Sonatala**



**Plate-3: Farmers Papaya Garden at Sonatala** **Plate-4: Farmers Sugarcane Field at Sonatala**



**Plate-5: Farmers Banana Garden at Sonatala** **Plate-6: Farmers Vegetable and Rice Field at Sonatala**





**Plate-7: Farmers Jute Field at Sonatala**



**Plate-8: Boro Rice Cultivation at Sonatala**

## CHAPTER FIVE: PRODUCTION COST OF RICE AND VEGETABLES

### 5.1 Cost of Rice Production

The production cost of paddy varies depending on crop season, variety (HYV/Hybrid/LV), land preparation (Power tiller/Tractor/Bullock), seeds and seedlings, manure and fertilizer, irrigation (complete irrigated (Boro Rice) and rain fed or provided supplementary irrigation), pesticide and labor. To assess farmers cost of rice production, Agriculture Economic Division of BRRI (2014-15) conducted survey all over the country in three rice seasons (Boro, Aus and Aman paddy). BRRI study findings shows that Boro and Aus farmers per kg rice production cost is Tk. 18.65 and Tk.18.64 and Aman rice production cost is Tk. 17.61 which is less than Boro and Aus (Table 16). Department of Agriculture Marketing was estimated production cost for Boro rice Tk. 18.20 per kg, Aman Rice Tk.18.08 per kg and Wheat Tk. 23.50 per kg in the year 2015-16. On this basis Government has declared buying rate of Boro rice Tk.20.70, Aman rice Tk. 18.50 per kg and Wheat 27.02 per kg respectively. Sonatala upazila farmers and DAE SAAOs reported that Boro rice per kg or per ha production cost is higher than T. Aman rice because T. Aman rice is cultivated by natural water or rain water. There is no need for supplementary irrigation for Aman rice production. Fertilizers and pesticides are needed more in Boro rice production in compared to Aman rice.

**Table 5.1: Cost of Rice Production (2014-15)**

Name of Rice	Average per kg rice production cost (TK)	Crop season	Source
Boro	18.65	Rabi	BRRI2014-15, Agriculture Economic Division
Aus	18.64	Kharif-1	
Aman	17.61	Kharif-11	
Boro	18.20	Kharif-1	Department of Marketing 2015-16
Aman	18.08	Kharif-11	
Wheat	23.50	Rabi	
Government Buying rate from Farmers: Boro Tk.20.70/kg, Aman Tk.18.50/kg & Wheat Tk.27.02/kg			

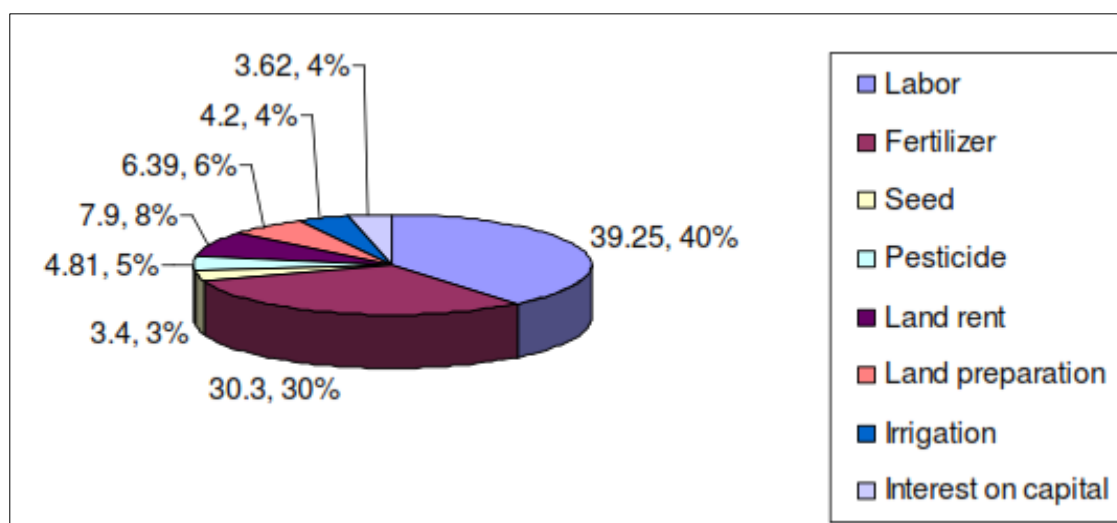
### 5.2 Cost of Vegetable Production

The production cost of vegetables varies depending on crop, variety, time, place, and season. During the survey, farmers were asked to identify the major types of production costs on which they usually spend. According to the respondents, the production cost of vegetables can be categorized into eight major categories: land preparation, seeds and seedlings, manure and

fertilizer, irrigation, pesticide, labor, lease/rent of land, and other expenses like fencing, shedding, mulching etc.

Monsura Zaman, Rokhsan-Ara-Hemel and Tahmina Ferdous (2010) assessed the cost of production of four winter vegetables namely cauliflower, cabbage, tomato and brinjal in five villages under Dhaka district. The study finding shows that 39.2% of the total cost was devoted to labor, 30.3% to fertilizer, 3.4% to seed, 4.8% to pesticides, 7.9 % land rent, 6.3% to land preparation, 4.2% to irrigation and 3.6% to interest on capital, whereas, the result estimated by AVRDC (2001) shows that 48.4% of the total cost was devoted to labor, 24.2% to fertilizer, 6.1% to irrigation, pesticides and 3.7% to seeds. Figure 5.1 shows that cost of per kg and per 40 kg was found approximately the highest for tomato and the lowest for cabbage and cauliflower.

Farmers of Sonatala Upazila reported that major cultivation occurred in land preparation (Power tiller/tractor cost), irrigation, pesticides, fertilizers and labor. Farmers reported that per ha cultivation cost is Tk. 7000-8000/- (*Upazila Agriculture Office, Sonatala*). Generally, supplementary irrigation provided to potatoes, Chili and winter vegetables. Supplementary irrigation cost is 2000-3000 taka or more depends on crops and number of application. The highest supplementary irrigation provided in winter and summer vegetables crop field. The highest pesticides used in T. Aman and Boro rice fields (Tk.5000-5500/-) and W & S. vegetables fields (Taka 4000-4500/ha). Labor cost day by day increased and per day labor cost more or less Tk. 450-500 depends on crop season.



Source: ASA University Review, Vol. 4 No. 1, January–June, 2010

**Figure 5.1: Percentage of Major Types of Production Costs for Vegetables**

The present study assessed financial profitability of Brinjal, Tomato, Potato and Cabbage/cauliflower vegetables production under Sonatala Upazila which is shown in Table 5.2. Finding shows that Tomato cultivation is more profitable (Tk. 377485 per ha) followed by Brinjal (Tk. 370226.1 per ha), Cabbage/Cauliflower (Tk.373500) and potato production (Tk. 227308.9 per ha) respectively. Study finding clearly indicated any kind of vegetables cultivation is more profitable for Sonatala famers.

**Table 5.2: Financial Profitability of 4 Types of Vegetables Production in Sonatala Upazila**

Vegetables	Yield (Kg/kg)	Price (Tk./Kg)	Gross Return (Tk./ha)	Total Cost (Tk./ha)	Net Return (Tk./ha)
Brinjal	26170	18.33	479696.1	109470	370226.1
Tomato	20500	23.17	474985	97500	377485
Potato	16170	18.17	293808.9	66500	227308.9
Cabbage/ Cauliflower	20000	22	440000	66500	373500

Source: SAOs Sonatala Upazila, DAE 2016

Farmers cultivate Brinjal vegetables throughout year. Study estimated and compared the financial profitability of Brinjal vegetable production in different region in Bangladesh. Several studies were done to estimate the financial profitability of Brinjal vegetable production (Table 5.3). It is evident from the table that productions of Brinjal vegetable were increased chronologically. This is due to adoption of farmers for different HYV varieties of Brinjal. Price of Brinjal vegetable also increased through time change. Farmers were adjusted their vegetables price due to change the production cost. Now farmers used different insecticide, pesticide and fertilizer to increase production and protect vegetables from disease and pest. For this reason profitability of different vegetables also increased. It is true that total production cost of different vegetables increased but net margin also increased. Farmers produce different vegetables because vegetables productions are profitable in the present study area which is reflected by high BCR for Brinjal vegetable. The previous studies were done several years ago and we can interpret the different return by yield, price and place difference. The prices of Brinjal vegetable are high in all over the country. Finally it is clear that productions of vegetables are more profitable in the study area like other vegetables growing areas.

**Table 5.3: Comparison of the Financial Profitability of Brinjal Vegetable Production in Different Region**

<b>Cultivation year</b>	<b>Study Area</b>	<b>Yield (kg/ha)</b>	<b>Price (Tk./kg)</b>	<b>Gross Return (Tk./ha)</b>	<b>Total Cost (Tk./ha)</b>	<b>Net Return (Tk./ha)</b>	<b>BCR</b>	<b>Sources</b>
<b>1997</b>	Bangladesh	11730	6.0	70372	17,343	53,029	4.06	EPC, 1997
<b>1998</b>	Comilla	24,699	2.51	61,994	31,339	30,655	1.98	Miah et al., 1998
<b>2002</b>	Jessore	43,899	7.09	3,10,293	1,77,457	1,32,836	1.75	Rashid et al. 2002
<b>2014</b>	Dhaka	55,691	18.00	10,02,438	269,627	732,811	3.72	Hasan et.al 2014

## **CHAPTER SIX: GROWTH OR DECLINE OF AGRICULTURAL LAND DURING LAST TEN YEARS**

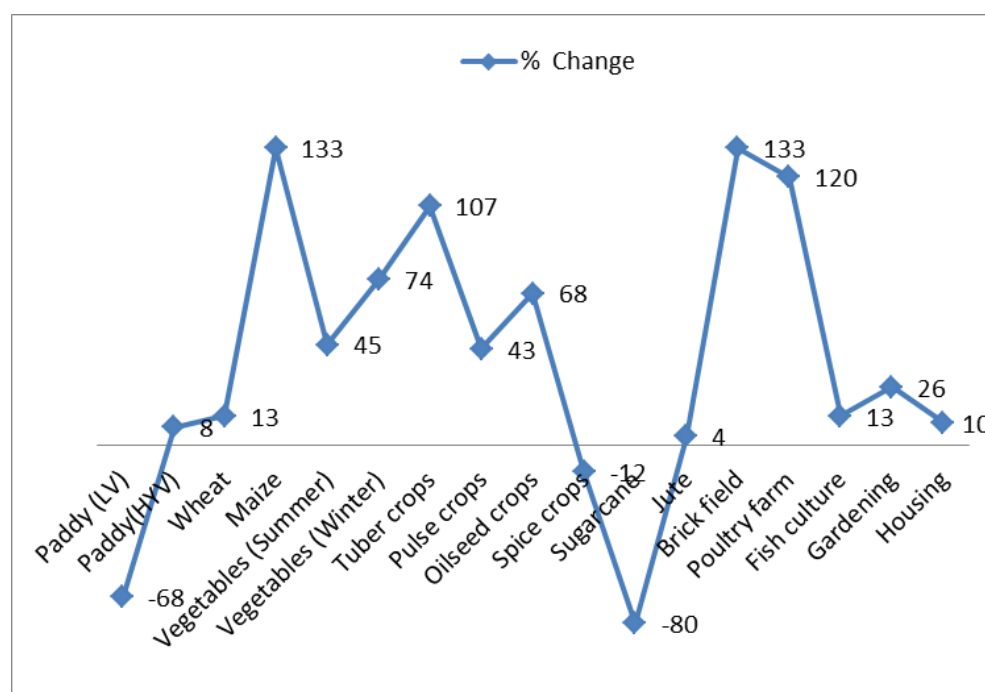
Land is the most valuable resource among all the natural resources of a country food, shelter including lifesaving elements to her ever increasing population. Bangladesh has long history of proudest for her rich and diversified land and water resources. But the fact is that these valuable resources are now under threat due to over exploitation and unplanned uses for urbanization, human settlements, and infrastructural development and meeting with demands of the people. A census on land resources reported that everyday 220 ha of arable land is converting for other uses like constructions of houses, roads, commerce and industries and for other non-agricultural activities, which is very alarming for the sustainability of land resources of our country. It is very important to know the present picture of agricultural land utilization for future development of sustainable plan in any area.

Quantification of various parameters in relation to land use and farming is really a very difficult task, specially, in Bangladesh where record keeping is poor either by an organization or by individual. Bearing this difficulty in mind a sincere attempt has been made to collect last ten year land use data (2005 to 2015) from Upazila Agriculture Office and discussion was conducted with 1 Municipality and 7 Unions all Sub- Assistant Agriculture Officers of Sonatala Upazila and the other documents were reviewed. The growth or decline of agricultural land use during last ten years under Sonatala Upazila is shown in Table 6.1 and Figure 6.1. Table 6.1 finding shows 68% local variety rice was decreased during last ten years. The main reason for decreased local variety rice area is fewer yields in compared to HYV rice and farmers are dictated to switchover cultivated HYV and Hybrid rice. The HYV/Hybrid paddy cultivation area was increased 8%. Due to the reason of increased yield of HYV rice many farmers are cultivating HYV and Hybrid rice. Remarkable significantly highest change or increase during last 10 years occurred in Maize (133%) followed by tuber crops (107%) and winter vegetables (74%) and oilseeds but highest decreased occurred in sugarcane (-80%) followed by local paddy (-68%) and spices crops cultivation (-12%). The main reasons for increases are produce crop market demand and price is high. Table 6.1 and Figure 6.1 shows, among the other purposes remarkable significant change occurred in Brick field (133%) and followed by poultry farm (120%), gardening (26%), fish cultivation (13%) and housing (27%) respectively. This finding clearly indicated crop land has gradually decreased day by day which is reflected on overall agriculture crop production.

**Table 6.1: Growth or Decline Agriculture Land Use during the Last 10 Year**

Sl. No.	Agricultural land use	Land Use (2005) in ha	Land Use (2015) in ha	Percentage (%) of Change
1	Paddy (local varieties)	1970	630	-68.02
2	Paddy (HYV)	16360	17735	8.4
3	Wheat	560	630	12.5
4	Maize	60	140	133.33
5	Vegetables (Summer)	155	225	45.15
6	Vegetables (Winter)	310	540	74.19
7	Tuber crops	1150	2375	106.52
8	Pulse crops	310	442	42.58
9	Oilseed crops	1530	2568	67.84
10	Spice crops	1945	1705	-12.34
11	Sugarcane	50	10	-80
12	Jute	2050	2140	4.39
14	Other purposes			
	Brick field	6	14	133.33
	Poultry farm	10	22	120
	Fish/shrimp culture	690	782	13.33
	Gardening	360	455	26.39
	Housing	1325	1460	10.18

Source: SAAOs, UAO, ULO, UFO and Upazila Statistic Office of Sonatala Upazila 2016



Source: SAAOs, UAO, ULO, UFO and Upazila Statistic Office of Sonatala Upazila 2016

**Figure 6.1: Percentage Changed of Land Used from 2005-2015 under Sonatala Upazila**

## **CHAPTER SEVEN: MAJOR PROBLEMS OF CROP PRODUCTION IN SONATALA UPAZILA (7 UNIONS AND 1 MUNICIPALITY)**

Agriculture survey findings and Participatory Rural Appraisal (PRA) conducted in August 2016 report findings show for farmers some problems are common in different unions under Sonatala Upazila such as flood, water logging, drought, bad communication, unavailability of wholesale market and infrastructure. Major problems identified are:

- Occurrence of sudden flood and damaged field crops;
- Lack of modern agricultural machineries;
- Less availability of quality different HYV crop seeds;
- River erosion and silted;
- Most of the old canals of the union were found closed due to construction of unplanned infrastructures (Market, houses, farms etc.), which are creating barriers to natural water flow and main cause of drainage congestion;
- Katcha irrigation drainage system and wastage of irrigation water;
- Indiscriminate use of water by setting up irrigation pump;
- Lack of seed store for high value crops;
- Lack of cold storage and vegetable cool-chamber;
- Lack of vegetables and fruits whole sale market infrastructure;
- Less availability of power tiller/tractor, harvester, sprayer & foot pump and high price;
- Lack of modern technologies;
- Pests and diseases;
- Power failure in Boro crop season;
- Damage of perishable vegetables due to undeveloped road system and lack of Vehicles for transportation;
- Farmers did not get their expectable market price for produce crops such as rice, chili and vegetables;
- Agricultural labor crisis during planting and crops harvesting time and also high wage rate;
- Farmer's knowledge gap on crop production technology;
- There is no agro processing center and industries under Unions level;
- Poor use of organic matter and soil nutrients deficiency and decrease of Agricultural land due to human intervention of unplanned infrastructural development activities.



## **CHAPTER EIGHT: POLICY FRAMEWORK AND CONCLUSION**

### **8.1 Policy Framework**

As per Sub-Assistant Agriculture Officers, Farmers and District, Upazila level different organizational Officers opinions and field visit following recommendations are made which will help for proper planning and adoption of appropriate crop production measure in future to different Unions beneficiaries under Sonatala Upazila.

#### **1. Developing Infrastructural Facilities**

Excavation and re-excavation of new and old canals making connection with the adjacent rivers and khals which will solve the problems of water congestion and irrigation facilities need to be improved for mitigating impacts of crop production related vulnerabilities and climate change. Road network at local level, agro-processing and whole sale marketing infrastructure development, reconstruction of damaged water management infrastructures need to be made. In each Union one wholesale market infrastructure need to be constructed. Further in each Union one seed store infrastructure need to be constructed and also cold storage and food godown need to be established. Construction of embankment with sluice gate and drainage system are needed for solving the flood problems which will increase the agricultural production and improvement of socio-economic condition of the peoples of this area.

#### **2. Reducing the Irrigation water Wastage**

Development of irrigation facility and planned uses of land as per its physical and chemical characteristic could help to control land degradation and ensure better yields of agricultural crops. The DTW, STW and LLP katcha drain need to be converted into pucca drainage system or introduce underground pipe irrigation system which will decrease the water loss and increase the irrigated command crop area. Uninterrupted electricity supply is an important issue for ensuring timely irrigation in the area. In this context it is also needed to monitor ground water table periodically.

#### **3. Farming and Adaptation Practices**

Adapt modern farming techniques and choose high yields and drought tolerant varieties are needed. There is need for conducting, strengthening and expanding crop demonstrations and block farming based on adaptation practices. Introduction of risk resistant crop varieties in agriculture with emphasis on crop diversification should be an integral part of the ToT, farmers training and demonstrations.

#### **4. Vegetables Production**

Different types of winter and summer vegetables grown in all 7 unions and Municipality area. All the Unions are excellent suitable for vegetables cultivation round the year. There is no cold storage and large vegetable selling center (market) in 7 Unions of Sonatala Upazila. As a result farmers could not get good price for their produced products. There is a need for establishment of cold storage and development of market infrastructure in each union.

#### **5. Crop Production Inputs Availability**

It is needed to ensure availability of quality HYV and Hybrid crop seeds, fertilizer, pesticides and cultivation machineries in subsidized rate. Information on quality seed need to be provided up to block level.

#### **6. Availability of Crop Seeds**

Drought and submergence tolerant variety of different quality HYV/Hybrid crop seeds are needed. BRRI, BARI, BSRI and BINA have recommended drought tolerant rice, wheat, maize, potato, pulses and oilseeds. These are BRRI Dhan-71, -72, 55, -57, -66, -67 and BINA Dhan-8, BARI Wheat-25, BARI-28, 29, 30 Muatard-11, 14, 17 BARI poato-21, 22, 50 should be widely introduced and farmers should be encouraged to cultivate.

#### **7. Fertilizer Management and Soil Health**

Chemical fertilizers application in HYV varieties crops trend is increasing but inorganic fertilizer (Green manure, cow dung) use is decreasing. As a result, soil nutritional health will be at alarming situation which in future will have serious effect on yield. There is a need for soil health improving program for Union farmers. DAE may arrange joint collaborative soil testing and recommendation and training program for beneficiaries. Financial support need to be provided to DAE from different Government project. One leguminous crop (Dhaincha/Pulses/ Fodder etc.) should be grown between two cereal crops. For increasing organic manure in the soil changing cropping pattern/crop rotation system need to be practiced.

#### **8. Pest Management**

Insects, rats, weeds and diseases are a chronic problems which causes considerable damage of crops every season and increase the farmers cultivation cost. For control this pests farmers apply pesticides under or over dose. Judicious use of pesticides needs to be developed and pest surveillance, monitoring and forecasting system should be implemented. Farmers also need to increase knowledge on Integrated Pest Management (IPM) technology through practical oriented program and DAE joint collaborative crop production training. Farmers training budget need to be provided to DAE from different Government projects.

## 9. Agro-based Industries

Establishment of Agro-based processing center & industries in 7 unions and Municipality area are needed. There is a need for construction of infrastructure for some agro-base processing center. Construction of potato and vegetables & fruits processing, grading and packaging industry/facility need to be developed in each of the seven unions of the Sonatala Upazila. There is a need for integrated effort for industrial effluents and waste management.

## 10. Zoning of land

Zoning of land as per its present uses and potentialities and the proper implementation of “**Preparation of Development Plan for Fourteen Upazilas**” Package 04 (Saghata, Sonatala and Sariakandi Upazila) which will be helpful to reduce unplanned infrastructural development intervention as well as ensure proper utilization of agricultural land are essential.

**11.** The following additional systems may be adopted in innovative ways for sustainable crop production and for ensuring sound environmental conditions of Sonatala Upazila:

- Biodynamic/eco-friendly agriculture
- Rice and non-rice crops integrated farming
- Grow vegetables predominantly
- Fruit tree based Agro-forestry system
- Integrated pest management
- Natural disasters adaptive, rain fed and resilience farming
- Minimize conversion of agricultural land to non-agricultural use and increase awareness among the people and land users for conservation of land.
- Ensuring planned and economic use of agriculture land, minimize agricultural land degradation and introducing regulatory measure like adopting land zoning law are necessary to protect the agriculture land.

## 8.2 Conclusion

Drainage congestion can be removed by excavation and re-excavation of new and old, silted canals by making connection to adjacent rivers and khals of the union. Land type and weather conditions are suitable for different vegetables, fruits crops and other high value crops cultivation round the year in Sonatala Upazila. There is a need to develop vegetables& fruits wholesale market and improvement of road communication system of different Unions to Upazila. Farmers need improved modern crop production technology training which will be helpful for crop diversification and proper utilization land and increased crop production. For improvement of irrigation facilities katcha drain are to be made lined channel which will reduce

irrigation water wastage and increase crop production. Integrated pest management need to be implemented for Banana, Papaya, orchard and vegetable cultivation and reduce pesticide use. Electricity power supply should be ensured during Boro crop season. Construction of potato and vegetables & fruits processing, grading and packaging industry/facility in each of the Unions is needed. Increase agriculture production through optimum use of land is recommended. Many high value crop vegetables grow in this Upazila. There is wide opportunity of growing Mango and litchi, Maize, Jute and vegetables in commercial basis for export out of the country. Potential agricultural land degradation is becoming a severe phenomenon in this Upazila. So, imposing land zoning law and other appropriate measures with motivation and awareness building program should be taken immediately to control unplanned and unwanted human interventions responsible for land degradation.

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## **ANNEXURE**

## Annexure- I: Questionnaire for KII

Name ----- Designation ----- Department -----

Upazila ----- District ----- Mobile No. ----- Date -----

### 1. Category Wise Distribution of Farm Families

Sl. No.	Category	No of farm family	%
1.	Land less (0.05 - 0.50 acre)		
2.	Marginal (0.51 - 1.50 acre)		
3.	Small (1.51 - 2.50 acre)		
4.	Medium (2.51 - 7.50 acre)		
5.	Larger (above 7.50 acre)		
<b>Total</b>			

### Present Land Use under Union

Sl. No.	Type of Land use	Present land used	
		Area (ha)	Percentage (%)
1.	Cultivated Area		
	Single Cropped area		
	Double Cropped area		
	Triple Cropped area		
2.	Net cropped area		
3.	Cropping intensity		

### 2. Relationship of Land Type and Flood Depth with Area Cultivated

Sl. No.	Land type and Flood Depth. (cm)	Present	
		NCA (ha)	Percentage (%)
1.	High land (0-30 cm) F0		
2.	Medium high land (30-90 cm) F1		
3.	Medium low land (90-180 cm) F2		
4.	Low land (180-360 cm) F3		
5.	Very low land above (360 cm) F4		
<b>Total</b>			

Source: CEIP field data and Upazila Agriculture Office, DAE

### 3. Major Crops/Cropping Patterns (both improper/exhaustive and sustainable)



Season	Farming Practices
Rabi (Mid October-Mid March)	
Kharif-I (Mid March-Mid July)	
Kharif-II (Mid July-Mid October)	
Irrigated Farming Rabi (Mid- October Mid March)	
Kharif-I (Mid March-Mid July)	
Kharif-II (Mid July-Mid October)	
<b>Name major cropping patterns</b>	1. 2. 3. 4.

#### 4. Crop Cultivated and Variety in Polder Area

Crop area	Name of crop	Name of variety
Cultivated crops under single crop area=		
Cultivated crops under double crop area=		
Cultivated crops under triple crop area=		
Cultivated crops under irrigated crop area=		
Cultivated crops under non crop area=		
Cultivated crops under homestead garden area=		
Orchard area=		
Seasonal Fallow land =		
How many commercial fruit garden within polder area? Yes ----- No-----	Name of fruits garden Banana: Papaya: Coconuts: Mango: Others:	Number:
In future which crops will be profitable in your polder area:		

#### 5. Present Crop Production and Area under polder/Upazila

Crop Area (ha)	Yield/ha	Total Production (MT)	Crop Area (ha)	Yield/ha	Total Production (MT)
Aus rice= LV = HYV =			Oilseeds=		
Aman rice= LV = HYV = Hybrid =			Mustard=		
Boro Rice= LV = HYV = Hybrid =			Sesame=		
Total Rice=			Sunflower=		
Wheat =			Groundnut=		
Maize =			Others=		
Pulses =			Winter vegetables=		
Khesari =			Summer vegetables=		
Mung bean =			Total vegetables=		
Soybean =			Fruits Watermelon=		
Cowpea =			Species=		
Chickpea=			Chili=		
Others=			Onion=		
Tuber crops=			Garlic=		
Potato=			Jute=		
Sweet potato=			Sugarcane=		
Bamboo=			Betel nut=		
Bete line (Pan)=					

## 6. (a) Short Term Needs for Better Crop Production under Polder

1. ----- 2. -----

3. ----- 4. -----

5. ----- 6. -----

**(b) Long Term Needs for Better Crop Production under Polder**

1. ----- 2. -----

3. ----- 4. -----

5. ----- 6. -----

## Annexure-II: Agriculture Questionnaire for Urban and Rural Economy Study

Name: \_\_\_\_\_ Designation: \_\_\_\_\_

Department: \_\_\_\_\_ Name of Block: \_\_\_\_\_

Name of Union: \_\_\_\_\_ Upazila: \_\_\_\_\_

District: \_\_\_\_\_

Mobile No.: \_\_\_\_\_ Date: \_\_\_\_\_

### 1. Category wise distribution of Farm Families in Block

Sl. No.	Category	No. of farm family	%
1	Land less (0.05 - 0.50 acre)		
2	Marginal (0.51 - 1.50 acre)		
3	Small (1.51 - 2.50 acre)		
4	Medium (2.51 - 7.50 acre)		
5	Larger (above 7.50 acre)		
<b>Total</b>			

### 2. Agricultural land and land Use in Block

Sl. No.	Description of agricultural land	Area (ha)
1	Total agriculture land area	
	High land	
	Medium high land	
	Medium low land	
	Low land	
2	Permanent fallow land	
3	Current/seasonal fallow land (with fallow period) -Rabi fallow	
4	-Kharif-I fallow -Kharif-II fallow	
5	Net cropped area	
6	Single cropped area	
7	Double cropped area	
8	Triple cropped area	
9	Total cropped area	
10	Cropping intensity (%)	

Sl. No.	Description of agricultural land	Area (ha)
11	Irrigated land area (%)	

### 3. Irrigation Facilities

Deep Tube Well (DTW)      Yes-----      No-----      Number-----

Shallow Tube well (STW)      Yes-----      No-----      Number-----

Low Lift Pump (LLP)      Yes-----      No-----      Number-----

Others-----

### 4. Cultivation Practices

Power tiller-----% Used, Tractor -----% Used

Bullock -----% Used

### 5. Cropping Pattern

Sl. No.	Cropping Pattern			Area of Land	Percentage (%)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

## 6. Cropping type and Present Crop Area & Production under Block

Crop Area (ha)	Area (ha)	Yield/ha	Crop Area (ha)	Area (ha)	Yield/ha
Aus rice LV HYV			Oilseeds		
Aman rice LV HYV Hybrid			Mustard		
Boro Rice LV HYV Hybrid			Sesame		
Total Rice			Sunflower		
Wheat			Groundnut		
Maize			Others		
Pulses			Winter vegetables		
Khesari			Summer vegetables		
Mung bean			Total vegetables		
Soybean			Fruits Watermelon		
Cowpea			Species		
Chickpea			Chilli		
Others			Onion		
Tuber crops			Garlic		
Potato			Jute		
Sweet potato			Sugarcane		
Bamboo			Betel nut		
Betelvine(Pan)			banana		
Other crops			Mango		
			Papaya		

## 7. Growth or Decline Agriculture Land During the Last 10 year.

SL No.	Agricultural land use	Land use (2005-06) in ha	Land use (2015-16) in ha	Causes of increase or decline
01	Paddy (local varieties)			
02	Paddy (HYV)			
03	Vegetables (Summer)			
04	Vegetables (Winter)			
05	Tuber crops			
06	Pulse crops			

SL No.	Agricultural land use	Land use (2005-06) in ha	Land use (2015-16) in ha	Causes of increase or decline
07	Oilseed crops			
08	Spice crops			
09	Fruit crops			
10	Wheat			
11	Maize			
12	Sugarcane			
13	Jute			
14	<b>Other purposes</b>			
	-Brick field			
	-Poultry farm			
	-Fish/shrimp culture			
	-Gardening/forestry			
	-Industries			
	-Housing			
	-Others			

**9. Major problems to Crop Production in Block/Union**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**10. Future Need for Sustainable Crop production.**

a)

\_\_\_\_\_

b)

\_\_\_\_\_

c)

\_\_\_\_\_

d)

\_\_\_\_\_

e)

---

**11. Major problems related to crop production system Under Union**

- 1.
- 2.
- 3.
- 4.
- 5.

**12. Future Need for Sustainable Crop production under Union**

- 1.
- 2.
- 3.
- 4.
- 5.

**13. Conclusion and Recommendation**

- 1.
- 2.
- 3.
- 4.
- 5.



## Annexure-III: Photographs

### Part-1: Photo of Discussion with SAAO

#### Meeting With Sub-Assistant Agriculture Officers in Sonatala Upazila Parishad



Upazila Agriculture Officer is giving his speech.



Agriculture Expert is lecturing to SAAOs.



Agriculture Expert is collecting data.



Project Manager is giving speech on the relation between project and agriculture.

## Part-2: Photographs of Questionnaire survey for KII and Agriculture

