Rural Development and Cooperatives Division
Ministry of LGRD & Cooperatives

Supported by Switzerland

MAKING MARKETS WORK FOR THE CHARS

Final Report

Analyzing the agriculture input market in the selected char regions in Bangladesh

RURAL DEVELOPMENT ACADEMY, BOGRA

swisscontact

Study by


INNOVISION
Research | Technical Assistance | Project Management

Acknowledgment

We thank Swisscontact for awarding us this assignment and for trusting us on our capacity to undertake this study with the purpose to assess Agri-input market of selected Char regions in Bangladesh.

We specially thank Mr. Abdul Awal, Team Leader, M4C Project at Swisscontact, for his technical direction on designing the study, and overall guidance and constant support throughout the assignment. We also thank Md. Tawhidul Islam, Senior Manager-Innovation, Knowledge Management & MRM, Mohtahsam Billah, Manager Monitoring and Results Measurements, and Yasir Arafat, Senior Manager - Partnership and Grants, of the M4C team for supporting us throughout the study. They have graciously helped us with necessary project documents and also helped us to manage the field activities of the study. We sincerely acknowledge their contribution.

We also thank M4C project field staff for helping us cordially during our data collection process. We finally thank all the respondents of this study. Their contribution helped us undertake a rigorous study, which we believe will help Swisscontact in its future endeavours in Bangladesh.

Acronym

AIC	Agricultural Input Company
BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agricultural Research Institute
BDT	Bangladeshi Taka
BINA	Bangladesh Institute of Nuclear in Agriculture
BRRI	Bangladesh Rice Research Institute
BSA	Bangladesh Seeds Association
CDRC	Char Development Research Centre
COGS	Cost of Goods Sold
DAE	Department of Agricultural Extension
FGD	Focussed Group Discussion
HYV	High Yielding Variety
KII	Key Informant Interview
LSP	Local Service Provider
M4C	Making Markets Work for Chars
MT	Metric Ton
NGO	Non-Government Organisation
OP	Open Pollinated
SRDI	Soil Resource Development Institute
UAO	Upazilla Agricultural Office

Executive Summary

Background: This study summarises the findings from the study undertaken to analyse Agricultural input markets in the selected char regions in Bangladesh, as a part of the 'Making Markets Work for Chars (M4C)' project implemented in Bangladesh since December 2011. Its main objective is to improve the market systems of the northern char region of Bangladesh and subsequently improve the socio-economic conditions and reduce poverty and vulnerability of the char region population. Findings from this study will be developed as a knowledge product for private and public input companies in Bangladesh to encourage them to invest in the char regions by identifying the potential opportunities for market growth in the input market which will enable them to expand their business and eventually develop the economic condition of Char dwellers. The current phase of M4C is being implemented from 2020 to 2024 in six districts of Bangladesh: Gaibandha, Jamalpur, Kurigram, Lalmonirhat, Rangpur and Shariatpur. In this study, we assessed the input market situation in the Char areas of Bangladesh by estimating the market size and growth potential of seeds, fertilisers including micronutrients pesticides and Agri-machinery, identifying the barriers and opportunities for scale-up of business of private sector companies in these areas and suggesting recommendations to overcome the challenges and leverage the opportunities.

Methodology: Data for this study was collected by Key Informant Interviews (KIIs) with input market stakeholders like retailers, distributors, farmers cooperatives, Government Associations, Private company representatives, and focus group discussions (FGDs) with farmers in the selected char-lands.

Market size: Four types of input products/services are used for crop cultivation in char-lands. These are:

- Seeds, Fertilisers-including micronutrients
- Pesticides (Crop Protection Solution)
- Agri-machinery

We have estimated the market size of each of these input products in Char-lands based on the analysis of our primary data collected from the study.

Seeds: The overall market size of the seeds with top three crops in each district is given below-

Input: Seed			**Total Market Size (MT)**			**Total Market Size (BDT)**		
			27,294			**2,793,535,485**		
Cultivated crops	**Total Market Size (MT)**	**Total Market Size (BDT)**	**Cultivated crops**	**Total Market Size (MT)**	**Total Market Size (BDT)**	**Cultivated crops**	**Total Market Size (MT)**	**Total Market Size (BDT)**
Kurigram	**3,305**	**455,077,606**	**Lalmonirhat**	**3,987**	**491,768,920**	**Rangpur**	**15,285**	**870,226,948**
Maize	177.92177	106,749,360	Maize	386	231,771,408	Potato	14,811	666,495,000
Paddy	259.46	90,811,088	Potato	2964	133,380,000	Pumpkin	5	70,410,000
Ground Nut	711.4	85,368,000	Paddy	425	95,733,000	Maize	115	69,264,000
Gaibandha	**702**	**377,389,357**	**Jamalpur**	**1,292**	**428,171,189**	**Shariatpur**	**2,723**	**170,901,465**
Maize	336	201,637,680	Maize	415	249,081,840	Potato	2462.4	110,808,000
Onion	15.05	90,292,167	Ground nut	494	59,305,200	Paddy	86.49	19,459,519
Paddy	138.38	31,135,230	Paddy	225	50,594,749	GroundNut	148.26	17,791,560

Fertilisers: Mainly, two types of fertilisers used in char-lands: macro-nutrient fertilisers and micro- nutrient fertilisers. We have focused on micro-nutrient fertilisers as the scope of private sector companies is more prominent here. The market size of fertilisers across districts is given below-

Input: Fertiliser	Total Market Size (MT) 21,073.01

Fertiliser	Kurigram	Rangpur	Gaibandha	Jamalpur	Shariatpur	Lalmonirhat
Gypsum (ton)	2,027.65	969.33	2,026.36	2,571.50	417.76	1,104.02
Zinc Sulphate (ton)	178.35	141.83	197.46	252.2	48.89	122.31
Magnesium Sulphate (ton)	1,513.99	1,177.81	2,485.75	2,723.00	196.92	780.33
Boron/ Boric Acid (ton)	435.67	167.82	460.42	568.23	63.65	129.91
Solubor Boron (ton)	49.6	24.16	73.65	84.5	8.26	19.98
Chelated Zinc (ton)	53.78	45.43	71.01	83.5	15.42	43.07
Total (MT)	**4,259.04**	**2,526.38**	**5,054.15**	**6,282.92**	**750.90**	**2,199.62**

Pesticides: Pesticides are used in two forms: Liquid form and Solid form. The total market size of the pesticides is given below-

Input: Pesticide	Total Market Size (MT) 2,065.88	Total Market Size (Litre) 354,850.49

District	Insecticide		Fungicide		Herbicide	
	Solid (kg)	Liquid (ml)	Solid (Kg)	Liquid (ml)	Solid (Kg)	Liquid (ml)
Kurigram	328,252.75	22,615,382.02	31,659.43	3,953,680.00	7,907.36	25,904,511.36
Rangpur	241,762.80	19,695,320.00	12,942.80	16,842,900.0	4,346.18	23,156,000.00
Lalmonirhat	438,039.22	29,975,233.00	20,855.10	3,756,200.00	12,827.5	7,854,400.00
Shariatpur	77,777.11	9,966,567.45	11,891.10	2,833,057.50	2,594.60	9,411,404.00
Gaibandha	352,781.13	30,534,150.65	37,620.53	0.00	7,457.73	51,486,520.00
Jamalpur	420,572.71	39,042,590.00	46,949.95	1,482,630.00	9,637.10	56,339,940.00
Total (kg/ml)	**1,859,185.7**	**151,829,243.1**	**161,918.9**	**28,868,467.5**	**44,770.5**	**174,152,775.3**
Total (MT/L)	**1,859.19**	**151,829.24**	**161.92**	**28,868.47**	**44.77**	**174,152.78**

Agri-Machineries: Farmers use a considerable number of Agri Machineries in char-lands, including large-sized machineries like tractors, combined harvester etc. and medium to small-sized machineries like Power Tiller, Reaper, maize sheller, irrigation pumps etc. These machinery services are provided by the following companies-

- Metal machineries
- ACI motors
- Alim Industries Limited (no active distribution network in Gaibandha and Jamalpur districts)
- Krishibid machineries
- Kamal machineries

Growth Potential: We have observed significant scope to increase the market size of input products in Char-lands. By introduction of low-cost irrigation methods in Char-land areas, the total cultivable land acreage can be increased by almost (5-10) %. As a result of this, market of all input products has the potential to expand. In case of seeds, private sector companies do not commercially sell seeds for a large portion of Open Pollinated (OP) crops like HYV Rice, Black Gram, Mustard, Groundnut etc. which are consequently cultivated with retained seeds. Also, there is a good potential of increasing market of maize and mustard seeds in char-lands as the yield of maize and mustard is seen to be much higher in chars than in mainland over the last couple of years. In case of fertilisers, we observed that-

- Current usage of all fertilisers is less than the recommended usage.
- Also, around 60% of the fertilisers used in char-lands are adulterated products.
- In addition, the use of organic fertiliser is not prominent in char-lands because of the high price of commercial compost.

By addressing these issues, market size of fertilisers can be increased substantially. In case of pesticides, the current usage of some of the pesticides is less than the recommended usage. Thus, there is a good potential of expanding market size of pesticides if these pesticides are used in right dosages in the current cultivable lands across districts. In addition, we have also observed the potential of Trichoderma as seed treating agent and compost activator in char-lands.

Challenges and Opportunities: We observed some major challenges in Agri-input market operation and Crop production practices in char-lands. Some of these are:

- High use of adulterated fertiliser and over use of fertiliser and pesticides
- Usage of adulterated and counterfeit Agri-chemical inputs
- Lack of char-focused distribution network by private companies
- Currently, only a few char farmers are utilising the existing DRR or eco-friendly crop protection solutions and cultivation technology in their crop production.

In addition, there are some good opportunities for private sector input companies to expand their business in char-lands. Some of these are:

- Scope of market expansion for HYV seeds by National input companies
- Digital promotion targeted at young farmers
- Addressing shortage of large Agri machineries in char-lands
- Scope for private company to promote Pumpkin, Mustard, Pulses, Oilseeds, and Groundnut etc.
- There is a potential for expanding the market of DRR or environmentally-friendly crop protection solutions in the char areas.

- The market's potential for addressing the penetration of drought, short height variety, storm, flood resistance, and short-duration seed variety is significant, especially considering Char as a natural disaster-prone area.

Recommendations: To address these challenges and opportunities, we have some recommendations for private input companies. These are given below:

- Establishing a char-focused distribution system
- Mass promotion of an improved variety of seeds
- Conducting digital promotion targeted at young farmers
- Promotion of Trichoderma in char-lands
- Increasing Availability of large Agri machineries in char-lands
- Promotion of DRR and environment-friendly input products in the char-lands. Private-sector companies that are interested in developing, promoting, and distributing DRR or environmentally-friendly crop protection chemicals (CPC) or seed varieties should actively engage in targeting the future business potential of Char.

To sum it up, the Agricultural sector in Bangladesh has experienced growth, but the Char-lands face challenges such as inadequate infrastructure and limited access to finance and quality Agri-inputs. To address these challenges, involving private sector Agri-input companies can bring new technologies and market linkages to improve efficiency and increase productivity. However, creating an enabling environment is necessary, including improving regulations, finance, infrastructure, and fostering public-private partnerships. By doing so, the private sector can contribute to the development of the Agricultural sector in the char-lands of Bangladesh.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Chapter 1: Introduction

1.1 Context of this study

The 'Making Markets Work for the Chars (M4C)' project was initiated in Bangladesh in December 2011 by the Embassy of Switzerland and the Ministry of Local Government, Rural Development and Co-operatives. Since then, it has been working to improve the socio-economic conditions of vulnerable and marginalised char dwellers living in the northern char region of Bangladesh. The main purpose of the project is to improve the market systems and subsequently reduce poverty and vulnerability of the char regions. This purpose is being achieved by the Making Markets Work for the Jamuna, Padma and Teesta Chars (M4C) Project. It is mandated by the Swiss Agency for Development and Cooperation (SDC) and the Ministry of Local Government, Rural Development and Cooperatives, Government of Bangladesh. M4C aims to reduce poverty and vulnerability of char households by facilitating market systems that enhance opportunities for income generation. Until 2021, it has benefitted 131,700 char households in ten districts of northern Bangladesh with an additional income of BDT 13,000/household. Swisscontact, in collaboration with Rural Development Academy, Bogura, has been implementing M4C in Gaibandha, Kurigram, Jamalpur, Rangpur, Lalmonirhat and Shariatpur until June 2024. A team of dedicated project staff supported by implementing partners (local NGOs) manage the implementation of project activities in the field.

Through time-bound partnerships, M4C supports public agencies (research, extension, etc.), private companies (agro-input, agro-processing, financial institutions, etc.), and local market actors (retailers, traders, etc.) to expand to peripheral char markets and to promote their products and services. M4C offers financial and non-financial support for a) pre- and post-market research, b) strengthening the capacity of relationships/ linkages between market actors, and c) piloting and scaling up inclusive business/ service delivery models.

M4C addresses the following transversal thematic areas: women's economic empowerment (WEE), disaster risk reduction (DRR), governance and conflict-sensitive project management (CSPM) in the project design and implementation. Onboarding and encouraging private and public sector actors in Bangladesh to invest in the char regions so that its economic potential in Agriculture and livestock rearing activities can be fully utilised.

Providing services that will contribute to the enhancement of economic performance of the poor char households.

The current phase of M4C is being implemented from July 2020 to June 2024. The project is being implemented in six districts of Bangladesh: Gaibandha, Jamalpur, Kurigram, Lalmonirhat, Rangpur and Shariatpur. In order to expand the input market into the peripheral char markets, and for promotion of the available products, and services, M4C supports public agencies, private sector companies, and local

market actors through time-bound partnerships. Additionally, to archive and disseminate information, knowledge, and lessons of various char development initiatives, M4C supports Char Development Research Centre (CDRC) and other NGOs as well. This creates awareness and mobilise initiatives and investments in the char regions from the wider public and private sector actors beyond the project period.

M4C intends to develop a knowledge product specified for the relevant stakeholders. The knowledge will be disseminated through regional and national events and as part of this, M4C commissioned this study to analyse Agricultural input markets in the selected char regions in Bangladesh.

M4C has its operations across six districts in Bangladesh. The locations of operation are given in the table below.

Table 1: Working areas of M4C

District Name	Upazila Name	# of union	# of village
Gaibandha	Fulchori	6	56
	Gaibandha Sadar	2	20
	Saghata	2	13
	Sundargonj	4	31
Gaibandha Total		**14**	**120**
Jamalpur	Bakshigonj	3	21
	Dewanganj	7	51
	Islampur	9	61
	Melandha	2	16
	Sarishabari	5	29
Jamalpur Total		**26**	**178**
Kurigram	Bhurungamari	8	29
	Char Rajibpur	3	33
	Chilmari	4	28
	Kurigram Sadar	6	55
	Nageshwari	8	55
	Phulbari	3	12
	Rajarhat	1	1
	Raumari	5	71
	Ulipur	8	74
Kurigram Total		**46**	**358**
Lalmonirhaat	Aditmari	1	4
	Hatibandha	4	14
	Kaliganj	1	3
	Lalmonirhaat Sadar	5	21
Lalmonirhaat Total		**11**	**42**
Rangpur	Gangachara	6	26
	Kaunia	4	20
	Pirgacha	2	20
Rangpur Total		**12**	**66**
Shariatpur	Bhedarganj	1	27

	Naria	3	28
Shariatpur Total		**4**	**55**
Grand Total		**113**	**819**

1.2 Agricultural production in the Char-lands of Bangladesh

Compared to mainland, Char-lands of Bangladesh have some unique characteristic and are also crippled with several challenges. Char lands contribute a substantial proportion to the national Agricultural production of Bangladesh. Bangladesh has a total land area of 14.846 million hectare, of which around 70%, i.e., 10.392 million hectare is Agricultural land (FAO, 2022)[1]. According to a 2016 report published by Bangladesh Agricultural Research Institute, Char-lands in Bangladesh constitute of 0.83 million hectares of which about 0.52 - 0.79 million hectares is suitable for Agricultural production (Bangladesh Agricultural Research Institute, 2016)[2].

Already, a significant number of crops are cultivated in Char-lands. Some of these crops are Aman rice, Boro rice, Maize, Jute, Wheat, Chilli, Onion, Potato, Pulses, Ground Nut and oil seed crops etc. These crops are grown in regular patterns in Char lands, however the yield of most of these crops is lower than national level yield. Thus, there is a potential to increase yield for these crops in the char lands.

There are opportunities to increase the Agricultural production in the Char-lands of Bangladesh for some particular crops which have more production potential in chars rather than mainland areas. Some of these crops are Maize, Mustard, Groundnut etc. The productivity of these crops can be increased significantly through usage of improved quality seed varieties and balanced use of fertiliser.

1.3 Objectives of the study

The overall objective of the study is to assess the input market situation in the Char areas of Bangladesh. The specific objectives of the assignment are as follows: c

1. Estimate the market size and growth potential
2. Examine the availability of quality products and participants
3. Identify the barriers and prospective fields for scale-up
4. Develop portfolio of the char and char-adjacent areas' crops, seeds, crop protection materials, micronutrients, advanced equipment, and key fertiliser market

1.4 Limitations of the study

This report summarises the findings from the assessment undertaken with key actors and stakeholders from the 6 selected districts under implementation of the M4C project. We used data from M4C project report, official documents from DAE and private input companies for Char-lands related facts and figures. In addition, we have collected primary data from 12 upazilas in the 6 selected districts for our study. The

1 FAO. (2022). *Implementation of the Global Strategy in Bangladesh*. Retrieved from FAO: https://www.fao.org/asiapacific/perspectives/Agricultural-statistics/global-strategy/results-in-the-region/bangladesh/en/

2 Bangladesh Agricultural Research Institute. (2016). *Unfavourable Eco-System: Crop Production Under Char-land Eco-System.* Dhaka: Crop Production Under Char-land Eco-System.

data collection would have been more comprehensive if we could have covered all the 27 upazilas under the M4C project implementation. However, there were some limitations.

1.5 Methodology

1.5.1 Study method

This study followed a qualitative approach to attain the key objectives of the assignment. However, in addition to the qualitative data related to the key objectives, the study collected relevant quantitative data to determine the market size, availability of products, and services, and estimate the growth potential. The study also analysed available secondary data from valid sources. The study method and frameworks that were used in the study are explained in the next section, as well as the data collection process, and sample size.

1.5.2 Secondary literature review

The study reviewed relevant reports, and articles on Agricultural production in Bangladesh and archival data of the M4C project on Agricultural production volume and input usage characteristics in the char regions to draw an initial comparison of the production practices, volume of production and input usage. Based on this, we identified the existing gaps and deficiencies as well as the required data to be collected (from primary investigation) to fill up the gaps.

1.5.3 Primary data collection

Primary data was collected from relevant stakeholders from the six districts- Gaibandha, Jamalpur, Kurigram, Lalmonirhat, Rangpur, and Shariatpur. FGDs and KIIs were used as instruments to collect necessary data from the relevant stakeholders. Input sellers, distributors, and private input company representatives were interviewed to understand the supply side of the input products. FGDs were conducted with the Char farmers to understand the demand side situation and to assess the level of awareness and knowledge on input usage. Government representatives were interviewed to understand the overall situation of the area and to assess the support functions in the system. In addition, farmers' association/cooperatives were interviewed to understand the perspectives on usage of quality inputs. The following table (table 1) details the sample size of the study.

Table 2: Sample size of the study

Respondent type	Number of interviews	Number of respondents
Input Sellers (seeds, fertilisers, pesticides)	36	36
Input Sellers (Agri-machinery)	12	12
Private Agri-input company representative	11	11
Distributors	19	19
Co-operatives/ Farmers Associations	3	3
Local-level government agencies (UAO and BADC representatives)	12	12
FGDs with farmers	24	192
Business Association of Input Companies	2	2
Research Organisations (BARI, SRDI)	2	2
Total	**121**	**289**

1.5.4 Data analysis and reporting

Against each of the study objectives, we made appropriate calculations from our primary data to determine market size and growth potential. Data collected from both the secondary and primary sources were compared to reach to conclusion. Additionally, quantitative information collected from the primary interviews were analysed to determine the demand supply situation and also to assess the input usage pattern. The calculation methods that have been adapted are as follows:

1. **For market size calculation of seeds,** we have identified the major crops cultivated in the Char-lands of selected districts from the FGDs conducted with Char farmers during our study, KIIs with Government officials, the production data received from the DAE and consultation with the M4C field team. Next, we took the area under cultivation of each crop in each district from DAE and M4C sources and multiplied them with the standard requirement of seeds (Kg/acre) of the major crops in each district obtained from BARI, BRRI and product portfolio of private companies to determine the market size of seed in selected districts.
2. **For market size calculation of fertilisers and pesticides,** we identified the standard usage practice of different fertilisers and pesticides for the major crops in Char-lands from the FGDs conducted during our study. This was multiplied with the area under cultivation of each crop in each district to determine the market size of fertilisers (by name) and pesticides (by type and form).

In addition to these, challenges, opportunities, and scope of intervention for government organisations and private sector companies have been analysed from both the qualitative and quantitative data collected. Analysed data has been summarised and presented in this report.

Chapter 2: Market Size

Chapter 2: Market Size

In the second section, we have determined the estimated market size of the Agricultural input products (fertiliser, seeds, pesticides, Agri-machinery) for the Char-land areas in the selected districts. Data obtained from the primary interviews with different stakeholders such as input sellers, farmers, local Agricultural office, private Agri-input companies etc. were used to make these estimations. In addition, we have taken cultivatable land area figures for Char-land areas from Department of Agricultural Extension (DAE). The detailed analysis is presented in the subsequent sections.

Four types of input products/services are used for crop cultivation in Char regions. These are:

1. Seeds
2. Fertilisers
3. Pesticides
4. Agri-machinery

We have collected primary data on inputs market from char-lands of twelve upazilas in six districts of Bangladesh, namely: Rangpur- Gangachhara, Lalmonirhaat- Hatiabandha and Kaliganj, Jamalpur-Islampur and Dewanganj, Shariatpur- Naria, Kurigram- Kurigram Sadar, Nageshwari, Ulipur, Rajibpur and Gaibandha- Sundarganj and Fulchhori. Based on the analysis of these data, we have estimated the market size of each of these input products in Char-lands. A snapshot is given below, and the detailed analysis is given in the following subsections.

Figure 1: Overall market size of the input products in Char-lands across districts

District	Total Market Size of Seeds (MT)	Total Market Size of Fertilizers (MT)	Total Market Size of Solid Pesticides (MT)	Total Market Size of Liquid Pesticides (Litre)
 Kurigram	3,305	4259.04	367.82	52,473.57
 Lalmonirhat	3,987	2199.62	471.72	41,585.83
 Rangpur	15,285	2526.38	259.05	59,694.22
 Gaibandha	702	5054.15	397.86	82,020.67
 Jamalpur	1,292	6282.92	477.16	96,865.16
 Shariatpur	2,723	750.90	92.26	22,211.03

2.1. Seeds:

2.1.1. Market size of Seeds:

At first, we identified the major crops cultivated in the Char areas from the FGDs conducted with Char farmers during our study. The identified crops were validated through KIIs with Government officials and the production data received from the DAE. Combining these two sources, an initial list of major crops cultivated in the Char-lands of the selected districts was developed. This list was cross checked and revised with the M4C field team, and a final list of major crops cultivated in the Char-lands of the selected districts was completed. Next, we took the total cultivable land of each crop (in hectare and acre) in each district from DAE. For some of the crops, we could not find land area from DAE. For these crops, we took cultivable land area from M4C database. For Shariatpur district, we obtained the data from KIIs with the local authorities. Other than Shariatpur, the DAE sources for rest of the districts are given in annex 1-5. The list of crops is given below-

Table 3: List of major crops across districts

District	Cultivated crops	Total cultivated land (Acre)
Kurigram	Maize	22,239
	Paddy	25,946
	Wheat	4,942
	Mustard	12,355
	Onion	2,471
	Potato	2,471
	Jute	22,239
	Black gram	19,768
	Ground Nut	17,785
	Chilli*	5,199
	Vegetable	6,598
Sub-total		**142,013**
Lalmonirhat	Maize	48285.71
	Paddy	42548
	Wheat	2527
	Groundnut	1544
	Mustard	2849
	Potato	4940
	Jute	4,878
	Vegetable	3,865
	Water Melon	556
	Pumpkin	235
Sub-total		**112,228**
Rangpur	Maize	14430
	Paddy	20353
	Wheat	687
	Potato	24685
	Groundnut	2235
	Pumpkin	2347
	Vegetable	4,678
	Mustard	4,292
	Jute	4,260
Sub-total		**77,967**

Gaibandha	Maize	44,479
	Paddy	24,711
	Chilli	12,355
	Jute	44,479
	Wheat	1,783
	Onion*	7,524
Sub-total		**135,331**
Jamalpur	Maize	49,421
	Chilli	21,004
	Jute	49,421
	Groundnut	12,355
	Mustard	7,413
	Paddy	32,124
	Vegetables	6565
Sub-total		**178,303**
Shariatpur	Paddy	8,649
	Maize	1,927
	Mustard	1,853
	Chilli	7,660
	Groundnut	3,707
	Potato	4,104
	Vegetable*	12,064
Sub-total		**39,964**

*For these crops, we took total cultivable land area as suggested by M4C reports since this data was not available in DAE database

We took the standard requirement of seeds (Kg/acre) of each crop from BARI, BRRI and product portfolio of private companies. Then, we have multiplied the total cultivable land of each crop with the standard requirement of seeds to find the total market size of each crop seed in each district (in Kg and MT). To determine the market value in BDT, we have taken the average price of seeds (BDT/kg) of each crop from interviews with private companies. Then we have multiplied the total market size of each crop seed in each district with the average price to find the total market size (BDT) of each crop seed in each district. This method is followed for all crops except vegetables, because it is quite difficult to determine a uniform average standard dosage and market price for vegetable seeds. So, for vegetables, we have limited out calculations to total cultivable land. From our calculations, the total market size of seeds in Char-lands of these six districts is 27,294 Metric Ton with a market value of 2,793,535,485 BDT. A snapshot of the total market size across districts is given in the figure below, and the detailed crop-specific breakdown is given in table 3.

Figure 2: Market size of seeds in Char-lands in selected districts

District	Total cultivated land (Acre)	Total Market Size (MT)	Total Market Size (BDT)
Kurigram	142,013	3,305	455,077,605
Lalmonirhaat	112,228	3,987	491,768,920
Rangpur	77,967	15,285	870,226,948
Gaibandha	135,331	702	377,389,357
Jamalpur	178,303	1,292	428,171,189
Shariatpur	39,964	2,723	170,901,465
Total	685,806	27,294	2,793,535,485

Table 4: Crop-specific market size of seeds in Char-lands across districts

District	Cultivated crops	Total cultivated land (Acre)	Total Market Size (MT)	Total Market Size (BDT)
Kurigram	Maize	22,239	177.92	106,749,360
	Paddy	25,946	259.46	90,811,088
	Wheat	4,942	247.11	13,590,775
	Mustard	12,355	49.42	8,895,780
	Onion	2,471	4.94	29,652,600
	Potato	2,471	1482.63	66,718,350
	Jute	22,239	53.37	13,343,670
	Black gram	19,768	316.29	31,629,440
	Ground Nut	17,785	711.4	85,368,000
	Chilli	5,199	2.08	8,318,543
	Vegetable	6,598		
Sub-total		**142,013**	**3,305**	**455,077,606**
Lalmonirhat	Maize	48285.71	386	231,771,408
	Paddy	42548	425	95,733,000
	Wheat	2527	126	6,949,250
	Groundnut	1544	62	7,411,200

	Mustard	2849	11	2,051,280
	Potato	4940	2,964	133,380,000
	Jute	4,878	12	2,926,800
	Vegetable	3,865		
	Watermelon	556	0.17	4,503,489
	Pumpkin	235	0.47	7,042,493
Sub-total		**112,228**	**3,987**	**491,768,920**
Rangpur	Maize	14430	115	69,264,000
	Paddy	20353	204	45,794,250
	Wheat	687	34	1,889,250
	Potato	24685	14,811	666,495,000
	Groundnut	2235	89	10,728,000
	Pumpkin	2347	5	70,410,000
	Vegetable	4,678		
	Mustard	4,292	17.17	3,090,394
	Jute	4,260	10.22	2,556,054
Sub-total		**77,967**	**15,285**	**870,226,948**
Gaibandha	Maize	44,479	336.06	201,637,680
	Paddy	24,711	138.38	31,135,230
	Chilli	12,355	4.94	19,768,400
	Jute	44,479	118.61	29,652,600
	Wheat	1,783	89.15	4,903,280
	Onion	7,524	15.05	90,292,167
Sub-total		**135,331**	**702**	**377,389,357**
Jamalpur	Maize	49,421	415.14	249,081,840
	Chilli	21,004	8.4	33,606,280
	Jute	49,421	124.54	31,135,230
	Groundnut	12,355	494.21	59,305,200
	Mustard	7,413	24.71	4,447,890
	Paddy	32,124	224.87	50,594,749
	Vegetables	6565		
Sub-total		**178,303**	**1,292**	**428,171,189**
Shariatpur	Paddy	8,649	86.49	19,459,519
	Maize	1,927	15.42	9,251,611
	Mustard	1,853	7.41	1,334,367
	Chilli	7,660	3.06	12,256,408
	Groundnut	3,707	148.26	17,791,560
	Potato	4,104	2462.4	110,808,000
	Vegetable	12,064		
Sub-total		**39,964**	**2,723**	**170,901,465**
Total		**685,806**	**27,294**	**2,793,535,485**

2.1.2. Growth Potential of Seeds

There is a significant scope to increase the market size of seeds in Char-lands. These are detailed out below-

- In Char-lands, a large portion of Open Pollinated (OP) crops like HYV Rice, Black Gram, Mustard, Groundnut etc. are cultivated with retained seeds. About 38% of respondent farmers in our study use retained seeds. Especially for Groundnut and Black Gram, almost the entire production is done by retained seeds because private sector companies do not commercially sell seeds for these crops. Besides, these crops are also grown in mainland adjacent to the Chars. Thus, there is a huge potential of growing the seed market in Char-lands and adjacent mainland areas by increasing the availability of these seeds.
- From our field observations, the yield of Maize is seen to be much higher in chars than in mainland. Particularly, in Kurigram, there was a two-fold increase of production volume of Maize over the last couple of years. The reason for the increasing growth of Maize cultivation can be attributed to the relatively low cost of maize cultivation in Char-lands than that in mainland, because of the following reasons:

    - **Lower susceptibility to pest infestation:** According to farmers and other Agricultural actors, chance of pest infestation in maize fields is lower in Char lands than that in mainland. The Fall Army Worm (FAW) which is quite prominent in maize cultivation now-a-days, has less chance to spread in chars due to isolation and periodic flooding.
    - **Low-irrigation crop:** Requirement for irrigation is lower in maize cultivation than other Rabi crops, particularly Boro rice. This is advantageous in char areas where the cost of irrigation is high in dry season.

- Mustard also has the potential to be a prominent crop in relatively old chars. Apiculture can increase the production of mustard and be a source of additional income for the farmers.
- By introduction of low-cost irrigation methods in Char-land areas, the total cultivable land acreage can be increased by almost 5-10%.

2.2. Fertilisers

2.2.1. Market size of fertilisers

In case of fertilisers, we identified the current usage practice of fertiliser in char-lands from the 24 FGDs conducted in 12 upazilas during our study. Then, we multiplied the median value of the fertiliser usage (crop-specific) obtained for these 12 upazilas with the total area under cultivation (crop-specific) in each district. Because of this large extrapolation of data, we found huge variations in the market size figures. The detailed table is given in Annex 6 and 7. Due to this, we have used the standard dosage data of the fertilisers to calculate the market size. We used the following calculation method:

- First, the standard usage practice of fertiliser was obtained from DAE.
- Then, we determined the median value of fertiliser usage (crop-specific).
- The median value was extrapolated by multiplying the median value of usage with the area under cultivation (crop-specific).
- Finally, we calculated the summation of the obtained value to estimate the growth potential of each fertiliser in the selected districts.

The market size of the fertiliser in char-lands across districts is given in the figure below. The standard dosage data is given in annex 8.

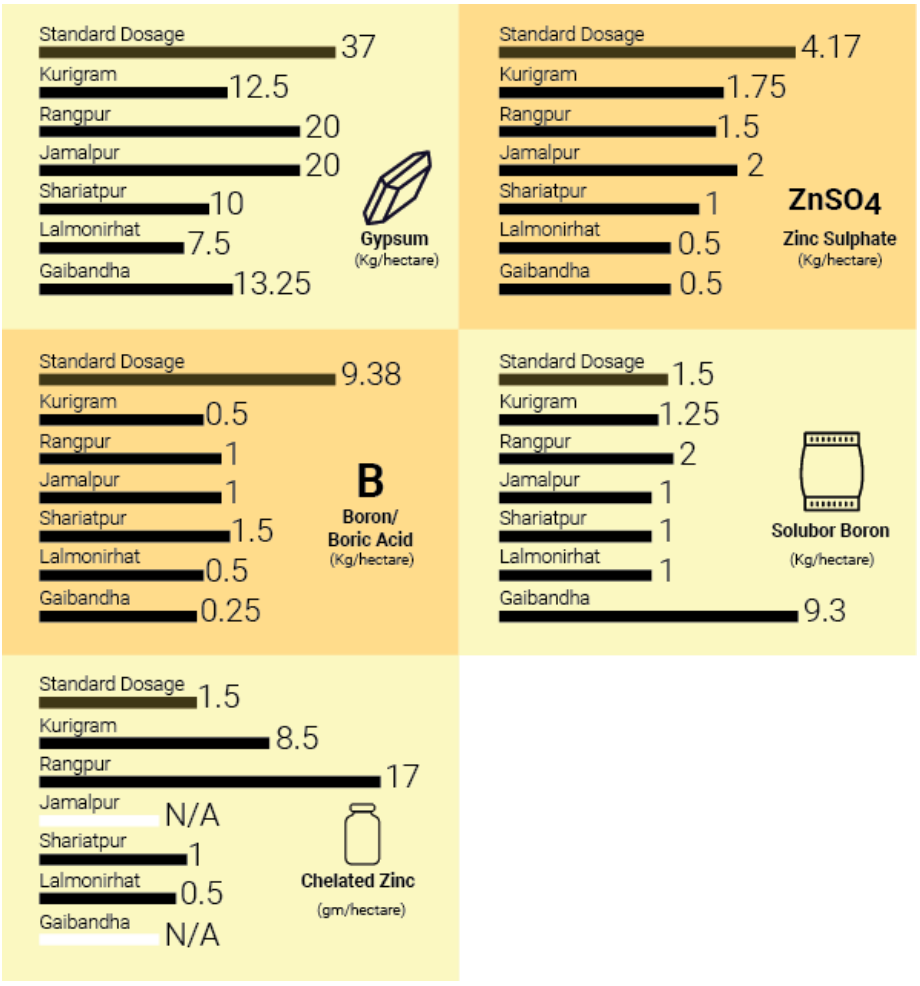
Figure 3: Market size of fertiliser in Char-lands of selected districts

Fertiliser	Kurigram	Rangpur	Gaibandha	Jamalpur	Shariatpur	Lalmonirhat
Gypsum (ton)	2,027.65	969.33	1,913.7	2,571.50	417.76	1,104.02
Zinc Sulphate (ton)	178.35	141.83	184.76	252.2	48.89	122.31
Magnesium Sulphate (ton)	1,513.99	1,177.81	2,388.31	2,723.00	196.92	780.33
Boron/ Boric Acid (ton)	435.67	167.82	431.86	568.23	63.65	129.91
Solubor Boron (ton)	49.6	24.16	69.08	84.5	8.26	19.98
Chelated Zinc (ton)	53.78	45.43	66.44	83.5	15.42	43.07
Total	4,259.04	2,526.38	5,054.15	6,282.92	750.90	2,199.62

2.2.2. Growth potential of fertilisers

From the current usage data, we have seen some discrepancies in usage of fertilisers from the standard recommended usage. These are shown in the bar chart given below.

Figure 4: Comparison of standard dosage and practiced dosage of different fertilisers in char-lands across districts



It can be seen from here that current usage of all fertilisers is less than the recommended usage. Thus, there is a good potential of expanding market size of fertilisers if fertilisers are used in right dosages in the current cultivable lands across districts. Also as mentioned in section 2.1.2, the total cultivable land acreage can be increased by almost 5-10% by introducing low-cost irrigation methods in Char-land areas. This will increase fertiliser usage in all districts.
In addition, it was gathered from our field observation that around 60% of the fertilisers used in char-lands are adulterated products. Thus, there is a significant scope of growth in market size of fertilisers if the usage of adulterated products can be eliminated. Also, from our observations it was seen that the use of organic fertiliser is not prominent in char-lands because of the high price and lack of awareness about benefits of the commercial compost. Also, commercial compost is not widely available in Char-land adjacent markets. To mitigate this situation, we have suggested using Trichoderma as compost-activator to produce low-cost compost. It is described in detail in section 2.3.2.1.

2.3. Pesticides

2.3.1. Market Size of Pesticides

As per our observation, three major types of pesticides are used in Char-lands - insecticide, fungicide and herbicide. All of these are sold in two forms in input markets: Liquid form and Solid form. Mostly, the solid and liquid forms are used interchangeably. Farmers are more prone to use the liquid form since it is easy to spray in crop fields. Like fertilisers, we obtained the current usage dosages of different types of pesticides from our field observations to determine the market size of each of these pesticides. But here as well, we found huge variations in the market size figures because of large extrapolation of data. The current usage dosage table and market size using this dosage is given in annex 9 and 10. Because of these variations, we have used the standard dosage data of the pesticides obtained from DAE to calculate the market size of pesticides in selected districts. Same calculation method as that of fertilisers was used for pesticides as well. The standard dosage data of pesticides is given in annex 11. The detailed market size across districts is given in figure 5.

Figure 5: Market size of pesticides in Char-lands of selected districts

	Insecticide		Fungicide		Herbicide	
	Solid (kg)	**Liquid (ml)**	**Solid (kg)**	**Liquid (ml)**	**Solid (kg)**	**Liquid (ml)**
Kurigram	328,252.75	22,615,382.0	31,659.43	3,953,680.0	7,907.36	25,904,511.3
Rangpur	241,762.8	19,695,320.0	12,942.8	16,842,900	4,346.18	23,156,000
Lalmonirhat	438,039.22	29,975,233.0	20,855.1	3,756,200	12,827.58	7,854,400
Shariatpur	77,777.11	9,966,567.45	11,891.10	2,833,057.5	2,594.60	9,411,404.00
Gaibandha	352,781.13	30,534,150.65	37,620.53	0.00	7,457.73	51,486,520
Jamalpur	420,572.71	39,042,590	46,949.95	1,482,630	9,637.10	56,339,940
Total (Kg/ml)	1,859,185.73	151,829,243.12	161,918.92	28,868,467.5	44,770.53	174,152,775.36
Total (Ton/Litre)	1,859.19	151,829.24	161.92	28,868.47	44.77	174,152.78

2.3.2. Growth potential of pesticide

From the current usage data, we have seen some discrepancies in usage of insecticides and fungicides from the standard usage data. These are shown in the bar charts given below.

Figure 6: Deviation of crop-specific current usage of insecticides from standard usage in char-lands across districts

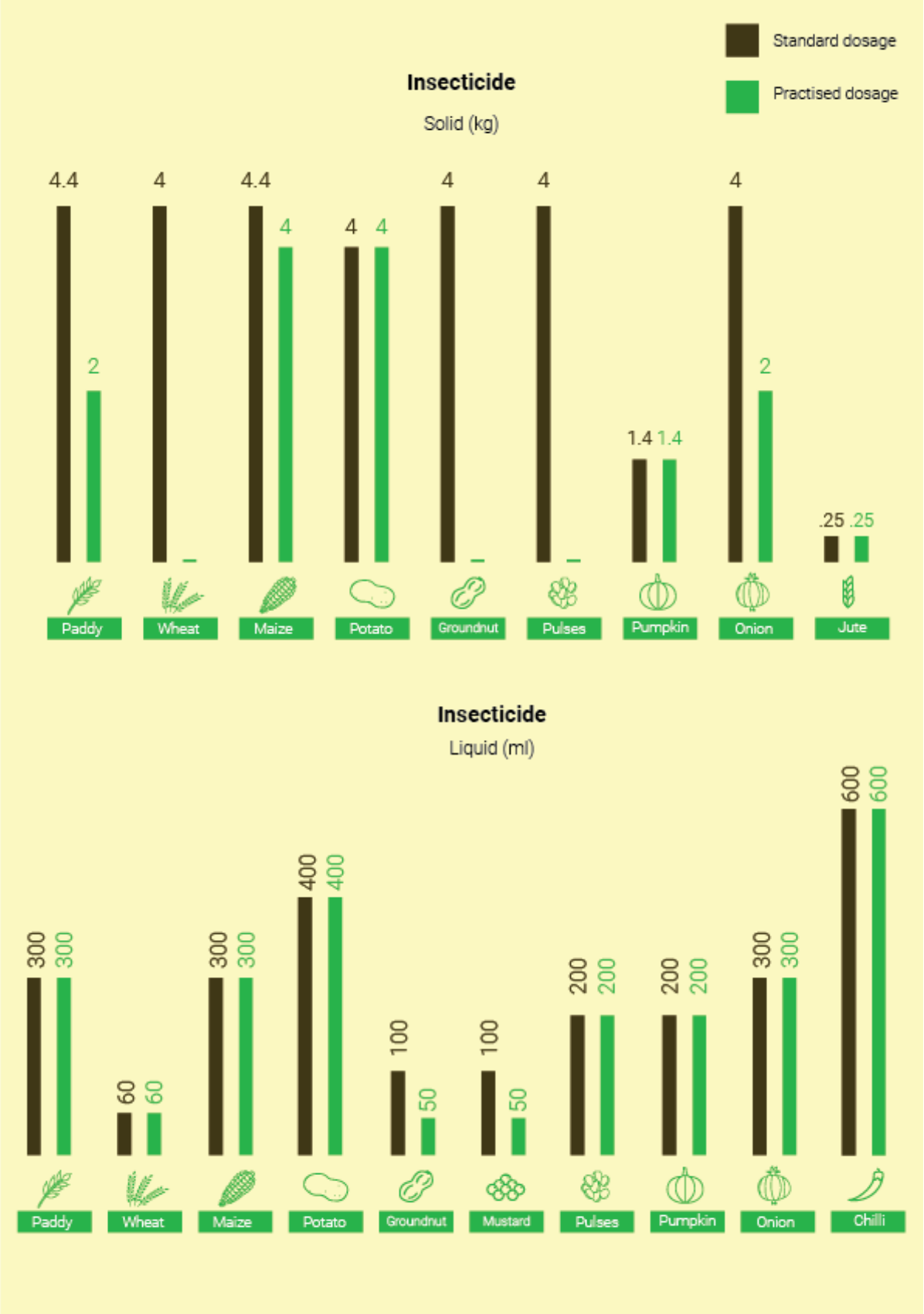
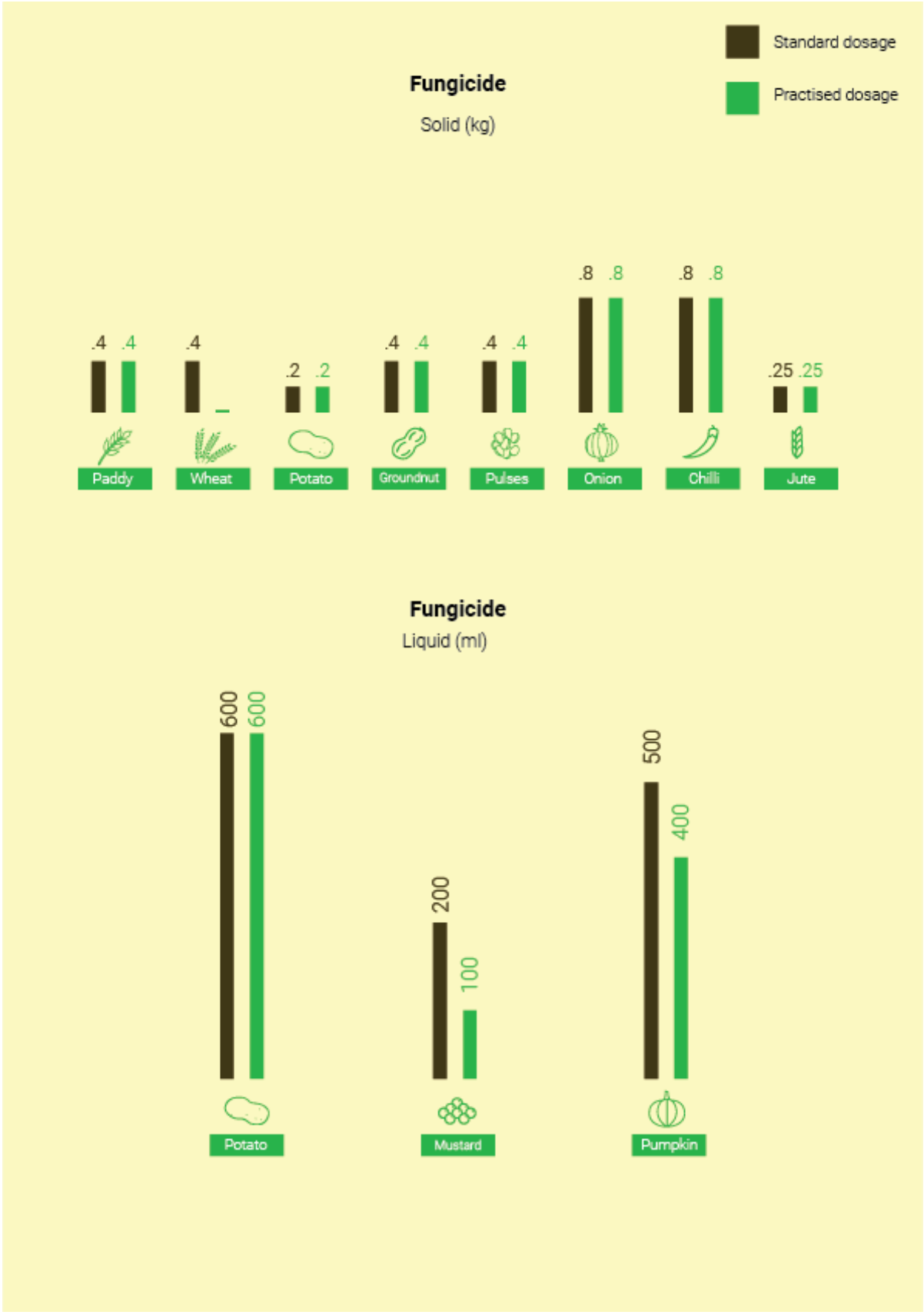


Figure 7: Deviation of crop-specific current usage of fungicides from standard usage in char-lands across districts



It can be seen from here that current usage of some of the pesticides is less than the recommended usage. Thus, there is a good potential of expanding market size of pesticides if these pesticides are used in right dosages in the current cultivable lands across districts. Also as mentioned in section 2.1.2 and 2.2.2, the total cultivable land acreage can be increased by almost (5-10) % by introducing low-cost irrigation methods in Char-land areas. This will also increase pesticide usage in all districts.

2.3.2.1. Case of Trichoderma

Trichoderma is a multi-purpose bio-agent which is a new product in Agri input markets of Bangladesh. This is used as seed treating agent for any crops other than chemically treated hybrid varieties; as seed treating agent for crops like Rice, Wheat, Potato etc. and as compost activator. As per our findings, it is not used in Char-lands yet, it does not have a presence in Char-adjacent markets. Few national input companies have gained very impressive growth in different pocket areas in Bangladesh. Consequently, they are expanding their Trichoderma production capacity. Hence, there is a good growth potential for it. In our calculation below, we have estimated the potential market size of Trichoderma as seed treating agent and compost activator.

Trichoderma as seed treating agent-
As per our interviews with private input companies, 10 gm of Trichoderma is used for 100 kg of seeds as a seed treating agent. We have multiplied this with the market size of seeds of different crops across districts to estimate the growth potential of Trichoderma as seed treating agent.

Trichoderma as compost-
We have observed from our field research that each acre of crop land requires around 500 kg compost. To make 500 kg of compost, 250 gm Trichoderma is needed as compost activator. We have multiplied the total cultivated land of different crops across districts to estimate the growth potential of Trichoderma as compost activator. The overall market size of Trichoderma in char-lands across districts is given below (figure 8), and the detailed crop-specific calculation is given in table 4. We can deduct from here that the potential market size for Trichoderma is quite promising.

Figure 8: Overall growth potential of Trichoderma in char-lands across districts

District	Cultivated crops	Trichoderma as seed treating agent (kg)	Trichoderma as compost activator (kg)
Kurigram		31267.07	8,095.15
Lalmonirhat		10282.97	4,756.15
Rangpur		11986.71	5,006.34
Gaibandha		3935.24	20,478.22
Jamalpur		9041.23	17,606.23
Shariatpur		27076.27	481.85
		93589.49 (Total)	56,423.94 (Total)

Crop-specific growth potential of Trichoderma varies across districts. The district-wise growth potential is as follows:

Table 4: Crop-specific growth potential of Trichoderma in char-lands across districts

District	Cultivated crops	Total cultivated land (Hectare)	Total cultivated land (Acre)	Total market size of seeds (KG)	Trichoderma as seed treating agent (kg)	Trichoderma as compost activator (kg)
Kurigram	Maize	9,000.00	22,239.45	177,915.60	N/A	5,559.86
	Paddy	1,000.00	2,471.05	259,460.25	2,594.60	N/A
	Wheat	2,000.00	4,942.10	247,105.00	2,471.05	N/A
	Mustard	5,000.00	12,355.25	49,421.00	494.21	N/A
	Onion	1,000.00	2,471.05	4,942.10	49.42	617.76
	Potato	1,000.00	2,471.05	1,482,630.00	14,826.30	617.76
	Jute	9,000.00	22,239.45	53,374.68	533.75	N/A
	Black gram	8,000.00	19,768.40	316,294.40	3,162.94	N/A
	Ground Nut	1,000.00	2,471.05	711,400.00	7,114.00	N/A
	Chilli	2,104.00	5,199.09	2,079.64	20.80	1,299.77
Lalmonirhat	Maize	5,000.00	12,355.25	98,842.00	N/A	3,088.81
	Paddy	5,000.00	12,355.25	123,552.50	1,235.53	N/A
	Wheat	800.00	1,976.84	98,842.00	988.42	N/A
	Groundnut	500.00	1,235.53	49,421.00	494.21	N/A
	Mustard	350.00	864.87	3,459.47	34.59	N/A
	Potato	500.00	1,235.53	741,315.00	7,413.15	308.88
	Jute	1,974.00	4,877.85	11,706.85	117.07	N/A
	Pumpkin	95.00	234.75	469.50	N/A	58.69
Rangpur	Maize	4,700.00	11,613.94	92,911.48	N/A	2,903.48
	Paddy	5,000.00	12,355.25	123,552.50	1,235.53	N/A
	Wheat	800.00	1,976.84	98,842.00	988.42	N/A
	Potato	14,124.06	34,901.26	889,578.00	8,895.78	370.66
	Groundnut	4,700.00	11,613.94	59,305.20	593.05	N/A
	Pumpkin	5,000.00	12,355.25	3,459.47	N/A	432.43
	Mustard	1,737.00	4,292.21	17,168.86	171.69	N/A
	Jute	1,724.00	4,260.09	10,224.22	102.24	N/A
Gaibandha	Maize	17,000.00	42,007.85	336,062.80	N/A	11,119.73
	Paddy	8,000.00	19,768.40	138,378.80	1,383.79	N/A
	Chilli	5,000.00	12,355.25	4,942.10	49.42	6,177.63
	Jute	12,400.00	30,641.02	118,610.40	1,186.10	N/A
	Wheat	18,000.00	44,478.90	89,150.54	891.51	N/A
	Onion	3,045.00	7,524.35	15,048.69	150.49	1,881.09
Jamalpur	Maize	5,000.00	12,355.25	415,136.40	N/A	12,355.25
	Chilli	18,000.00	44,478.90	8,401.57	84.02	5,250.98
	Jute	721.56	1,783.01	124,540.92	1,245.41	N/A
	Groundnut	51,721.56	127,806.56	494,210.00	4,942.10	N/A
	Mustard	20,000.00	49,421.00	24,710.50	247.11	N/A
	Paddy	8,500.00	21,003.93	224,865.55	2,248.66	N/A
Shariatpur	Paddy	5,000.00	12,355.25	86,486.75	864.87	N/A
	Maize	3,000.00	7,413.15	15,419.35	N/A	481.85
	Mustard	13,000.00	32,123.65	7,413.15	74.13	N/A

	Chilli	69,500.00	171,737.98	3,064.10	30.64	N/A
	Groundnut	3,500.00	8,648.68	148,263.00	1,482.63	N/A
	Potato	780.00	1,927.42	2,462,400.00	24,624.00	N/A
Total					**93,041.61**	**52,524.64**

2.4 Assessment of Agri-Machinery

In Char-lands, we observed the usage two types of Agri-Machineries in Agricultural production; large-sized machineries like tractors, combined harvesters, and medium to small-sized machineries like power tiller, irrigation pumps, maize shellers etc. Tillage with tractors is getting popular in char-lands as its usage is much more efficient for farmers than that of power tiller. A tractor can cover 2.5 acres of land per hour. But tractors are not widely available in char-adjacent areas. We found the presence of some Agri-Machinery companies who provide tractor and other Agri-machinery services in the char-lands. They are-

1. Metal machineries
2. ACI motors
3. Alim Industries Limited
4. Krishibid machineries

These companies have showrooms in major cities of different districts. Commissioned agents from different areas sell these machines to Local Service Providers (LSPs). LSPs rent them as per need to farmers in different chars during cultivation season. For instance, in Kurigram tractors come basically from Rangpur and Lalmonirhat districts.

Other small machinery services like shallow machine, pesticide sprayer, irrigation pumps etc. are mostly available in upazilas. These are distributed via input distributors or dealers to Agri-machinery retailers in Char-adjacent markets who sell or rent these machines to the farmers. Some farmers also own irrigation pumps themselves which they rent to other farmers in char area.

In addition to these, some machineries like combined harvester and maize sheller can be used more widely in Char-lands. Combined harvester is used in Rice and Wheat cultivation mostly. However, it is a cost-intensive machine, so its commercial feasibility in char-lands needs to be assessed. In addition, maize sheller is used in a small scale now, but as the demand for maize sheller is increasing due to the increased production of maize in the char-lands, there is a good opportunity of expansion of its usage in char-lands. Also, irrigation pumps are widely used in char-lands, however, low-cost and solar-based irrigation pumps can be introduced to minimize the cost of usage of these machineries.

Chapter 3: Challenges and Recommendations

Chapter 3: Challenges and Recommendations

3.1 Challenges

Bangladesh is a country with a predominantly agrarian economy. As a result, the Agricultural input market in Bangladesh has significant potential for growth and expansion. Especially, in char areas, where despite the challenges posed by the geography, Agriculture remains the primary earning source of the dwellers. However, there are several challenges that need to be addressed in order to fully capitalize on the opportunities. This assessment focused on the challenges in terms of expanding the Agri-input market in the Char-lands of Bangladesh. The identified challenges are as follows:

Lack of proper transportation services: One of the key challenges in expanding market to char areas, is expensive transportation services. Water vessels like boat and horse cart are the primary transport for the char dwellers, and are expensive compared to the land vehicles. The expensive transportation services pose significant challenge for the input suppliers, as it increases the COGS (cost of goods sold). Around 50% of the input sellers interviewed identified this as their most significant challenge while marketing their product into the Char-lands. Additionally, transportation to the remote Char-lands is time-consuming. The input sellers, and distributors are reluctant to travel to Char-lands due to high travel time requirement. As such, char-focused marketing of input materials is being impeded.

Lack of market infrastructure inside the char areas: Lack of market infrastructures inside the Char-lands are one of the most significant challenges faced by the private sector companies while marketing their products. Majority of the Char-lands do not have any permanent marketplace. As such, there are no direct retail points for private sector companies. However, it also needs to be mentioned that the geography of the Char-lands makes it difficult to build permanent marketplaces.

High use of adulterated fertiliser: Our assessment suggests that adulterated fertiliser like micronutrients is commonly used by majority of the char farmers. According to the Agri-input company representatives, around 60% of the char farmers do not use quality fertilisers like micronutrients. On the contrary, majority of the farmers use good quality pesticides (private company products). One reason behind this could be the imminent outcome pesticides bring. As the farmers can get the outcome of using pesticides sooner, they emphasize on the good quality of the products. As the outcome of good quality fertiliser do not come imminently, farmers often do not realise the importance of using good quality products. As such, adulterated fertiliser usage rate in the Char-lands was observed to be very high. Usage of adulterated fertiliser is also evident in the recent soil analysis study. The study by Soil Resource Development Institute (SRDI) conducted in Kurigram, Lalmonirhaat and Rangpur showed that the content of organic components, Nitrogen and micronutrients like Zinc and Boron are very low in all three aforementioned districts. The detailed table is given below and the source is given in annex 12.

Table 5: Presence of nutrient components in soil

Components	Presence in components in soil across districts		
	Kurigram	Lalmonirhat	Rangpur
Organic components	Very low	Very low	Very low
Nitrogen	Very low	Very low	Very low
Phosphorus	Low	Low	Very High
Potassium	Low	Low	Medium
Sulphur	High	Very High	Low
Zinc	Low	Very low	Very low
Boron	Very low	Very low	Low
Calcium	Medium	Low	Very low
Magnesium	Very High	Medium	Very low
Copper	Very High	Very High	Very High
Iron	Very High	Very High	Very High
Manganese	Very High	Very High	Very High

Increased operational cost makes the business expansion difficult for the private companies: Most Agricultural input products (seeds, fertilisers, pesticides etc.) are imported. Due to international unrest and recent economic crisis, price of these products has increased. Besides this, the cost of fuel is on the rise. This has increased transportation cost at each stage of the input supply chain. Moreover, the government has recently decreased the subsidy and raised the prices of urea, DAP, TSP, and MOP fertilizers by BDT 5 per Kilogram[3]. These contributed to an overall rise in the production and logistics cost, and consequently impacted on supply of products. Availability of macro fertilisers has also decreased in the national market in recent months, and Government has also increased price of macro fertilisers.

As per our study, 32% of the input distributors operating in Char-land adjacent markets indicated an overall shortage of input products, particularly shortage of Urea in general and shortage of other fertilisers in *Robi* season. This shortage of supply is also contributing to high price of products and consequently profit margin is decreasing. This has been identified by 53% of the input distributors as a significant challenge.

Increased usage of retained seeds: Farmers use retained seeds for crops like- pulses, oilseeds and groundnuts etc. Additionally, farmers were also reported to purchase seeds from informal channels (from other farmers). Germination rate of retained seed is often low, and they are more prone to pest attacks and diseases. Private sector companies are yet to penetrate this market.

Usage of adulterated and counterfeit Agri-chemical inputs: Our assessment suggests that there is a high prevalence of adulterated and counterfeit Agri-input products in the char adjacent markets. Farmers unknowingly use these products causing lower production volume. For example, calcium carbonate is often sold instead of calcium sulphate as Gypsum. From our field observations, we have found a particular incident of counterfeit product in Rangpur. It is presented below:

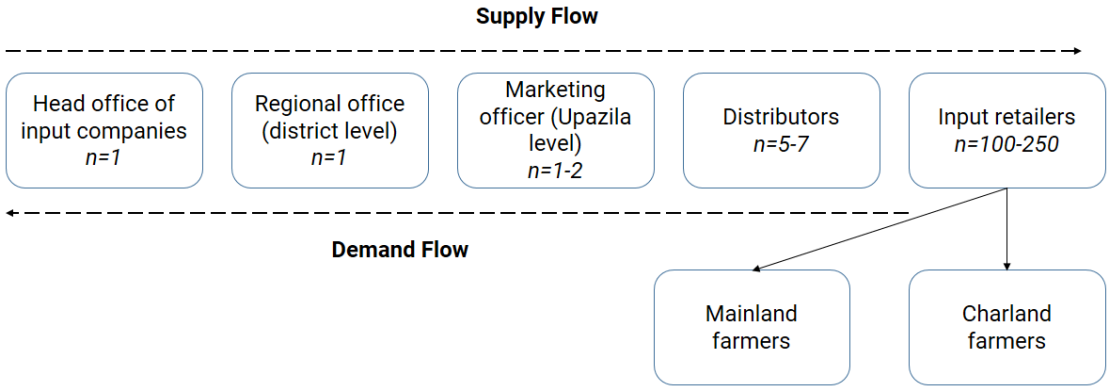
[3] https://www.tbsnews.net/economy/fertiliser-prices-tk5-kg-614670

Case-Somota Agro: In Kaunia, Rangpur, during an input market monitoring activity by Upazila Agricultural Office (UAO), the authority confiscated a pesticide from a company called *Somota Agro* because the company did not have a valid registration number. Upon further investigation, UAO along with the district magistrate, raided the company's office in Ranpur and confiscated a large volume of counterfeit products. It was also found that they were using the trade license number of another company to operate their business.

Lack of char-focused distribution network: Private Agri-input companies have limited char-focused distribution network. Private companies have their distribution network up to Upazila/Union-level local market retail points. However, it should be noted that some M4C partner AICs (Agricultural Input Companies) established their distribution network considering the char customer-based haat bazaar. Additionally, some non-partner AICs have recently started their business in the M4C working treatment area and they are still continuing their business.

Char farmers usually procure their products from char adjacent retail markets. The distribution network does not have any char-focused or char-specified arrangements. A typical distribution flow is illustrated in figure 9. As can be seen in the figure, the input retailers are the last distribution points for the companies. Retailers from char-adjacent markets supply to both the Char-land farmers and mainland farmers. For char-adjacent market retailers, mainland farmers constitute the larger customer base. Additionally, while mainland farmers require Agri-input products throughout the year, Char-land farmers cultivate crops in Robi season. As such, retailers put special focus on mainland farmers' demands, and serve Char-land farmers on need basis.

Figure 9: Agri-input product supply and demand flow



Practice of credit-based transaction in the downstream direction of Agri-input supply chain: Majority of char farmers purchase input products from retailers on credit. Because of this, some input retailers take advantage of the char farmers by selling them poor quality inputs. Also, realisation of credit on time often gets difficult. This delay in credit realisations means that the input sellers face a constant shortage of capital, thus they cannot stock demanded products on time at required quantity. Besides, private input companies only provide credit support to trusted dealers/distributors only. The average credit duration is less than 3 months, a few companies offer a 6-months period. This reduces supply of good quality products in Char-adjacent markets which increases the possibility of sale of counterfeit and fake products. This situation disincentivizes overall scale-up possibilities of input companies in Char regions.

High irrigation cost restricts farmers to invest further in Agri-inputs: The irrigation cost in Char-lands is quite high. There are various reasons contributing to it. Firstly, electricity is not widely available in Char-lands, thus irrigation process is mostly fuel-fed. Due to the increase of fuel cost, the cost of irrigation has increased. Secondly, the water retention capacity of Char-lands soil is very low due to the sandy nature of soil. In chars. Thus, higher frequency of irrigation is required during dry season, which contributes to higher cost of irrigation. This prevents farmers to invest further for good quality input products.

Limited usage of DRR or eco-friendly crop protection solutions: A small number of farmers in Char-lands are currently taking advantage of available disaster risk reduction (DRR) or eco-friendly crop protection solutions and cultivation technology in their agricultural practices. DRR refers to measures and strategies aimed at reducing the vulnerability of communities and ecosystems to natural hazards, such as floods, cyclones, and droughts. In the context of crop production, DRR solutions can include practices like proper land management, efficient water use, soil conservation, and the use of weather forecasting and early warning systems to mitigate the risks associated with extreme weather events. Similarly, eco-friendly crop protection solutions involve adopting environmentally sustainable methods to control pests, diseases, and weeds without relying heavily on chemical pesticides or fertilisers. There could be several reasons for farmers to not adopt these practices yet- Lack of awareness about availability and benefits of DRR and eco-friendly practices, limited infrastructural and technological resources, adherence to traditional farming practices etc.

3.2 Opportunities

Promotion of balanced fertilisation: There is a scope of improving quality of fertiliser in char areas of Bangladesh by using proper quantity of organic components and micronutrients. Existing fertilisation practices should be strengthened by promoting balanced fertilisation practices. Also, usage of organic fertiliser like compost should be increased in Char-lands as organic matter in Char soil is very poor as per the SRDI assessment.

In order to enhance soil condition, farmers have the option to produce organic fertilizers at the household level and apply them in their farmlands. Furthermore, they can consider cultivating *Sesbania* and *Leguminosae* crops prior to planting T-Aman as an additional measure. By adopting these practices, farmers can improve soil health, leading to increased crop productivity. This approach can also help mitigate the issue of macro fertiliser supply shortages in the market during times of global unrest. Furthermore, the utilisation of compost, including *Leguminosae*, enhances the water retention capacity of the soil. As a result, farmers can expect a reduction in irrigation costs. Moreover, compost can be prepared at a low cost within farmer households. This process can be facilitated by introducing Trichoderma in Char-lands. Remarkably, a mere 100 grams of Trichoderma powder formulation can yield a minimum of 200 kilograms of compost. Not only does Trichoderma increase the volume of compost, but it also significantly enhances its efficiency and quality.

Scope of market expansion for HYV seeds by National input companies: Pulse (mostly Mashkalai) and Oilseeds like groundnut, mustard etc. are among the major cultivated crops in char regions. But these seeds are not available commercially in Char-adjacent markets as national input companies did not target this segment yet. Bangladesh Agricultural Research Institute (BARI) and Bangladesh Institute of Nuclear in Agriculture (BINA) are working to develop a number of new varieties of pulse and oilseeds. They are very interested to collaborate with private input companies to provide sourcing and technical support. This is a huge opportunity for private input companies to expand their business in Char-lands and adjacent mainland as well. For instance, Groundnut cultivation area in Char-lands is around 11,000 hectares, and it is entirely cultivated by retained or informally sourced seeds. Thus, the production volume is suboptimal, for instance, average yield of Groundnut in Kurigram district is 3 Mt/ha. Introduction of commercial seeds for Groundnut

can prove to be a huge opportunity for private companies to expand their business in Char-lands. This can be shown in a case study below.

Case study of record yield of Groundnut production: Dudu mia, one farmer in Char Modhupur of Kawnia Upazila in Rangpur reported a record yield of 4.8 Mt/ha yield of BARI Badam 8 in 2019. Moreover, many Groundnut farmers are harvesting BARI Badam 8 at 4Mt/ha. The researcher of BARI attributed this yield in Kawnia due to superior variety and better soil nutrient management. The groundnut farmers in Kawnia cultivated groundnut in the potato fields which had residual fertilisation effect from potato cultivation. In addition to that they used Gypsum, Magnesium and Boron fertilisers during production. Thus, usage of improved variety of seeds and proper fertiliser management can improve Groundnut production to a great extent. This can be possibly replicated for Pulses and Oilseeds production in Char-lands.

In recent years, the market linkages between Chars and private companies are getting better. Expanding their business in new sub-sectors like this will help to further strengthen their portfolio in Char-lands. Increased volume of business will also help to reduce transportation costs and time incurred by private companies to work in Char-lands and increase their business profitability.

Judicious use of pesticides: In response to high price and indiscriminate usage of pesticides, awareness campaigns and capacity building training should be conducted targeting Char-lands farmers to promote proper usage of pesticides. There are some environment-friendly and low-cost bio-solutions (for example Trichoderma) which are available nationally, but they are not available in Char markets as per our study findings. Introduction of these bio-solutions in Char-lands will lower cost of production of the farmers and increase their profitability. Now a days, bio-solution products are getting popularity all across Bangladesh.

Digital promotion targeted at young farmers: To mitigate the issue of lack of physical presence of input sellers and distributors in Char-lands, private input companies can conduct digital promotional activities via mobile phone services and social media platforms, targeted at young population belonging to farmer families in Char-lands who have exposure of social media platforms. From our field observations, we have seen the presence of a substantial number of young populations in Char-lands who are well adept in using smartphones and social media platforms like Facebook, YouTube. Private companies can make information-based videos and tutorials on their products and technologies and market them via digital media to increase awareness among this target group. These young farmers can also be considered to be appointed as company ambassadors, to lead product demonstration activities, awareness campaigns and effective dissemination of knowledge in Char-lands on behalf of the companies.

The aforementioned opportunities of business expansion of private input companies in Char-lands will contribute to increased productivity and profitability of farmers. These will improve their purchase power, and they will be able to buy more input products on cash from retailers instead of purchasing on credit. Elimination of difficulty of credit realisation from farmers will eventually increase available capital at input sellers' end and enable them to purchase larger volumes of input products from reputed private input companies. This will increase the supply of good quality input products in market and possibly decrease presence and sales of counterfeit products.

Addressing shortage of large Agri machineries in Char-lands: The remote Char-lands are geographically constrained to use heavy Agri-machineries. However, heavy machineries like tractors are getting popular in Char-lands because of its efficiency and lower frequency of usage than that of power tiller. But these tractors are not widely available in char-adjacent markets. Moreover, a significant number of respondents from our farmer FGDs have mentioned the need of combined harvester for their production is growing but

is not widely available. Large machinery marketing companies have showrooms in major cities of different districts. LSPs (Local Service Providers) rent these services as per need to farmers in different chars during cultivation season. According to our study, farmers have complained that sometimes tractors are not readily available during cultivation season. Additionally, particularly in Kurigram district, the production of maize is expanding, but sufficient number of maize shelling machines are not available.

3.3 Recommendations

Against the identified challenges, and opportunities this study recommends the following to expand private-sector led Agri-input businesses in the Char-lands of Bangladesh. Additionally, there are some recommendations that will help improve the overall Agricultural productivity in the Char-lands that will consequently help the private sector companies to expand their business in the Char-lands. In the context of the study, we have proposed some opportunities for the M4C project to support the cause. The recommended activities, will at the same time ensure quality product usage by the farmers that will consequently improve the overall Agricultural productivity in the Char-lands of Bangladesh.

Establishing char-focused distribution system: Private companies can leverage upon their existing network to expand it to the Char-lands to capture the potential market. The companies already have network at the char adjacent mainland markets. Appointing LSP/retail point/exclusive or non-exclusive representative in the Char-lands will help catering to the Char-land farmers' demands. The appointed personnel can be engaged with some commission per sales with no fixed cost burden.

Potential results: Char-specific market expansion and capturing the potential market from the Char-lands.

Increasing market monitoring to eliminate counterfeit products and increase sales of the quality products: As discussed at the previous sections, the prevalence of adulterated and counterfeit products is increasing in Char-lands. To prevent this, UAO is mandated to conduct periodical market monitoring of the Char-adjacent input markets. M4C can establish a mechanism involving BCPA, DAE and UAO so that these monitoring activities can be performed more effectively in a planned manner. This will help the private sector companies capture the market currently being covered by counterfeit products.

Potential results: Regular and effective market monitoring activities will help to eliminate presence of adulterated and counterfeit input products from Char-adjacent markets and consequently help improve Agricultural productivity.

Mass promotion of improved variety of seeds: There is an untapped scope to introduce improved variety of commercial seeds of Rice, Oilseed, vegetable seeds and Pulses to reduce dependency on retained seeds and improve production volume of these crops. In order to do so, M4C can approach Bangladesh Seeds Association (BSA) and other private seed companies with business opportunity to expand their business in seed market by providing them with relevant statistics regarding production of these crops in Char-lands (area of cultivation, percentage of retained seeds used, production volume etc.). Further, they can connect the interested companies with different research organisations (BINA, BARI etc.) to facilitate the commercial sourcing of these seeds and later on, collaborate with these companies to pilot these seeds commercially in the Char-adjacent markets.

Potential Results: Like Trichoderma, this also gives input companies a great opportunity to expand their business portfolio in Char-lands. This will also improve seed usage practice in Char-lands and increase productivity and profitability of farmers.

Digital promotion targeted at young farmers: As mentioned in the opportunities section**,** private input companies can conduct digital promotional activities via mobile phone services and social media platforms targeting young population belonging to farmer families in Char-lands with access to social media platforms. Private companies can make information-based videos and tutorials on their products and technologies for this target group. This information will be disseminated by them within the farmer communities by word-of mouth and will increase their awareness about improved Agricultural practices and quality input products, which is consequently help to increase sales volume of these companies. Some of these young farmers can be selected and trained to be appointed as company 'ambassador farmers' to lead product demonstration activities, awareness campaigns and effective dissemination of knowledge in Char-lands on behalf of the companies. The promotional videos and activities will then act as knowledge material for these ambassador farmers.

Potential results: These promotional activities will act as a pull strategy for the input companies. Farmers' increased awareness and knowledge of good quality inputs will enable them to identify their input needs, and demand good quality products by name from input sellers. Increase in demand from farmers will encourage input sellers to stock good quality products in their shop and possibly reduce or eliminate selling fake or counterfeit products, thus enhancing the sales volume of private companies.

Promotion of Trichoderma in Char-lands: There is a substantial market size of Trichoderma in the Char-lands. The assessment suggests that usage of quality fertiliser is quite low, and additionally, the soil quality of the Char-lands is also deteriorating. Moreover, farmers use lower than recommended dosage impacting the productivity. To tackle these issues, Trichoderma can be used as a compost activator at household levels. This can accelerate the composting period and quality with available organic material (cow dung, kitchen wastage, crop residues) in Char-lands. Besides this, Trichoderma can be also used as seed treating agent and bio pesticide, thus mitigating the issues of wider usage of retained seeds and high price of pesticides in Char-lands. Trichoderma can be introduced in Char-lands by National private input companies (Haychem, Ispahani) who have Trichoderma in their product portfolio. They can introduce Trichoderma in Char-lands by various promotional activities like demonstration plot in farmers' lands or households, awareness campaigns via farmers' cooperatives and courtyard meetings *(uthaan boithok),* digital marketing campaigns on social media platforms targeting young adults from farmer families who can disseminate the information to their family members and peers.

Potential results: Input companies will expand their business portfolio in Char-lands by introduction a new demanding product. This will also improve fertiliser usage practice in Char-lands and increase productivity and profitability of farmers.

Increasing Availability of large Agri machineries in Char-lands: Heavy machineries like tractors and maize shelling machinery services are not widely available in the Char-lands. They are rented to farmers in Char-lands as per need by commissioned agents and LSPs assigned by the companies. To make these services more directly available, M4C can arrange Business Planning Sessions with traders from Char adjacent market to forecast the business opportunities of these Agri machineries in Char-lands. Based on these sessions, they can select suitable traders and facilitate their connection with machinery companies directly so that they can serve as commissioned agents of the company and directly bring these services to the farmers in Char-lands.

Potential results: Direct availability of the services in Char adjacent markets will motivate farmers to use these machineries as frequently as needed and will improve their productivity and profitability.

Establishing low-cost (solar panel-based) irrigation facilities and DRR practices to tackle climate challenges: Recently, solar panel-based irrigation facilities have been successfully implemented in some

areas of Bangladesh. This is a cost-effective and environment friendly technology which also helps to reduce dependency on electricity. M4C can conduct a feasibility study to test whether this technology will be suitable for Char-lands to reduce irrigation cost of Agricultural production. In addition, this will also enhance DRR practices. Some companies like Energypac, Shakti pump [4] has started the initiative in Bangladesh, and it is expected that this practice will soon expand across the country. In addition, to promote the adoption of disaster risk reduction (DRR) and environmentally-friendly practices in char-lands in Bangladesh, it is crucial for private-sector companies to actively participate in developing, promoting, and distributing DRR or environmentally-friendly crop protection chemicals (CPC) or seed varieties. By recognising the future business potential of char-lands, these companies can focus their efforts on providing sustainable and effective solutions tailored to the specific needs of farmers in these areas. This involvement can include research and development of DRR technologies and eco-friendly inputs, establishing distribution networks, and conducting awareness campaigns to educate farmers about the benefits and usage of these products. By engaging in these activities, private-sector companies can contribute to the sustainable development of char-land agriculture while also exploring profitable business opportunities.

Potential results: If feasibility can be ensured, then successful implementation of these technology in collaboration with government agencies and private sector companies will optimise irrigation cost and increase production capacity in Char-lands both at horizontal and vertical expansion.

4 https://thefinancialexpress.com.bd/views/opinions/solar-power-to-revolutionise-bangladesh-irrigation-1552917511

Chapter 4: Conclusion

Chapter 4: Conclusion

In recent years, the Agricultural sector in Bangladesh has witnessed significant growth, and the government has taken several initiatives to improve the sector's productivity and ensure food security for the population. However, there are still some challenges in the sector, particularly in the Char-lands of the country, where Agricultural activity faces various constraints, such as the lack of adequate infrastructure, limited access to finance, and inadequate supply of quality Agri-inputs, weak communication and bad roads etc.

To address these challenges, there is a need to explore new approaches and partnerships to enhance Agricultural development in the Char-lands of Bangladesh. One such approach is to increase the involvement of private sector Agri-input companies, which can bring in new technologies, best practices, and market linkages to improve the efficiency and effectiveness of Agricultural production in the region.

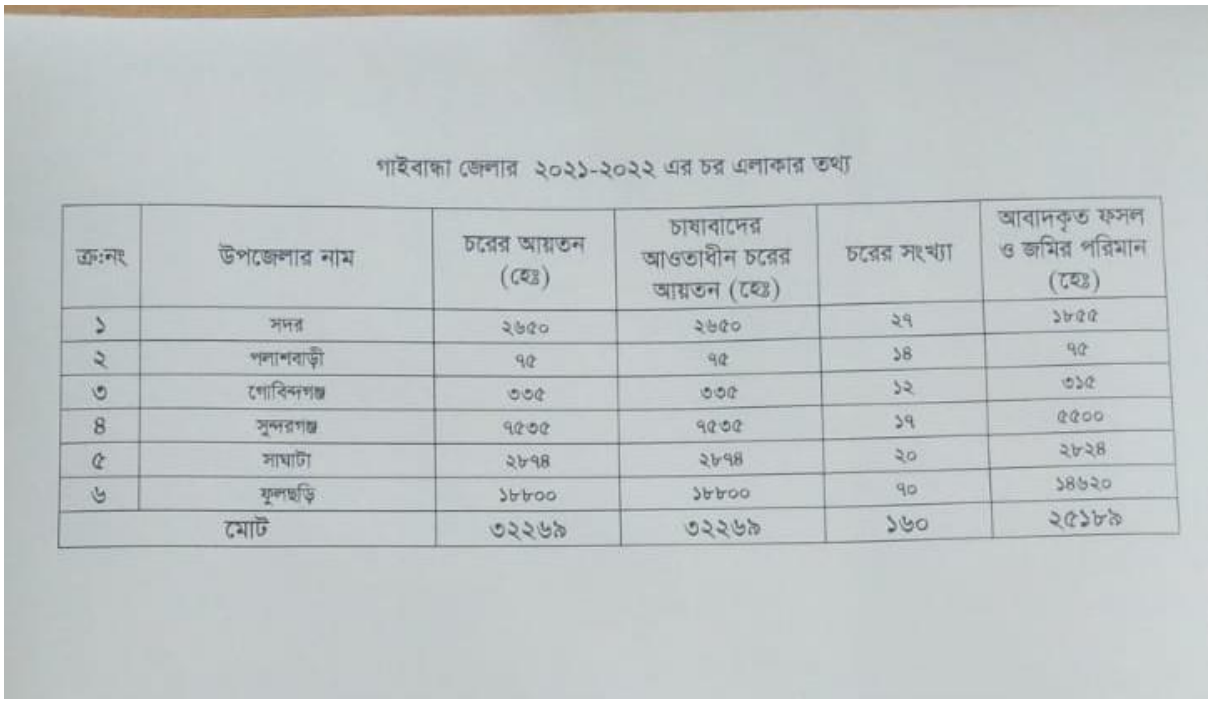
The private sector can play a crucial role in the development of the Agricultural sector in the Char-lands by providing access to high-quality seeds, fertilisers, pesticides, and other inputs to farmers. These inputs can help farmers improve their yields, enhance the quality of their crops, and access better markets for their products, leading to increased income and improved livelihoods. Additionally, private sector companies can also provide technical assistance, training, campaign, demonstration, field day, product sampling and extension services to farmers, which can further improve their productivity and profitability.

However, to enable private sector Agri-input companies to operate effectively in the Char-lands, there is a need to create an enabling environment that fosters innovation and entrepreneurship. This includes improving the regulatory framework, enhancing access to finance and infrastructure, and creating public-private partnerships that promote collaboration between the government, private sector, and other stakeholders.

In conclusion, the Char-lands of Bangladesh offer immense potential for Agricultural development, and the private sector can play a significant role in unlocking this potential. By increasing their involvement in providing Agri-inputs, private sector companies can help farmers in the Char-lands improve their yields, enhance the quality of their crops, and access better markets for their products. Therefore, it is recommended that the government of Bangladesh and relevant stakeholders work together to create an enabling environment for private sector Agri-input companies to operate in the Char-lands and contribute to the development of the Agricultural sector in the region.

ANNEX

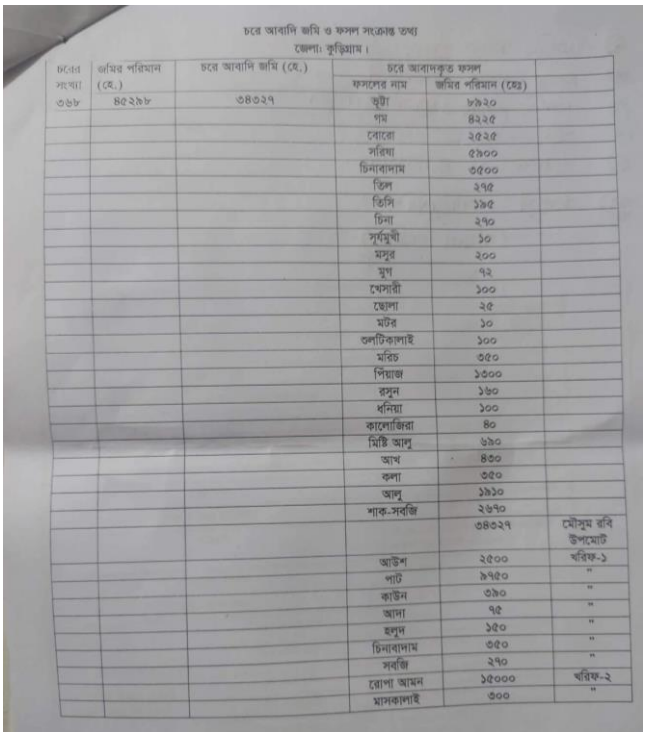
Annex 1: Char-land cultivation data of Gaibandha (Polasbari and Gobindogonj is not M4C working area.)



গাইবান্ধা জেলার ২০২১-২০২২ এর চর এলাকার তথ্য

ক্রঃনং	উপজেলার নাম	চরের আয়তন (হেঃ)	চাষাবাদের আওতাধীন চরের আয়তন (হেঃ)	চরের সংখ্যা	আবাদকৃত ফসল ও জমির পরিমান (হেঃ)
১	সদর	২৬৫০	২৬৫০	২৭	১৮৫৫
২	পলাশবাড়ী	৭৫	৭৫	১৪	৭৫
৩	গোবিন্দগঞ্জ	৩৩৫	৩৩৫	১২	৩১৫
৪	সুন্দরগঞ্জ	৭৫৩৫	৭৫৩৫	১৭	৫৫০০
৫	সাঘাটা	২৮৭৪	২৮৭৪	২০	২৮২৪
৬	ফুলছড়ি	১৮৮০০	১৮৮০০	৭০	১৪৬২০
মোট		৩২২৬৯	৩২২৬৯	১৬০	২৫১৮৯

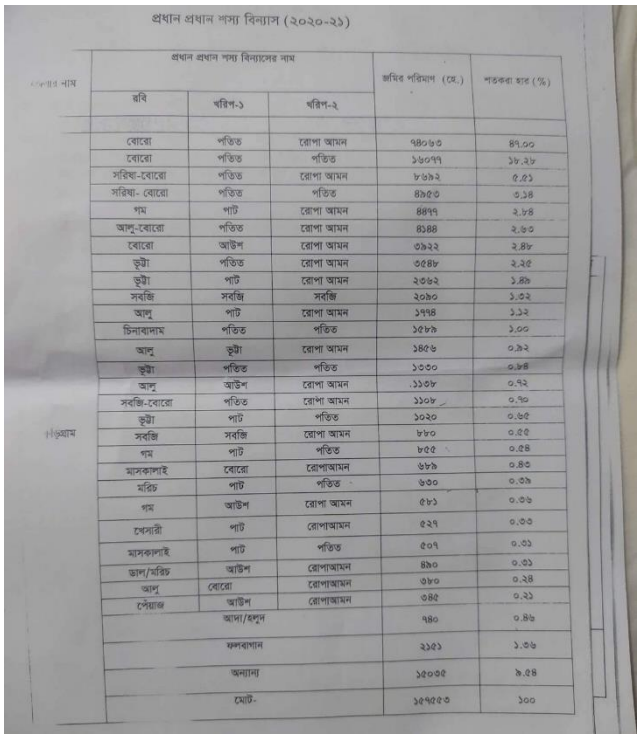
Annex 2: Char-land cultivation data of Kurigram



চরে আবাদি জমি ও ফসল সংক্রান্ত তথ্য

জেলা: কুড়িগ্রাম।

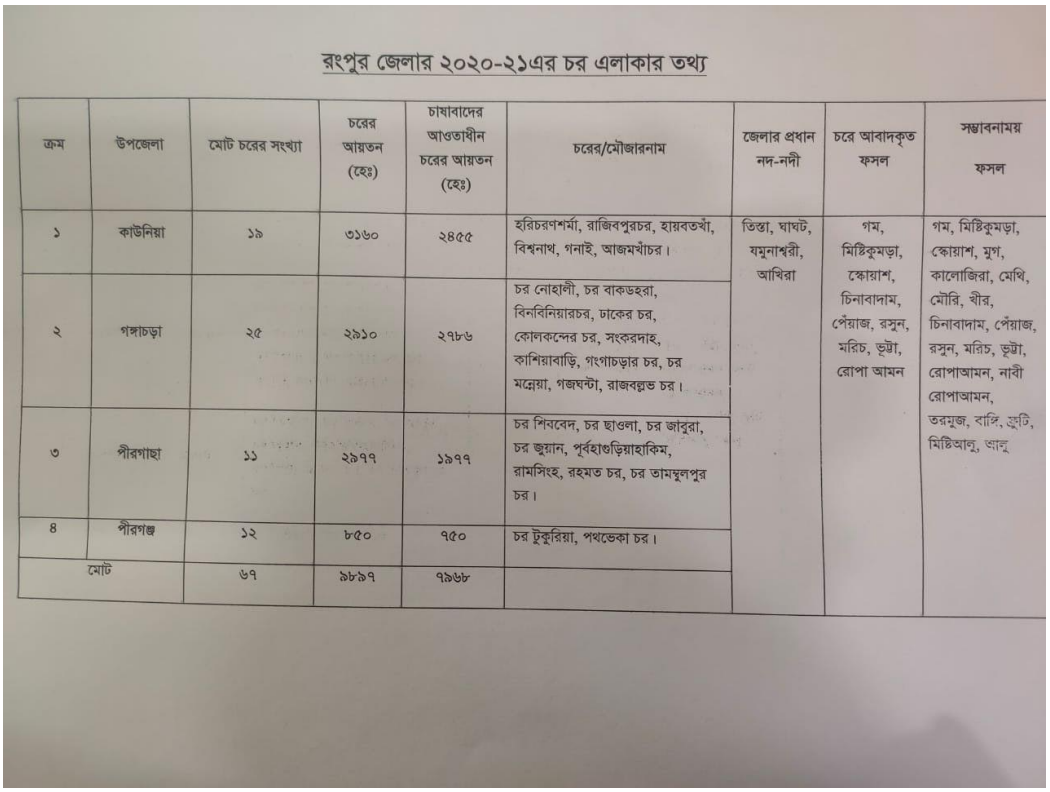
চরের সংখ্যা	জমির পরিমান (হে.)	চরে আবাদি জমি (হে.)	চরে আবাদকৃত ফসল		
			ফসলের নাম	জমির পরিমান (হেঃ)	
৩৬৮	৪৫২৯৮	৩৪৩২৭	ভূট্টা	৮৯২০	
			গম	৪২২৫	
			বোরো	২৫২৫	
			সরিষা	৫৯০০	
			চিনাবাদাম	৩৫০০	
			তিল	২৭৫	
			তিসি	১৯৫	
			চিনা	২৭০	
			সূর্যমুখী	১০	
			মসুর	২০০	
			মুগ	৭২	
			খেসারী	১০০	
			ছোলা	২৫	
			মটর	১০	
			গুলটিকালাই	১০০	
			মরিচ	৩৫০	
			পিঁয়াজ	১৩০০	
			রসুন	১৬০	
			ধনিয়া	১০০	
			কালোজিরা	৪০	
			মিষ্টি আলু	৬৯০	
			আখ	৪৩০	
			কলা	৩৫০	
			আলু	১৯১০	
			শাক-সবজি	২৬৭০	
				৩৪৩২৭	মৌসুম রবি উপমোট
			আউশ	২৫০০	খরিফ-১
			পাট	৯৭৫০	"
			কাউন	৩৯০	"
			আদা	৭৫	"
			হলুদ	১৫০	"
			চিনাবাদাম	৩৫০	"
			সবজি	২৭০	"
			রোপা আমন	১৫০০০	খরিফ-২
			মাসকালাই	৩০০	"



প্রধান প্রধান শস্য বিন্যাস (২০২০-২১)

প্রধান প্রধান শস্য বিন্যাসের নাম			জমির পরিমাণ (হে.)	শতকরা হার (%)
রবি	খরিপ-১	খরিপ-২		
বোরো	পতিত	রোপা আমন	৭৪০৬৩	৪৭.০০
বোরো	পতিত	পতিত	১৬০৭৭	১৮.২৮
সরিষা-বোরো	পতিত	রোপা আমন	৮৬৯২	৫.৫১
সরিষা- বোরো	পতিত	পতিত	৪৯৫৩	৩.১৪
গম	পাট	রোপা আমন	৪৪৭৭	২.৮৪
আলু-বোরো	পতিত	রোপা আমন	৪১৪৪	২.৬৩
বোরো	আউশ	রোপা আমন	৩৯২২	২.৪৮
ভূট্টা	পতিত	রোপা আমন	৩৫৪৮	২.২৫
ভূট্টা	পাট	রোপা আমন	২৩৬২	১.৪৯
সবজি	সবজি	সবজি	২০৯০	১.৩২
আলু	পাট	রোপা আমন	১৭৭৪	১.১২
চিনাবাদাম	পতিত	পতিত	১৫৮৯	১.০০
আলু	ভূট্টা	রোপা আমন	১৪৫৬	০.৯২
ভূট্টা	পতিত	পতিত	১৩৩০	০.৮৪
আলু	আউশ	রোপা আমন	১১৬৮	০.৭২
সবজি-বোরো	পতিত	রোপা আমন	১১০৮	০.৭০
ভূট্টা	পাট	পতিত	১০২০	০.৬৫
সবজি	সবজি	রোপা আমন	৮৮০	০.৫৫
গম	পাট	পতিত	৮৫৫	০.৫৪
মাসকালাই	বোরো	রোপাআমন	৬৮৯	০.৪৩
মরিচ	পাট	পতিত	৬৩০	০.৩৯
গম	আউশ	রোপা আমন	৫৮১	০.৩৬
খেসারী	পাট	রোপাআমন	৫২৭	০.৩৩
মাসকালাই	পাট	পতিত	৫০৭	০.৩১
ডাল/মরিচ	আউশ	রোপাআমন	৪৯০	০.৩১
আলু	বোরো	রোপাআমন	৩৮০	০.২৪
পেঁয়াজ	আউশ	রোপাআমন	৩৪৫	০.২১
আদা/হলুদ			৭৪০	০.৪৬
ফলবাগান			২১৫১	১.৩৬
অন্যান্য			১৫০৩৫	৯.৫৪
মোট-			১৫৭৫৩	১০০

Annex 3: Char-land cultivation data of Rangpur



রংপুর জেলার ২০২০-২১এর চর এলাকার তথ্য

ক্রম	উপজেলা	মোট চরের সংখ্যা	চরের আয়তন (হেঃ)	চাষাবাদের আওতাধীন চরের আয়তন (হেঃ)	চরের/মৌজারনাম	জেলার প্রধান নদ-নদী	চরে আবাদকৃত ফসল	সম্ভাবনাময় ফসল
১	কাউনিয়া	১৯	৩১৬০	২৪৫৫	হরিচরণশর্মা, রাজিবপুরচর, হায়বতখাঁ, বিশ্বনাথ, গনাই, আজমখাঁচর।	তিস্তা, ঘাঘট, যমুনাশ্বরী, আখিরা	গম, মিষ্টিকুমড়া, স্কোয়াশ, চিনাবাদাম, পেঁয়াজ, রসুন, মরিচ, ভূট্টা, রোপা আমন	গম, মিষ্টিকুমড়া, স্কোয়াশ, মুগ, কালোজিরা, মেথি, মৌরি, খীর, চিনাবাদাম, পেঁয়াজ, রসুন, মরিচ, ভূট্টা, রোপাআমন, নাবী রোপাআমন, তরমুজ, বাঙ্গি, ঢুটি, মিষ্টিআলু, আলু
২	গঙ্গাচড়া	২৫	২৯১০	২৭৮৬	চর নোহালী, চর বাকডহরা, বিনবিনিয়ারচর, ঢাকের চর, কোলকন্দের চর, সংকরদাহ, কাশিয়াবাড়ি, গংগাচড়ার চর, চর মন্নেয়া, গজঘন্টা, রাজবল্লভ চর।			
৩	পীরগাছা	১১	২৯৭৭	১৯৭৭	চর শিবরেদ, চর ছাওলা, চর জাবুরা, চর জুয়ান, পূর্বহাগুড়িয়াহাকিম, রামসিংহ, রহমত চর, চর তামুলপুর চর।			
৪	পীরগঞ্জ	১২	৮৫০	৭৫০	চর টুকুরিয়া, পথভেকা চর।			
মোট		৬৭	৯৮৯৭	৭৯৬৮				

Annex 4: Char-land cultivation data of Lalmonirhat

চর সংক্রান্ত তথ্য

জেলা: লালমনিরহাট

উপজেলার নাম	চরের সংখ্যা	চরের আবাদি এলাকা (হেক্টর)	মোট আবাদি এলাকা (হেক্টর)	মোট আবাদি জমির শতকরা হার (%)	আবাদকৃত ফসলের নাম	সম্ভাবনা
সদর	৬	৩৪৫০	১৯৯১৪	১৭.৩২	গম, সরিষা, আলু, ভূট্টা, পেঁয়াজ, মরিচ	চিনাবাদাম, মিষ্টিকুমড়া, স্কোয়াস
আদিতমারী	৬	৯৮০	১৬২০০	৬.০৫	মিষ্টিকুমড়া, ভুট্টা, গম, চিনাবাদাম, পেঁয়াজ, শাকসবজি	স্কোয়াস, তরমুজ
কালীগঞ্জ	১০	১৪৮১	১৯৪৯০	৭.৬০	ভুট্টা, গম, আলু, সরিষা, চিনাবাদাম, শাকসবজি, পেঁয়াজ, মরিচ, মিষ্টিকুমড়া, তামাক	মসুর, মাসকলাই, মুগ. সূর্যমূখী
হাতীবান্ধা	২০	২২৪৫	২৩৫২০	৯.৫৫	ভুট্টা, চিনাবাদাম, পেঁয়াজ, সরিষা, আলু, গম, মরিচ, মিষ্টিকুমড়া	সূর্যমূখী
পাটগ্রাম	১৭	৪১৫	২১২৬০	১.৯৫	ভুট্টা, পেঁয়াজ, মিষ্টিকুমড়া, চিনাবাদাম,	চিনাবাদাম, মিষ্টিকুমড়া
জেলার মোট	৫৯	৮৫৭১	১০০৩৮৪	৮.৫৪	ভুট্টা, গম, আলু, সরিষা, চিনাবাদাম, পেঁয়াজ, মরিচ, মিষ্টকুমড়া, শাকসবজি, তামাক	মসুর, মাসকলাই, মুগ. চিনাবাদাম,মিষ্টকুমড়া,স্কোয়াস, তরমুজ, সূর্যমূখী

স্বাক্ষরিত/-

১৯/১২/২০২২

উপপরিচালক

কৃষি সম্প্রসারণ অধিদপ্তর

খামারবাড়ি, লালমনিরহাট

Annex 5: Char-land cultivation data of Jamalpur

জামালপুর জেলার উপজেলাভিত্তিক চরের তথ্য

উপজেলার নাম	মোট আবাদী জমি (হে.)	চরের নাম ও জমির পরিমাণ (হে.)		চরে আবাদকৃত প্রধান প্রধান ফসলের নাম	মন্তব্য
		চরের নাম	জমির পরিমাণ (হে.)		
সদর	৩৭৫১৮	ভালুরচর	২৫০	গম, মাসকলাই, চিনাবাদাম, মিষ্টিআলু, বেগুন, মরিচ, টমেটো	
		সাতিয়ানতুলা	২৫০		
		তুলশীরচর	২০০		
		চরগোবিন্দবাড়ি	৫০০		
		নাওভাঙ্গা	২৫০		
		আমনগর	৩৫০		
		দেওপাড়চন্দ্রা	২৫০		
		চরগগনপুর	২৫০		
		মল্লিকপুর	২০০		
		চন্দ্রের হাওয়া	২৫০		
		পশ্চিম আরমহাটি	৪০০		
		ভাটিপাড়া	৩০০		
		লক্ষীরচর	৩০০		
		চরপাড়া	৩০০		
		মোট	৪০০০		
সরিষাবাড়ী	২১৫৮৮	নান্দিনা, চরজামিরা, রৌহা, মালিপাড়া, টাকুরিয়া, গাছবয়ড়া, চুনিয়াপটল, শিশুয়া, শুয়াকৈর, হেলেঞ্চাবাড়ী, বড়বাড়িয়া, চরধারাবর্ষা, চরহরিপুর, কলারছড়া, বিন্যাফৈর, দামুদরপুর, চরহাটবাড়ী, চরবাসুরিয়া, ঘুইঞ্চা, আওনা, বারইকান্দি, চন্দনপুর, নলসন্ধ্যা, চর মিরকুটিয়া, ডাকাতিয়ামেন্দা	৮৩৩০	সরিষা, বোরো, ভূট্টা, মরিচ, মিষ্টিআলু, চিনাবাদাম	
মেলান্দহ	২১০৮৩	চরখাবুলিয়া, চরগোবিন্দী, বংশীবেলতৈল, বাগবাড়ী, বাহেরচর, চরপানসি, কলাবাধা, আমবাড়ীয়া, সরুলিয়া, চরহাতিজা, চরমাহমুদপুর, পোড়ারচর, বানিপাকুরিয়া, মামাভাগিনা, আলোকদিয়া, ৫ নংচর, চরচন্দ্রা, চরকম্পপুর, শিহরী, মধ্যেরচর, ভাবকী, চরপলিশা, শিহাটা, হাওড়াকুড়ারচর, দাতভাঙ্গা, চরআদিয়ারপাড়া, দিলালেরপাড়াচর, ঘোষেরপাড়া, ছবিলাপুর, চরসগুনা, আমিত্তি, রুহিলী, টগারচর, পইরবাড়ি, দক্ষিণঝাউগড়া, মধ্যেঝাউগড়া, পশ্চিমঝাউগড়া, দহেরপাড়, ইন্দ্রবাড়ী, রেহাইপলাশতলা, কাপাশহাটিয়া, শেখসাদী, টুপকারচর, ২ নংচর, কাজাইকাটা, দক্ষিনবালুরচর, পূর্বশ্যামপুর, উত্তরবালুরচর, প্রতাপঝগড়ী, পশ্চিমশ্যামপুর, শাহজাতপুর, নয়ানগর, জালালপুর	6960	মরিচ, পেঁয়াজ, গম, ভূট্টা, সরিষা, মাষকলাই, শাকসবজি, বোরো, রোপাআমন,	

উপজেলার নাম	মোট আবাদী জমি (হে.)	চরের নাম ও জমির পরিমাণ (হে.)		চরে আবাদকৃত প্রধান প্রধান ফসলের নাম	মন্তব্য
		চরের নাম	জমির পরিমাণ (হে.)		
ইসলামপুর	২৪৩১১	হরিণধরা	৩০০	বাদাম, ভূট্টা, মরিচ, পেঁয়াজ, পাট, মাসকলাই	
		নোয়ারপাড়া	১২০০		
		সাপধরী	৫০০		
		চরশিশুয়া	৩০০		
		মন্ডলপাড়া	৩০০		
		চেংগানিয়া	২০০		
		রাজাপুর	৩০০		
		ইন্দুলমারি	৩৫০		
		আমতলী	৫০০		
		আকন্দপাড়া	৫০০		
		চরনন্দননের পাড়া	৩০০		
		বীরনন্দনের পাড়া	৩০০		
		আজমবাদ	২৫০		
		পালায়ান বাদ	২০০		
		শিংভাংগা	১৫০		
		বিশরাশি	২০০		
		জিগাতলা	২০০		
		চরবেলকুশা	৪৫০		
		প্রজাপতি	২৫০		
		মন্নিয়া	৩৫০		
		বরুল	২৫০		
		চরদিঘাই	৩০০		
		শশারিয়াবাড়ী	৩০০		
		কুলকান্দি	৩০০		
	মোট		৮২৫০		
দেওয়ানগঞ্জ	১৭৭৮১	চরবাহাদুরাবাদ	৪০০	গম, মরিচ, ডাল জাতীয়, ভুট্টা, চীনাবাদাম, তিল, পেঁয়াজ, মিষ্টি আলু	
		টিনেরচর	৩২০		
		হরহলকাহাবড়াবাড়ী	৪৮০		
		শেখপাড়া	১১২		
		খোলাবাড়ী	১২৮		
		ষাটবিঘারচর	৪০		
		খুদুপাগলারচর	৪০০		
		হলকারচর উঃ	৫৬০		
		বাদেঃবাড়ী	১৬০		
		চরডাকাতিয়া	২৪০		
		মৌলভীরচর	৬৪০		
		শেখপাড়া	৫৪৪		

		চর হাতীভাঙ্গা	৪৩২		
		চকারচর	৫৬০		
		তিলকপুর	৬৪০		
		চর পোল্লাকান্দি	৩৭২		
		মোট	৬০২৮		

উপজেলার নাম	মোট আবাদী জমি (হে.)	চরের নাম ও জমির পরিমাণ (হে.)		চরে আবাদকৃত প্রধান প্রধান ফসলের নাম	মন্তব্য
		চরের নাম	জমির পরিমাণ (হে.)		
মাদারগঞ্জ	১৭৭৫৫	হিদাগাড়ী, পাকরুল, ঝারকাটা, নব্যচর	৮০০	মরিচ, ভূট্টা, গম, বেগুন, বাদাম, খেসারি তরমুজ, আলু, শসা, পেঁয়াজ, রসুন, মিষ্টি আলু	
		চরগোপালপুর, গুনারীতলা পূর্বপাড়া	২৫০		
		দ্বীপচর, চরনাংলা, নাদাগাড়ী, চরশুভগাছা	১০৫০		
		চরবেতাগা, ফুলজোড়, হাটমাগুড়া, বারইপাড়া, কুকুরমারী, কামারপাড়া,খামারমাগুড়া	১৫০০		
		চরপলিশা, বাজিতেরপাড়া, হেমড়াবাড়ি, চরকয়াড়া, চরদুধিয়াগাছা	৫৫০		
		চরলোটাবর, চরসিধুলী, চরনান্দিনা, চরভাটিয়ানি	৬৫০		
		মোট	৪৮০০		
বকশীগঞ্জ	১৫১৩৮	চর গাজীরপাড়া	১৫০	সরিষা, গম, ভূট্টা, পাট, মরিচ, সবজি, ডাল জাতীয়, তিল, বাদাম, মিষ্টি আলু, আখ	
		চরকামালেরবাত্তী	২০০		
		কুতুবেরচর	২৫০		
		মদনেরচর	১৫০		
		খেতারচর	১০০		
		মাদারেরচর	২৮০		
		মাইছানীরচর	৩০০		
		খেয়ারচর	১৩০		
		চিনারচর	১২০		
		রবিয়ারচর	৩৮০		
		মেরুরচর	১৫০		
		সেকেরচর	১৩০		
		কারচর	১১৫০		
		বালুরচর	২৭২		
		পেরীরচর	২০০		
		বিনোদেরচর	৬০		
		চর কুশলনগর	২৪০		
		মোট	৪২৬২		
জেলার মোট			৪২৬৩০		

Annex 6: Current usage of fertilisers across districts obtained from the FGDs conducted in our study

District	Kurigram	Rangpur	Jamalpur	Gaibandha	Shariatpur	Lalmonirhaat
Area under cultivation (decimal)	36.5	250	82.5	802.25	1579.5	1303
Gypsum (kg)	12.5	20	20	13.25	10	7.5
Zinc Sulphate (kg)	1.75	1.5	2	0.5	1	0.5
Magnesium Sulphate (kg)	0	0	0	0	0	0
Sulphur (80%) (kg)	0	0	0	0	0	0
Boron/ Boric Acid (kg)	0.5	1	1	0.25	1.5	0.5
Solubor Boron (KG)	1.25	2	1	9.3	1	1
Chelated Zinc (gm)	8.5	17	0	0	1	0.5

Annex 7: Market size of fertilisers in each district based on current usage data

Fertiliser (MT)	Kurigram	Rangpur	Lalmonirhat	Shariatpur	Gaibandha	Jamalpur	Total (MT)
Gypsum	3,629.91	202.626	21.619	10.466	135.890	2,606.95	**6,607**
Zinc Sulphate	870.424	20.260	2.162	1.810	3.694	172.974	**1,071**
Boron/ Boric Acid	200.000	1.483	1.441	1.716	1.847	0.054	**207**
Solubor Boron	634.409	21.622	2.389	2.735	3.694	95.135	**760**
Chelated Zinc	8.254	0.277	0.001	0.858	0.000	0.000	**9**

Annex 8: Standard dosage of fertilisers used to calculate market size of fertilisers

Crop	Standard dose (KG/Hectare)						
	Gypsum	**Zinc Sulphate**	**Magnesium Sulphate**	**Sulphur (80%)**	**Boron/ Boric Acid**	**Solubor Boron**	**Chelated Zinc**
Maize	37	6.95	105	0	9.38	1.5	2.5
Paddy	37	3.48	0	0	0	0	1.25
Potato	37	5.56	53	0	9.38	1.5	2
Mustard	37	4.17	26	0	12.5	2	1.5
Chilli	37	4.17	0	0	6.25	1	1.5
Jute	37	0	26	0	12.5	2	0
Ground nut	37	4	5	0	8		
Onion	37	4.17	32	0	9.38	1.5	1.5
Wheat	37	5.56	42	0	9.38	1.5	2
Black gram	37			0	8.5		
Pumpkin	37	12.5	20	0	10		
TOTAL	**37**	**4.17**	**26**	**0**	**9.38**	**1.5**	**1.5**

Annex 9: Current usage of pesticides across districts obtained from the FGDs conducted in our study

Crop	Insecticide		Fungicide		Herbicide	
	Solid (kg)	**Liquid (ml)**	**Solid (Kg)**	**Liquid (ml)**	**Solid (Kg)**	**Liquid (ml)**
Paddy	2	300	0.4		0.3	

Wheat		60			0.025	
Maize	4	300				
Potato	4	400	0.2	600		800
Mustard		50		100		
Groundnut		50	0.4			800
Pulses		200	0.4			800
Pumpkin	1.4	200		400		
Onion	2	300	0.8			800
Chilli		600	0.8			800
Jute	0.25		0.25			800

Annex 10: Market size of pesticides in each district based on current usage data

District	Insecticide		Fungicide		Herbicide	
	Solid (kg)	**Liquid (ml)**	**Solid (Kg)**	**Liquid (ml)**	**Solid (Kg)**	**Liquid (ml)**
Kurigram	161,236.01	21,108,369.52	29,682.59	2,718,155.00	7,907.36	40,132,511.36
Rangpur	80,583.39	8,537,096.40	6,896.68	2,010,672.00	3,756.00	5,780,208.00
Lalmonirhat	81,400.50	8,289,190.03	6,902.92	1,144,201.75	3,756.00	5,879,240.00
Shariatpur	41,423.03	9,688,574.33	11,891.10	2,647,728.75	2,594.60	12,376,664.00
Gaibandha	253,504.33	30,534,150.65	36,907.33	0.00	7,457.73	51,486,520.00
Jamalpur	274,286.55	38,054,170.00	46,949.95	741,315.00	9,637.10	66,224,140.00
Total	**892,433.80**	**116,211,550.92**	**139,230.57**	**9,262,072.50**	**35,108.77**	**181,879,283.36**
Total (Ton/Litre)	**892.43**	**116,211.55**	**139.23**	**9,262.07**	**35.11**	**181,879.28**

Annex 11: Standard dosage of pesticides used to calculate market size of pesticides

Crop	Insecticide		Fungicide		Herbicide	
	Solid (kg)	Liquid (ml)	Solid (Kg)	Liquid (ml)	Solid (Kg)	Liquid (ml)
Paddy	4.4	300	0.4		0.3	
Wheat	4	60	0.4		0.025	
Maize	4.4	300				
Potato	4	400	0.2	600		800
Mustard		100		200		
Groundnut	4	100	0.4			
Pulses	4	200	0.4			800
Pumpkin	1.4	200		500		
Onion	4	300	0.8			800
Chilli		600	0.8			800
Jute	0.25		0.25			800

Annex 12: Char Fertility status data in Kurigram and Lalmonirhat

কুড়িগ্রাম জেলার চরাঞ্চলের উর্বরতা মান (গড়মানের ভিত্তিতে)

প্রতিক্রিয়া (পিএইচ)	জৈব পদার্থ (%)	মোট নাইট্রোজেন (%)	ফসফরাস (ও)	পটাশিয়াম	গন্ধক	দস্তা	বোরণ	ক্যালসিয়াম	ম্যাগনেশিয়াম	তামা	লৌহ	ম্যাংগানিজ
মৃদু ক্ষার	অতি নিম্ন	অতি নিম্ন	নিম্ন	নিম্ন	উচ্চ	নিম্ন	অতি নিম্ন	মধ্যম	অতি উচ্চ	অতি উচ্চ	অতি উচ্চ	অতি উচ্চ

লালমনিরহাট জেলার চরাঞ্চলের উর্বরতামান (গড়মানের ভিত্তিতে)

প্রতিক্রিয়া (পিএইচ)	জৈব পদার্থ (%)	মোট নাইট্রোজেন (%)	ফসফরাস (ও)	পটাশিয়াম	গন্ধক	দস্তা	বোরণ	ক্যালসিয়াম	ম্যাগনেশিয়াম	তামা	লৌহ	ম্যাংগানিজ
মৃদু ক্ষার	অতি নিম্ন	অতি নিম্ন	নিম্ন	নিম্ন	অতি উচ্চ	অতি নিম্ন	অতি নিম্ন	নিম্ন	মধ্যম	অতি উচ্চ	অতি উচ্চ	অতি উচ্চ