THE FINAL REPORT
OF THE PROJECT ON

Promotion of Water Management & Climate Change Adaptation in Agriculture in Jhenaidah District

Asia Arsenic Network

Financed by Ministry of Foreign Affairs (MoFA), Japan

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From
the People of Japan

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EDITORS

Md. Abiar Rahman
Shamim Uddin
Tamiko Ishiyama

CONTRIBUTORS

Md. Golam Mustofa
Md. Rezaul Karim Razu
Saad Ahmad
Roni Mia
Moshiur Rahman
Obaidur Rahman
Md. Zihadul Islam
Md. Kabir Uddin
Songram Mia

JASHORE OFFICE

Krishnabati, Pulerhat,
Jashore-Benapole Road,
Jashore – 7400
Telephone: 088-42168663
https://aanbangladesh.org

DHAKA OFFICE

Flat – 2B, Plot – 1/A, Road – 1/B,
Nikunja – 2, Khilkhet,
Dhaka – 1229

MIYAZAKI OFFICE

Miyazaki NPO House, room 208
2-9-6 Tsurunoshima
Miyazaki – 880 014
Telephone: (81-985) 20-2201

MESSAGE

The agriculture sector in Bangladesh has particular importance for the sustained food and nutritional security of its larger, dense and ever-growing population. The implementation of climate-resilient practices in agriculture, with a specific focus on water management in Boro rice cultivation, has become paramount. The company has been working continuously to achieve this target around the clock. In working with these efforts, the project aims to accelerate the ongoing development of agriculture and enhance food security by producing Boro rice, Aman rice, and safe vegetables. To successfully achieve the goal of climate-smart agriculture while sustaining the current development momentum in Bangladesh, collaboration between both public and private entities is essential. Working together, they can contribute to the sustainable growth of the agricultural sector in the face of climate challenges.

I appreciate the approach on Sustainable Agriculture Practice (SAP) under the project of "Promotion of Water Management and Climate Change Adaptation in Agriculture in Jhenaidah District" carried out by Asia Arsenic Network, Japan. The approach, including less water irrigation practice, less chemical fertilizer and pesticide promotion in Rabi crops and vegetables production, vermicomposting, soil test, etc., is not only impacting farmers' economies, but it also helps meeting environmental challenges. By visiting project farmers, I feel that the farmers shall continue to improve SAP approach and its expansion through farmer-to-farmer exchange, hands-on-training to gather more knowledge, to get benefitted both economically and environmentally. I feel deeply that it would help bringing quality of life improvement, boosting up the food security and meeting climate challenges.

I am also happy to see the report highlights some field observations that will serve as a reference for policy inputs for the government, development partners and other users in their endeavors towards the agricultural development of the country.

I would like to extend my sincere thanks to officials of aforementioned organizations involved in striving for excellence.

Md. Asgar Ali
Deputy Director
Department of Agricultural Extension
Jhenaidah

MESSAGE

AAN has promoted a sustainable agriculture practice (SAP) with farmers and government in Jhenaidah district for six years. This final report shows the achievements of SAP in the last 3 years (SAP-II).

The purpose of SAP-II is to promote the water management and adaptation for climate change (abbreviated as WACC) in agriculture at the 6 Upazilas in Jhenaidah district. I would like to show the main points of this project below. In the SAP II, we, firstly, have raised the farmer's awareness for WACC, and secondly, have conveyed with the agriculture officers of DAE to farmers how to deal with WACC. From the above activities, the following successful results, for example, have been obtained.

a) The rice production was increased and the costs of irrigation, fertilizer, etc. were reduced by implementation of AWD (Alternate wetting and drying) rice farming in the dry season.

b) The planting of field crops was increased by stopping rice farming during the dry season and switching to field farming.

c) Farmers made the climate-adaptive cropping patterns with DAE and used climate-tolerant species by getting the climate-tolerant seeds from government agencies through the Union Congress and DAE.

d) Farmers set up the direct-from-farm sales outlets, where the environmentally friendly vegetables were sold at fair prices. Sales at the store generated profits, which motivated farmers to continue with SAP farming.

Considering the results mentioned above and other results that could not be mentioned here, it can be said that the project goal of "Developing farmers' ability to practice the right crop in the right place through sustainable water use and climate-resilient food production methods'' was fully achieved. This is due to the hard work of farmers and the agriculture officers of DAE and we would like to express our heartfelt gratitude. In addition, as the achievement provides sufficient foundations for the spread of SAP farming, we would like to hope that SAP farming is to be developed further in Bangladesh in the future.

Prof. Hiroshi Yokota
Representative Director
Asia Arsenic Network

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ACRONYMS AND ABBREVIATIONS

AAN	Asia Arsenic Network
AEO	Agriculture Extension Officer
AEZ	Agro Ecological Zone
As	Arsenic
AWD	Alternate Wetting and Drying
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BDT	Bangladesh Taka
BRRI	Bangladesh Rice Research Institute
BLS	Baseline Survey
BSMRAU	Bangabandhu Sheikh Mujibur Rahman Agricultural University
CI	Cropping Intensity
DAE	Department of Agricultural Extension
DCML	Decimal (1/100 acre = 40.4686 meter square)
DD	Deputy Director
DFID	Department for International Development
DTW	Deep Tube Well
FFS	Farmers Field School
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GK	Ganges-Kobadak Irrigation Project
IFMC	Integrated farm management component
IPM	Integrated Pest management
IRRI	International Rice Research Institute
MoU	Memorandum of Understanding
MT	Metric Ton
NARO	National Agriculture and Food Research Organization
NGOs	Non-governmental Organizations
OM	Organic Matter
PDM	Project Design Matrix
SAAO	Sub-Assistant Agriculture Officer
SAP	Sustainable Agriculture Practice
SAP-I	Promotion of Sustainable Agriculture Practice with Less Irrigation with less irrigation water-Aim for the fundamental solution of arsenic pollution
SAP-II	Promotion of Water Management and Climate Change Adaptation in agriculture
SDGs	Sustainable Development Goals
SFC	Safe Food Corner
SRDI	Soil Resource Development Institute
STW	Shallow Tube Well
UAO	Upazila Agriculture Officer
UNO	Upazila Nirbahi Officer (Sub-district Chief Executive)

ACKNOWLEDGMENT

AAN is deeply thankful to the Ministry of Foreign Affairs (MOFA) Japan for engaging AAN in this project and providing technical oversight and financial support. AAN expresses thanks to the local LGIs, Upazila administrations, and NGO Affairs BURO for their kind assistance and support during the project period.

We are grateful to Md. Asgar Ali, Deputy Director, DAE, Jhenaidah; Md. Enamul Haque, Agriculture Engineer, DAE, Jhenaidah, and Sub Assistant Agriculture Officers (SAAOs) of different upazilas for their extensive cooperation and generous support for the group formation of farmer field schools, training to the model farmers, various workshops, and final seminar. Their contributions and input are highly appreciated. In addition, we would like to express our gratitude to the Upazila Agriculture Officers (UAOs) of Shailkupa, Harinakunda, and Mahespur Upazilas for their helpful cooperation during the project period.

We are thankful to the National Agriculture and Food Research Organization (NARO), Japan for their technical cooperation in conducting On-Farm research and to Share the Planet Association (SPA), Japan for their strenuous and efficient efforts to coordinate many people involved in this project with technical advice. Special thanks to the researchers of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) and Bangladesh Rice Research Institute (BRRI).

We acknowledge the professional support and guidance of the Central Management Committee (CMC) of AANB and the laboratory staff of AANB for providing their valuable time and efforts during this project period. Our profound thanks to all the staff of SAP-I and SAP-II for spending their time in helping and giving support whenever needed in fabricating and implementing the project. Their professionalism is also acknowledged.

EXECUTIVE SUMMARY

The excessive use of underground water for agricultural purposes is becoming a threat to the sustainable food production in terms of quality and quantity in Bangladesh. Additionally, in recent years, abnormal and uncertainty of weather events such as heavy rain/storm, prolonged drought heatwave are occurring frequently that hampering crops cultivation severely.

Asia Arsenic Network (AAN), which was established for solving arsenic pollution in underground water and related issues in the Asian countries, has implemented two projects recently on "Promotion of Sustainable Agriculture Practice with Less Irrigation Water" – Aimed for the Fundamental Solution of Arsenic Pollution (SAP-I) from 2017 to 2020; and the second one "Promotion of Water Management and Climate Change Adaptation in Agriculture" (SAP-II) from 2021 to 2024" in Jhenaidah District of Bangladesh.

Key Findings of SAP-I Project

i. Irrigation volume could be reduced through expanding oilseeds, pulses, vegetables other crops that require less water during Rabi season. Less irrigation uses in rice cultivation following Alternative Wetting and Drying (AWD) method should be disseminated by GOs and/or NGOs with various technical and logistic supports such as AWD pipe (locally known as magic pipe), crop varieties that require less water, checking water table, poly pipe, quality seeds etc.

ii. Even the rice grown in the same place using the same well water, the Arsenic concentration in rain-fed rice (Aman season) using less underground irrigation was lower than that of irrigated rice (Boro season).

iii. However, the Rabi crops were found sensitive to abnormal weather such as unusual rain during winter season and prolonged draught.

iv. Therefore, for expanding less irrigation agriculture, promotion of climate change adaptation is indispensable to minimize crops damage due to climate change issues.

SAP-II Project

Based on the SAP-findings, SAP-Ⅱ was designed to strengthen sustainable food production system through water management and climate change adaptation in Jhenaidah district. The project was also emphasized to develop for the capacity of target farmers.

Specific objectives of SAP-II project

1. Develop a strong linkage between DAE and farmers.
2. Aware farmers climate change and make them understand about future water crisis.
3. Increase farmers' ability for water management in agriculture under changing climate.
4. Introduce various measures for climate change adaptation in agriculture in target area.
5. Assess the impacts of the approaches and supports of the project introduced for water management and climate change adaptation.
6. Disseminate the outcomes and good practices.

Major features of SAP-II project

- A total 1500 farmers were selected and divided into 50 groups.
- About 400 model farmers received training in different aspects of agriculture.
- A total 50 farmers' field school (FFS) were organized six times for all the farmers.
- Several surveys such as baseline, midline, endline, climate change, and safe food.
- More than 400 soil samples of farmers' fields were tested and the farmers received fertilizer recommendation cards for crop production. Three campaigns on soil sample collection and importance of soil test were organized with the support from Soil Resources Development Institute (SRDI).
- More than 500 water samples were tested to check the Arsenic levels in irrigation water.

Approaches and Methodology

To achieve the objectives, various activities were done during the project period. Some of the activities are as follows:

- **Capacity building:** classroom training, FFS, field day, exposure visit etc. A training module was prepared in different aspects related to the project. Government officials (DAE and SRDI), researchers and development workers were invited as research person.
- **Awareness:** posters, leaflets, billboards and wall paintings were prepared and shared with farmers.
- A total 1056 farmers received AWD (magic) pipe, 2450 feet underground pipes, 50 mini ponds and 150 seed storage drums, 402 soil sample analysis were supported to the farmers from the project.
- **Feedback:** During the project, seminars/workshops were organized six times with the participation of GI, farmers, NGOs, civil society, journalists, and local leaders. At the end of the project, the final seminar was organized with policy makers and other stakeholders at Dhaka. Discussion meetings and trainings for the SAP-II staffs were also arranged.

Climate Scenario and Impacts

Climate change is prominent in the recent years. Long-time weather data indicated erratic and uneven distribution of rainfall and both maximum and minimum temperature showed increasing trends. Due to uneven distribution, farmers are compelled to apply irrigation during Aus and Aman rice seasons. On the other hand, off-time sudden heavy rainfall and cyclones affecting rice yield severely in the project area.

Key Achievements: Baseline to Endline

- At the end of the project, 99% target farmers have good linkage with DAE officials and they are getting supports.
- Due to regular group meeting, at the end of the third year, all the farmer groups (50 groups) could develop cultivation plan and reviewed their previous year plan that they had developed and accordingly they updated it for the next season. This was happed due to:
  - Project facilitated farmers mutual learning with GI.
  - Farmer groups were formated through GI support (30 farmers per group).
  - Supported regular field school for mutual learning. (six times during the project)
  - Taught farmers through field school how to make a plan and review.
  - Shared good practices through exposure visit
  - Trained farmers on different aspects and issues related to sustainable agriculture.

- At the end of the project, cultivation area of Rabi crops increased to 69% from 20% baseline survey.
- Introduce of AWD as a sustainable water management technique was one of the main targets of the project. It was observed that 89% farmers using AWD by either using pipe of eye estimation, which was only 30% during the baseline and it was mostly eye estimation. Uses of plastic pipe and underground pipe were found very effective for irrigation water saving after the end of the project. Promotion of these water saving techniques also helped to reduce the risks of Arsenic contamination in soils, crops and health hazards.
- Fifty mini ponds were constructed where farmers stored rainwater and used for seedbed and homestead crop production. Besides, they used the banks of the ponds for vegetable cultivation and cultured fishes in the pond. This integrated system helped then to get quality food and income generation.
- SAP-II worked with different GOs/NGOs to develop a climate resilient cropping pattern for the target area and presented it to the farmers and provided supports in introducing to their practices. All the farmers have adapted the recommended cropping patterns and other techniques for the target areas that made them resilient farmers under changing climate. The project provided supports to the farmers in association with DAE, SRDI and other GOs and NGOs.
- Under this project, importance and methods of soil improvement was explained to the farmers. For this purpose, supports and trainings were provided to the farmers for producing vermicompost and Trichocompost. Soil tests of farmers' fields were done with the support of SRDI and farmers got the fertilizer recommendation card. Farmers expressed their satisfaction on mulching, raised-bed and IPM (parching, yellow trap, organic pesticide etc.) techniques for crop cultivation. About 98% of the target farmers are using those technologies now. All those methods are very effective for climate change adaptation.
- Many farmers are now producing and preserving own seeds and some of them are doing seed business maintaining quality and less price than market.
- A flowchart to get early warning and weather forecasting information was developed mentioning different possible sources of information. More than 60% farmers opined it as a very effective information for sustainable crop production against diseases, insects, drought, flood, and storms etc.

Research Findings

- After one year use of AWD, a survey was conducted to know the farmers' perceptions on AWD. It was found that farmers saved 23% irrigation water with 8% yield increment by using AWD method. Farmers also experienced less disease and insect infestations and higher tillering in AWD, but weed infestation was higher in AWD method.
- On-Farm experiments were conducted to investigate the effects of AWD on water saving, rice yield and Arsenic contamination in soil and rice grain during Boro rice season. Bangladesh AWD (BD-AWD) and AWD developed by NARO to reduce arsenic concentration in rice (NARO-AWD) were compared with farmer practice (traditional irrigation). We found the lowest Arsenic concentration was found in NARO-AWD (0.54 mg kg-1) followed by BD-AWD method (0.63 mg kg^{-1}) and FP (0.83 mg kg^{-1}) and rice grain yield did not vary significantly among different irrigation treatments.
- Homestead gardening helped farmers to ensure food and nutrition securities, especially for the women and children. A survey was conducted to safe food production and consumption. It was found most of the farmers, traders and consumers are concern about safe food and showed their interests. In connection, three safe food corners were constructed under this project with the active support from the LG at the third year of the project. It is not only profitable for the producers and traders, but also very

satisfaction at consumer levels. Moreover, for the betterment of environment and request from LG, more than 1500 seedlings for different timber, fruit and medicinal trees were given among selected farmers.

- At end of the project, balanced diet situation was calculated and the score indicates that most of the farmers have nearly best diet (score 16.9), which was not good (14.3) before starting the project.

Concluding Remarks

It also found that 6-million-ton water, the same as three-year drinking water of the district, was saved as the result of the efforts of less irrigation by 3,325 farmers (both SAP-I and SAP-II projects). At the same time, findings of the research showed that AWD method is more suitable for water saving and National Agriculture and Food Research Organization (NARO) method is effective for reducing Arsenic concentration by 20-30% under intermittent irrigation in rice. Income generation from different sectors of agriculture was increased remarkably with active participation of woman in farming activities. Farmers are now getting advice from DAE and SAP-II project members on various issues of crop production such as pest and disease control measures, AWD, fertilizers, seeds, soil management and weather information. As a result, sustainable water management and climate change adaptation in agriculture are now effective for resilient farming in Jhenaidah district. The project would help in achieving the SDGs 1, 2, 3, 5, 6, 12, 13 and 15 at local level. Also, the project satisfied 8 out of 26 pillars of National Agricultural Extension System (NAES) of Bangladesh.

BACKGROUND OF THE PROJECT

Bangladesh is a small country where live 170 millions of people. It is very difficult to grow a large quantity of crops and vegetable for the huge population of the country with the limited lands. To meet the food demands for the increasing population, the number of cropping season has been expanded from one to several times per year in Bangladesh. Groundwater arsenic pollution is one of the severe environmental problems in Bangladesh. Approximately 90% of groundwater is utilized for crop and vegetable cultivation in Bangladesh which poses threaten arsenic contamination in soil and food-chain. It is estimated that above thousands of tons arsenic sludge annually transferred from groundwater to arable land by the groundwater irrigation, which threat a potential risk for future food production in Bangladesh. Here excessive withdrawn of groundwater might also decreasing groundwater level every year, which threatens the availability of access safe water throughout the year. Nowadays, due to the climate change issues country faces unexpected abnormal weather like as heavy rain, storm, drought, cold wave, increase sea level and spreading saline contamination in surface and groundwater which affect agricultural farming and affect for sustainable food production in many areas of Bangladesh. On the other hand, farmers are widely used excessive chemical fertilizers, pesticides and herbicides in the agricultural fields, which turns contaminate surface water, soil and food-chain system and threaten for public health.

The project area is located in three upazilas (Moheshpur, Harinakundu and Shailkupa) under Jhenada district. The area belongs to the high Ganges River floodplain in the agro-ecological zoning of Bangladesh, a part of High Ganges River flood plain of southwestern Bangladesh. The topography is characterized predominantly by highland and medium highland, and few low laying areas comprising 'Baor and Beels' are also located in some areas. The texture of the soil is very fine (loamy/clay) mainly calcareous dark grey floodplain soils and calcareous brown floodplain soils. The annual rainfall is lowest and most variable, and the summer temperatures are generally the highest having a range of maximum annual mean temperature between 37°C and 41°C and the mean annual rainfall ranges from 1,467 to 1,537 mm. Water table is generally raised during heavy rainfall periods and flood-level fluctuates both within the rainy season and from year to year according to rainfall intensity and erratic weather pattern and/or climate variability. The area is mostly suitable for Rabi crops such as pulses, oilseed, winter vegetables and spices like turmeric, onion, garlic etc., but it also favors for cereals e.g., AUS, AMAN & BORO rice, wheat & maize; cash crops like - banana, mango, sugar cane, betel vines and ornamental crops. But lack of availability of quality Rabi crops seeds of different varieties limit crop diversification. The groundwater level is the highest (about 2 m below ground) in September and then gradually decreases to lower alarming levels in March. During dry season, many drinking wells remain problematic in some places due to extensive use of ground water by shallow and deep tube wells that may pave the way for increasing arsenic contamination in groundwater that could affect agriculture. As such, an apprehension of correlation among water, soil and crop is not unlikely that might have also risk of arsenic metabolism due to nutritional deficiency; it is an issue of concern and risk for having exposure to both human and animal health. DFID and WHO survey results identified high arsenic contamination in drinking water in Bangladesh, which poses a risk of serious threat to public health.

Concerning all these aspects, it is very much important to grow environment friendly, climate tolerable and safe food production in Bangladesh. All those above matters were addressed through this project and introduced water saving irrigation technologies by alternate wetting and drying (AWD) method, water supply using poly-pipe, underground pipeline network, rainwater preservation, mini-pond, promote surface water where it is available and introduced alternative crops that's needed less water. On the other hand, project put emphasis to reduce excessive application of chemical fertilizers through soil management and encouraged vermin-compost/compost production. Project also promoted pheromone traps, yellow-traps, perching and herbal pesticides for pest management. Several climate resilient adaptive technologies were introduced for the sustainable agricultural practices and strengthen farmer's capacity building. Project also introduced high value crops rather than cultivation traditional crops that may play important role to increase farmers socio-economic status and improve their food balance. Farmer's interaction linked with government institutions and local LGIs for sustainable food production. Established model safe food corner to strengthen safe food farming, marketing system developed and their demand creation. The outcomes of this project were disseminated through field visits, IEC materials, human case-studies, coordination meetings, progress reports and seminars which will guide them to promote environment friendly farming and strengthen safe food production in Bangladesh.

OBJECTIVES OF THE PROJECT

The goal of the project was to strengthen sustainable food production system through water management and climate change adaptation in Jhenaidah district. The project was also emphasized to develop for the capacity of target farmers.

Specific objectives of SAP-II project

1. Develop a strong linkage between DAE and farmers.
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GENERAL AND AGRICULTURAL INFORMATION OF THE PROJECT AREA

Jhenaidah is one of the most populous and southwestern gateways and districts of Bangladesh. The total area of the district is 1964.77 sq km, located in between 23°13' and 23°46' north latitudes and in between 88°42' and 89°23' east longitudes. It is bounded by Kushtia district on the north, Jashore district and West Bengal state of India on the south, Rajbari and Magura districts on the east, Chuadanga district and West Bengal state of India on the west.

Gorai, Kumar, Nabaganga, Chitra, Bhairab, Kobadak, Betna and Kaliganga are the major rivers in the district. There are a good number of canals, beels and baors in the district. However, most of the waterbodies are not active specially during dry season. It is an agrarian district and agriculture is the single most income source of the people, which contributes about 67% to the economy.

Three upazilas namely, Moheshpur, Shailkupa and Harinakundu were selected as the project area (Figure 1). The general and agricultural information were collected from the Department of Agricultural Extension (DAE), Jhenaidah office. Although, Moheshpur is the lasgest in area, but population, education rate and population density are higher in Shailkupa. However, land:man ratio are almost same in all the upazilas (Table 1). Medium high land is dominated and 100% land in Moheshpur is under irrigation followed by 77% in Shailkupa and 56% in Harinakundu (Table 2). Most of the farmers are small to marginal (Table 3) and more than 55% lands are under triple cropped area (Table 4). Rice-based cropping pattern is dominated in the project area (Table 5). The highest cropping intensity is reported in Moheshpur (259%) followed by Harinakundu (248%) and Shailkupa (245%). Jhenaidah is a food surplus district and Moheshpur is the highest food surplus area followed by Shailkupa and Harinakundu (Figure 2).

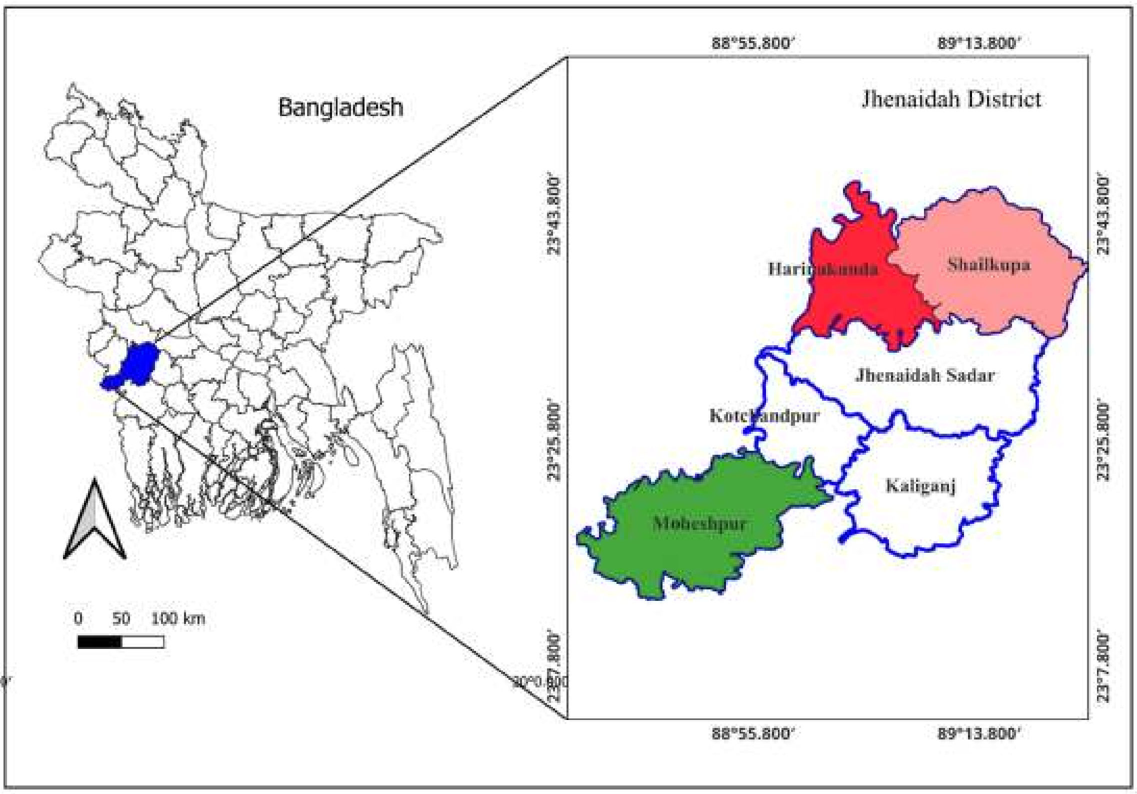


Figure 1: **Project area.**

Table 1: **General information of the project area**

Parameter	Moheshpur	Harinakundu	Shailkupa
Population	3,59,967	1,97,723	3,61,648
Total area (ha)	41,785	22,723	37,434
Education (%)	43.7	42.3	47.18
Land:Man (ha)	0.12	0.12	0.11
Population density (per km^2)	862	870	966

Table 2: **Land category**

	Moheshpur	Harinakundu	Shailkupa
High land (ha)	12,305 (36.55)	1,550 (8.70)	3,230 (10.00)
Medium high land (ha)	16,380 (48.65)	12,130 (68.07)	18,915 (56.00)
Medium low land (ha)	3,487 (10.36)	3,130 (17.56)	5,125 (15.00)
Low land (ha)	1,495 (4.44)	1,011 (5.67)	4,720 (14.00)
Very low land (ha)	0	0	1,770 (5.00)
Total	33,667 (100)	17,821 (100)	33,760 (100)
Total irrigated area (ha)	33,667 (100)	10,000 (56)	26,000 (77)

Figures in the parenthesis indicate percent values.

Table 3: **Land holding category**

Parameter	Moheshpur	Harinakundu	Shailkupa
Landless (0-0.49 acr)	7,016 (9.55)	1,453 (3.81)	3,580 (5.47)
Marginal (0.5-1.49)	19,952 (27.12)	8,491 (22.29	25,824 (39.49)
Small (1.5-2.49)	30,353 (41.26)	25,192 (66.12)	24,350 (37.24)
Medium (2.5-7.49)	15,869 (21.57)	2,878 (7.55)	10,883 (16.64)
Large (>7.50)	370 (0.50)	87 (0.23)	753 (1.16)
Total farm family	73,560 (100)	38,101 (100)	65,390 (100)

Figures in the parenthesis indicate percent values.

Table 4: **Land use pattern**

Parameter	Moheshpur	Harinakundu	Shailkupa
Total cultivable land (ha)	33,667	22,728	35,350
Total land under cultivation (ha)	24,797	17,121	31,502
Total all categories	33,087	17,821	31,740
Single cropped area (ha)	934 (3)	2,630 (15)	3,720 (12)
Double cropped area (ha)	12,650 (38)	5,150 (29)	10,125 (32)
Triple cropped area (ha)	19,503 (59)	10,041 (56)	17,895 (56)

Figures in the parenthesis indicate percent values.

Table 5: **Major cropping pattern**

Moheshpur	Harinakundu	Shailkupa
Boro-Fallow-Aman (10,642)	Boro-Fallow-Aman (7,460)	Onion-Aus-Aman (4,585)
Boro-Aus-Aman (6,368)	Betel leaf-Betel leaf-Betel leaf (1,380)	Boro-Aus-Aman (3,835)
Maize-Aus-Mash (4,357)	Boro+mustard-Fallow-Aman (1,320)	Onion-Jute-Aman (2,250)
Maize-Mug-Mash (1,793)	Vegetable-Jute-Aman (1,305)	Boro-Fallow-Fallow (2,280)
Maize-Jute-Mug (1,591)	Lentil-Jute-Aman (785)	Garlic-Jute-Aman (1,750)
Boro-Jute-Chilli (1,242)	Banana-Banana-Banana (780)	Wheat-Jute-Fallow (1,210)

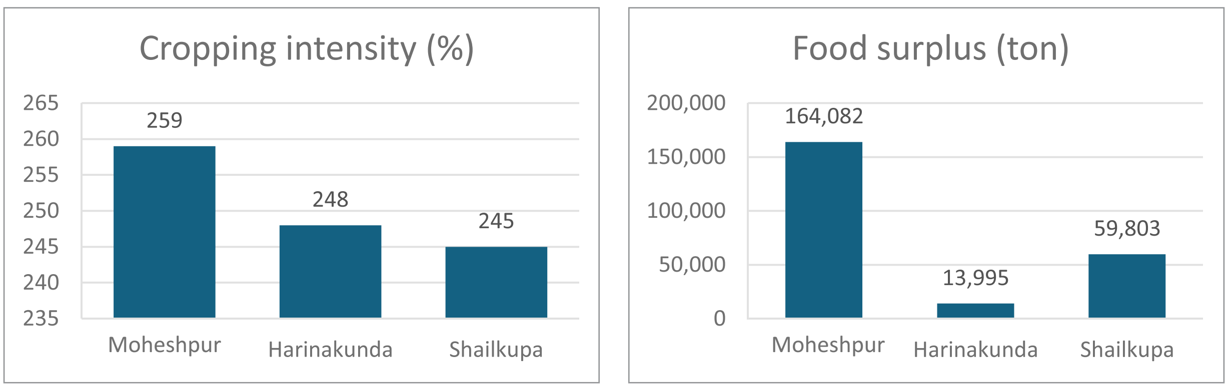


Figure 2: **Cropping intensity and food situation of the project area.**

APPROACHES AND METHODS

The major part of the project was to develop skills of at least 1,500 target farmers on the diverse farming practices and approaches that were expected to benefit them economically, environmentally and socially acceptable manner so as to sustain their productions, incomes, resources and communities. The project activities were divided into six major parts: 1) Strengthening the linkage between DAE and farmers; 2) Fostering farmers' understanding of issues and countermeasures related to water and climate crisis; 3) Promoting water management in agriculture; 4) Introducing climate change countermeasures in agriculture in the target area; 5) Verification of effectiveness of water management and climate change adaptation; 6) Information sharing and Dissemination.

This project has also given hardware support in three upazilas such as 3 underground pipelines, 3 safe food corners and 50 mini ponds. To make them sustainable, MoU was signed with the landowner with some conditions, so that these supports are maintained for at least five years.

Strengthening the Linkage Between DAE and Farmers

An MoU was signed between DAE and AAN for technical cooperation from DAE for smooth implementation of the project. AAN was responsible for carrying out project activities according to its PDM and shared with DAE on a regular basis; here DAE was the supporting organization.

Role of DAE

DAE played a key role for capacity buildup of SAP-II farmers in various aspects in achieving the outcomes of sustainable agriculture practices through joint project implementation and promote climate change adaptation techniques. Provided supports to the farmers through training on water management, climate change adaptation, seed production & preservation system, vermicompost production and soil management to strengthen sustainable food production system through water management and climate change adaptation in the targeted areas. Sub-Assistant Agriculture Officer (SAAO) supported the Farmers Field School (FFS), trainings, farmer group meetings, and provide technical guidance to the farmers. DAE officials, local government representative, public representative visited in formal and informal trainings, meetings, seminars, workshops with SAP farmers and staff members. Also, DAE officials visited the SAP fields regularly and provided support services having dialogue with SAP farmers. SAAO provided overall supports to the SAP-II farmers regarding any problems and various diseases in their crop and vegetable production at the field level. They supplied seeds modern rice and vegetable varieties and other inputs to the farmers.

Role of SRDI and other agricultural related organizations

SRDI and other agricultural related organizations also helped to SAP-II farmers for capacity building in different aspects. SRDI Jhenaidah Office helped to analyze about 39% farmers' soil samples and provided fertilizer recommendation cards to the farmers. Besides, campaigning on optimum fertilizer use for crop production though soil test was carried out. Farmers were trained on the importance of soil test and procedure of soil sample collection. A good linkage between farmers and SRDI has been established and disseminated among other farmers. As a result of the SAP-II farmers now understand better and do not fertilize the land without soil testing. Farmers followed SRDI recommended crops with recommended doses of chemical fertilizers.

LGI

There are two types of local government settings in Bangladesh, rural and urban. At the rural level the existing system provides a three-tier structure, which is Zila (district) Parishad, Upazila Parishad, and Union Parishad (UP). UP is the last tier of local government, which provided full cooperation from the beginning to the end of the SAP-II project in the implementation of the project. UP Chairmans and Members played a major role in the implementation of any development project. The Union Parishad played an important role in forming the project team and various committees as well as different meeting of farmer groups. (Fig. 3).

Union Parishad played the following roles in project implementation:

1. Provided full cooperation in identifying the work area.
2. Helped in forming SAP II farmers groups.
3. Helped in selecting group leader.
4. Helped if there is any kind of problem at the field level in the implementation of the project
5. The seeds of new varieties from BRRI and BINA are given to the farmers through DAE. UP members assisted the farmers in getting seeds of these new varieties.

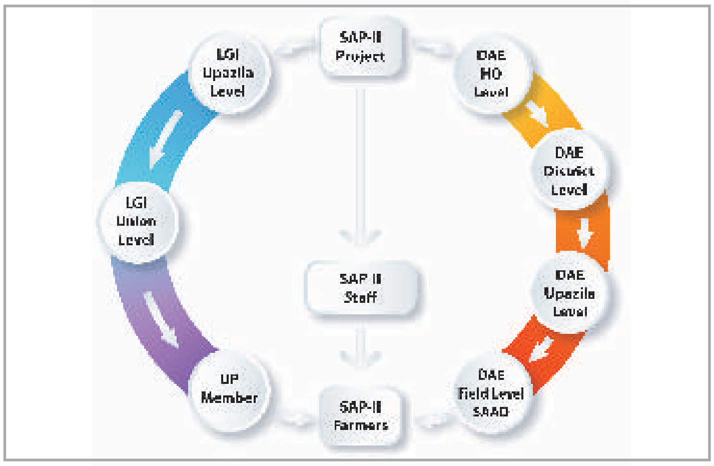


Figure 3: **LAI, LGI, SAP-II linkage.**

Fostering Farmers' Understanding of Issues and Countermeasures Related to Water and Climate crisis

Capacity building of group members by formal trainings, workshop, seminar, meeting on appropriate technologies, developing advanced farmers as resource persons in groups for facilitation and shared learning, have them exposure on demo plots & field days, yearly self-evaluation and planning.

Group formation

With the consultation with DD, UAO, AEO, SAAO of DAE, Jhenaidah, a total 50 Farmers Groups (FGs) were formed in 7 Unions and 2 Paurashavas under Moheshpur, Harinakundu and Shailkupa upazilas in Jhenaidah district. Each FG compost of 30 male and female farmers. Among 50 FGs (total 1500 farmers), 20 FGs (600 farmers) from Moheshpur, 15 FGs (450 farmers) from Harinakundu and 15 FGs (450 farmers) from Shailkupa, were selected in accordance with SAP criteria as the Primary Beneficiaries of the project, among whom 280 (18.6%) are female farmers & 1220 (81.3%) are male farmers.

Among the FGs, 35 were formed based on the old IPM (FFS) and IFMC (FFS) and 15 FGs (9 from Moheshpur and 6 from Harinakundu) were totally new. All the groups were formed with the consent and collaboration of DAE and respective Upazila Agriculture Offices. New groups were formed following SAP feasibility criteria and respective SAAOs recommendations involving their new CIG and GAP groups under the National Agricultural Technology Program-II. During the group formation, it was observed that most of the old IPM (FFS) and IFMC (FFS) were inactive, govt. officials being transferred frequently, incomplete electronic database, hardly any follow up activities for those old FFS.

Criteria was approved in the inception workshop

1. Farmers own land of 50 decimal or more, or even if the land area does not meet the requirements, they have an environment where they can grow seedlings, make compost, etc., and are interested in sustainable agriculture.
2. Farmers work on land where they can decide how to plant and till the land.
3. Farmers have land suitable for sustainable agricultural practices and are interested in implementing them.
4. Include at least 5 female members in a group of 30 people.
5. There is a member of the group who owns a cow (cow dung is used as compost)
6. There is an owner of an irrigation well in the group (water-saving irrigation practice)

The project adopted group approach by forming 50 groups identified through baseline and criteria as laid down in SAP i.e. member should possess at least 50 decimal arable lands and informed consent of SAP Practices. The advanced 400 farmers (on an average 8 person in a group) among 1500 farmers were selected and trained in SAP approaches. They performed as resource persons (Farmer) in groups to facilitate SAP practices and conducted training.

All groups were found functional out of 50 groups. Members took part in group planning exercises, review & develop business plan for crop diversification, Rabi seed production, use of magic pipe, less water irrigation practice in Boro rice facilitated by resources persons. Our field staff attend these meetings and kept continuing support to them; among other, vermicompost production, soil test and linking SAP farmers with government officials etc. for technical assistance and networking.

Out of 1,500 farmers, the project provided formal training to 27% (400) of the SAP farmers on SAP approaches. Even the number was less for formal training, but the number all the farmers were brought under informal training. We experienced that 1,500 SAP farmers have their capacity built on formal and informal training, workshop, seminar exposure etc. However, many of the SAP farmers had keen interest on recurring capacity building on new technology in agriculture, know-how of maximizing profit on their small lands and integrated farm management. They wanted training sessions as close as possible to their living places to save time, cost and for convenience of field works.

Baseline, midline and endline surveys

The aim of the project was to develop skills of 1,500 farmers on the diverse practices and approaches that are economically benefited, socially acceptable and environmentally sound as well to sustain incomes, resources and communities. To know the changes over time due to the practices of SAP technologies, three surveys were conducted. The baseline survey of the project was done in Mar-Apr 2021 just after the beginning of project, the midline survey was done in Aug-Sep in 2022 and the end line survey was done in Sep-Oct in 2023. In these three surveys, the project staffs visited all farmers' homes and collected data by face to face interview using a structured questionnaire.

Photo 1: **SAP-II Staff Interviewing farmer.**

Farmer field school (FFS)

FFS is an important training for farmers. It is a non-formal training. This training is organized in the farmers' fields or in the yard of their houses (Photo 2). 1500 farmers have been given FFS training during the project period twice every year.

The trainings were organized at the facility of the model farmers and are attended by project staff. SAAOs are present as resource persons in training. In this training, the diseases and problems of various crops in the farmer's field are discussed in detail. In this training, farmers reviewed cropping pattern and business plan.

Photo 2: **Farmer field school.**

To facilitate regular FFS, the resource person selection from the farmers group was done during the group meetings. The selected resource persons participated in the classroom training and disseminated the knowledge through Farmers Field School (FFS). Through the FFS mutual learning sessions, SAP farmers got comparatively more collaborative responses from govt. officials (SAAOs, AEOs, SRDI and UAOs).

Model farmer training

Model or advanced farmers refer to those who are engaged in 5 to 6 components out of 9 components of the SAP-II project and have good knowledge on agriculture and better understanding of improved agricultural technology. The model farmer plans and cultivates agricultural crops and vegetables in all the land in the garden and field of the house. Among 1,500 SAP farmers, 400 (26%) farmers were selected as model farmers in consultation with groups from three upazilas and trained them in seed production and preservation technology.

Photo 3: **Training for the model farmers.**

We build up the capacity of model farmers through classroom training and group meetings (Photo 3). We also build up their capacity through demonstration and exposer visit of various crops. Model farmer also produce quality seeds of different crop varieties at farmers' reach matters in terms of production, multiplication, early marketing and farmers' economies. Availability of diverse quality seeds enhances crop diversity both in Rabi and Kharif seasons.

Annual plan development

Farmers developed annual plan that helped them a lot, for example, the details of which crops to cultivate at what time are in the annual plan. Generally, in FFS training SAAO and our staffs helped farmers to make annual plan of cultivation (Photo 4).

The annual plan indicates what kind crops will be grown in which season with sequence and detail management practices. Farmers shared their year-round plan in group meeting, FFS training and class training and made the cropping pattern with the advice of other farmers. Annual cropping pattern made the farming profitable and no land kept fallow. The farmers also could share their year-round plan with DAE to get advice. In terms of crop production, farmers included land preparation, intercultural operations and harvesting in the plans.

Photo 4: **Annual plan of crop cultivation.**

Apart from these, capacity building of the farmers through different types of training which are as follows:

- Group meeting for all members once in a month where the resource farmers facilitated shared learnings to other fellow farmers in their respective groups;
- Field meetings in presence of DAE officials (SAAO) and provided field training to farmers;
- Field days on farmers' challenges in crop production, protection etc., where DAE officials paid attention;
- Visits, discussed mitigation measures on challenges that farmers experienced.
- Self-evaluation of farmers' SAP practices, planning and reinforcement exercises by themselves in groups and assembling in yearly upazilla workshops where DAE officials, public representatives, LGIs representatives, other officials like Bank etc., participated, observed and exchanged views;
- Field exposure of farmers held time to time on advanced farmers' fields who raised demo plots; in all field exposure, DAE officials also participated;
- Frequent field visit by the project staff members, local & foreign experts and provided their feedback to the staff members and farmers;
- Vermicompost production, soil test, Arsenic test etc., support services and hands on training were also provided by the project staff and SRDI resource personnel.

Safe food corner (SFC)

As a part of farmer's capacity development, three Safe Food Corners (SFC) have been established in 3 places, Khalishpur bazar in Moheshpur upazila, Parbatipur bazar Harinakundu upazila and Kabirpur bazar Shailkupa (Photo 5). The aim was to encourage safe food production by creating a place where safely grown vegetables can be sold at a fair price.

Photo 5: **Safe food corner.**

SAP farmers cultivate safe vegetables and sell at SFC. They consume the vegetables for nutritional needs and the surplus they sell to SFC at a fair price to earn extra income. The vegetables sold here are grown without any kind of chemical fertilizers and pesticides, only used organic fertilizers and vermicompost.

Exchange visit for farmers

It is an educational program for farmers. Farmers of one area or a group do something good and the farmers of other area see it and they get lessons and experiences. We identified good practices at Ganna village under Jhenaidah Sadar upazila and planned to arrange exchange visits for the farmers of other areas (Photo 6). In this connection, 90 group farmers from Shailkupa, Horinakunda and Moheshpur upazilas visited and got knowledge and education on various aspects of agriculture.

Photo 6: **Exchange visit for farmers.**

The farmers listened and/or watched the success stories of the farmers of Ganna village on use of AWD pipe and its benefits; seed collection, storage and use; vermicompost production use and benefits; pesticide use; homestead vegetable cultivation; soil testing and fertilizer use; Robi crop success; Boro paddy cultivation etc.

Field day observation program

Field day observation program has been implemented in 3 upazilas (Photo 7). This program was held in Shailkupa on 12.11.2023; Harinakund upazila on 17.11.2023; and Moheshpur upazila on 18.11.2023. The main point of the program is that when a farmer or group cultivates a good vegetable or Robi crop, other farmers, groups and representatives of DAE observe and give advice and suggestions to the farmers on various issues.

Photo 7: **Field day observation program.**

In the first phase, 120 to 150 farmers gathered together along with DAE officers and SAP-II representatives (Photo 8). A discussion was arranged on crop diseases and quality seed production. DAE and SAP-II personnel answered all the questions one by one and gave suggestion on various issues.

In the second phase, all the farmers, DAE officials and SAP-II staff went to the field together. Everyone observed good practices of vegetable and rabi crop cultivation. Farmers explain how to grow these vegetables and others listened and learned. Necessary advises were given to the farmers on related matters.

Photo 8: **Field day observation program.**

Promoting Water Management in Agriculture

Water is a critical input for agricultural production and plays an important role in food security. Due to population growth, urbanization, and climate change, competition for water resources is expected to increase, with a particular impact on agriculture.

Sustainable water management in agriculture was one of the major objectives of this project. The following interventions were done:

AWD method

Alternate wetting and drying (AWD) is a management practice in irrigated lowland rice that saves water and reduces greenhouse gas (GHG) emissions while maintaining yields. The practice of AWD is defined by the periodic drying and re-flooding of the rice field (Photo 9).

Photo 9: **Installation of AWD pipe.**

A practical way to implement AWD safely (without yield loss) is to monitor the depth of ponded water on the field using a 'field water tube' magic pipe. After irrigation, the water depth gradually decreases. When the water level has dropped to about 15 cm below the surface of the soil, irrigation should be applied to re-flood the field to a ponded water depth of about 5 cm. From one week before to one week after flowering, the field should be kept flooded, topping up to a depth of 5 cm as needed. After flowering, during grain filling and ripening, the water level can be allowed to drop again to 15 cm below the soil surface before re-irrigation.

AWD can be started a few weeks after transplanting. When many weeds are present, AWD should be postponed for 2-3 weeks to assist suppression of the ponded water and improve the efficiency of herbicide.

Before irrigation, farmers must see the water inside the AWD pipe. If water is seen inside the pipe then there is no need to apply water to the field. If only soil is visible inside the pipe, the farmer will water the field.

Benefits of AWD

Reduced water use: By reducing the number of irrigation required, AWD can reduce water use by up to 30%. It can help farmers cope with water scarcity and increase reliability of downstream irrigation water supply.

Greenhouse gas mitigation potential: In the 2006 IPCC methodology, AWD is assumed to

Photo 10: **Water measurement in rice field by AWD pipe.**

reduce methane (CH_4) emissions by an average of 48% compared to continuous flooding. Combining AWD with nitrogen-use efficiency and management of organic inputs can further reduce greenhouse gas emissions. This suite of practices can be referred to as AWD.

Increased net return for farmers: "Safe" AWD does not reduce yields compared to continuous flooding, and may in fact increase yields by promoting more effective tillering and stronger root growth of rice plants. Farmers who use pump irrigation can save money on irrigation costs and see a higher net return from using AWD. AWD may reduce labor costs by improving field conditions (soil stability) at harvest, allowing for mechanical harvesting.

Fita pipe

The total cost to the farmer is reduced if water is applied to the agricultural land through Fita pipes. Water consumption is less, land wastage is less and farmers can grow crops on more land. The farmer can give this ribbon pipe to his land as per requirement, the farmer does not have to suffer any hesitation. In terms of water management, ribbon irrigation is a cost-effective method and can be easily used by farmers. Beside, to ensure food security and sustainable water management for agriculture, there is an urgent need to produce more crop per drop of water used in the agricultural sector and hence ensure that water use efficiency is increased without negative impacts on downstream water quantity and quality.

Photo 11: **Using Fita pipe for irrigation.**

Before the project started, SAP-II farmers used to irrigate the land using conventional methods. Currently irrigation is done through poly pipes, which reduced the cost and minimized the wastage of water.

Ground water is a very essential input and a scarce resource for increasing crop productivity as well as sustainable agriculture which is being gradually depleted and contaminated by arsenic concentration unscrupulously over couple of years. Therefore, if water management in agriculture is done properly, the underground water is safe and the water level is also corrected.

Underground pipeline

Water management through underground pipeline reduces water loss and electricity bill. On the other hand, the wastage of land is less and it is financially beneficial. Underground pipeline established in 3 upazilas with the financial support from SAP-II project.

Site Select Criteria of underground pipeline:

1. Underground pipeline has been installed where agricultural lands of 25-30 SAP-II farmers will have cover.
2. At least 1000-1300 dcimals of land should be available where the underground pipeline has been installed.
3. Underground pipeline has been installed in places where Robi crops, winter vegetables and paddy are cultivated.
4. There should be an irrigation pump in that place.
5. Pump owner should be SAP-II member.

A total 1200 feet underground pipeline has been constructed in Harinakundu upazila, 450 feet in Moheshpur upazila and 800 feet in Shailkupa upazila. At least 164 farmers applying irrigation through underground pipeline covering 5610 decimal of lands (Table 6).

Table 6: **Number of beneficiaries, length of pipe and area coverage of underground pipelines constructed under SAP-II project**

	Harinakundu	Shailkupa	Moheshpur	Total
Number of beneficiaries	67	47	50	164
Length of pipeline (ft)	1,200	450	800	2,450
Area coverage (bigha)	75	45	60	170

** One bigha is 33 decimals of land.*

The following are the major advantages:

1. The farmers get water at or near their fields.
2. The quantity of water delivered from each outlet remains the same, irrespective of the elevation and distance from the outlet.
3. Water is supplied to each field plot either directly or through a field channel of short length originating from the outlet.
4. Maintenance cost of the water distribution system is very low.

Mini pond

In farmlands with no irrigation source, rainwater harvesting through mini ponds as a climate change adaptation technology can provide supplemental irrigation. The practice is suitable to small and medium landowners. Limited family labor is required for the excavation of the mini pond, which farmers prefer to locate on a corner of the field.

Photo 12: **Mini pond.**

Mini pond is a climate adaptation technology for cultivating different crops in the agricultural sector. Water can be retained through the mini pond and that water can be used for the preparation of seedbeds for the farmers and the water can be used for the cultivation of various types of vegetables in the pond bank. Farmers in mini ponds cultivate different varieties of fish for their own consumption and earn extra money by selling the surplus fish in the market. Again, by growing different types of vegetables on the bank of the pond, the family members eat the raw food to meet their nutritional needs and earn extra money by selling their surplus in the market, thus the financial condition of the farmer has improved compared to before.

A total of 50 mini ponds have been excavated/re-excavated in the SAP-II working area with the financial supported by AAN. Out of which 30 mini ponds have been dug in Moheshpur upazila, 15 in Harinakundu upazila and 15 in Shailkupa upazila.

Site selection criteria of mini pond:

1. Must be a member of SAP-II and have at least 2 decimal of land for digging ponds.
2. Mini ponds have been constructed in places where water accumulates.

3. The mini pond should be near the dwelling house so that women and children can work.
4. It is better to have a pond before because it can be re-excavated.
5. Mini pond water can be used for seed bed and vegetable cultivation.
6. The nutritional needs of the family can be met by growing fish and vegetables in the mini pond.
7. Mini ponds are dug in places where paddy is cultivated.

SAP-II farmers are happy after digging this pond. This mini pond is a good intervention for water management which can be easily done by the farmers. It may be noted that 21 mini ponds have been dug by farmers' initiative.

Demonstration plot

SAP-II Farmers have a display plot of various vegetables next to their mini pond. In these demonstration plots, they have been financially benefited by cultivating improved and different varieties of vegetables. Vegetables from these gardens are being consumed by the family members to meet their nutritional needs, while the surplus vegetables are sold to SFC for a fair price. Again, extra vegetables come to the house and are given to nearby relatives. A demonstration plot of this vegetable was developed next to 50 mini ponds in the SAP II work area. Farmers enjoy doing all this and they are financially benefited by getting extra money.

Photo 13: **Demonstration plot of bottle gourd.**

Climate Change Adaptation

Mitigation and adaptation are two important tools for reducing the risks of climate change. Due to climate change, precipitation patterns changed in Bangladesh, causing more intense rainfall on rainy days and more dry days in the summer season (in a year). As a result, agricultural production, the critical sector in Bangladesh, is suffering. The impacts of climate change have significantly reduced agricultural production in flood, drought and salinity-prone areas.

Cropping pattern

Agriculture is the science and practice of producing crops; and cropping pattern expresses the shares of various crops in the farmers' total cultivated area in an agricultural year. Cropping pattern is an important indicator of a farmer's decision making ability and also influences the consumption pattern as well as health and nutritional status of the people. Cropping pattern vary from region to region, country to country and culture to culture.

Healthy soil is necessary to sustain biodiversity, ecosystems and agriculture. SAP farmers have been gradually maintaining healthy soil by diversifying crops in the area's rice-based cropping pattern; it has been sustainably enhancing cropping intensity too, thereby saved cost of production and improved farmers' economies. Our field staff of 3 upazila collected data of 1,500 farmers in two times in a year. The data were checked and verified by the upazila coordinator, monitoring & documentation officer & project consultant and entered into spreadsheets for analysis.

Cropping pattern is discussed in detail in Farmers Field School (FFS) training. Cropping pattern, annual plan, crop pests and modern various technologies are discussed with FFS training twice a year in 50 groups in 3 upazilas (Moheshpur, Harinakundu and Shailkupa). As a result of cropping pattern, the farmer does not have any fallow land but the farmer cultivates one crop after another. In our SAP-II all farmers adopt cropping pattern they plan their crop which increases their total yield and farmer development.

Seed management

Seed selection, production, storage and marketing are the steps of seed management. Seed is the foundation of agriculture for enhancing crop production. But the availability of quality seed is the main constraint to crop production in Bangladesh. The use of quality seed can contribute significantly to increase grain yield as well as to increase the availability of every day's food intake. Seed management is seen as an extension of women's domestic duties: women are responsible for all seed processing, storage and exchange for field as well as home garden crops.

Quality seed is considered to be the basic input for increasing agricultural output and thereby achieving self-sufficiency in food production. Effectiveness of other inputs like fertilizer and irrigation depends largely on good seed. But use of improved seed is still very limited. National Seed Policy provides for policy directives to increase production of improved seed both in the public and private sectors and for making best quality seeds available to the farmers on timely basis, and at competitive price.

Seed selection

Seed selection is a prerequisite for good seed. The rice grain of the rice plant is not the same in all the fields. Good seeds are obtained by saving seeds from rice plants whose grains are healthy and strong. SAP-II farmers usually cut some paddy plants from the middle of the field and save them as seeds. Good seed selection is a critical issue. Better seeds reduced production cost and 15-20% more yield is obtained by using good seeds.

Seed production

Usually SAP-II women produce seed at rural level. The good seeds are separated from the bad seeds. After separating the good seeds, they are dried in the sun. After drying in the sun, the seed should be stored in clay pots or plastic drums. Before planting the seeds, the seeds should be treated with jam leaf juice and dried in light sun and cooled.

Community-Based Rice Seed Production aims to strengthen the production capacity of SAP-II farmers through community level seed production, farmer-to-farmer supply of quality seeds, and promotion of local seed markets.

Seed preservation and business

After drying the seeds in the sun, SAP-II farmers store the seeds in earthen pots or plastic drums. A total 150 plastic seed drums were distributed to 150 SAP farmers under SAP-II project.

After placing the seeds in the earthen pot, the farmer first paints the inside of the pot with tar, so

Photo 14: **Seed preservation.**

that outside air cannot enter inside, so that the humidity of the seed is correct. After keeping the seeds in plastic drums or earthen pots, the upper space should be covered with neem leaves to prevent insect infestation. Sometimes earthen pots or plastic drums are dried in the sun. SAP-II farmers do not sell the seeds as food but they sell them as seeds and it is more profitable. Farmers do this business after getting license from UAO and they sell these seeds to various agencies and SAP-II farmers.

Soil management

Soil test

Soil testing is a soil-management tool used to determine the fertility of soil as well as the optimum lime and fertilizer requirements for crops. A soil test is important for several reasons: to optimize crop production, to protect the environment from contamination by runoff and leaching of excess fertilizers, to aid in the diagnosis of plant culture problems, to improve the nutritional balance of the growing media and to save money and conserve energy by applying only the amount of fertilizer needed.

Photo 15: **Soil sample collection.**

The farmer knows that the soil is healthy. We encourage farmers to apply fertilizers by checking the health of the soil. It is necessary to test the soil to understand what kind of fertilizer is in the soil and what kind of fertilizer should be given. What type of crop is suitable for a soil can also be understood through soil testing. Fertilizer application based on soil testing results in less chemical fertilizers and higher yields. This protects the health of the soil and the farmer benefits financial.

The need for and importance of soil testing is discussed among the farmers in various trainings including FFS training. Farmers collected and processed the soils in the prescribed manner and provide the samples along with the fee to the SAP-II staff. SAP-II staff sent the samples to SRDI Jhenaidah office. After that, after the specified time, the soil test card is collected and delivered to the specified farmers.

Importance of Soil Testing:

- Fertilizer wastage was reduced, and farmers got benefits.
- Increased yield.
- Crops are of good in quality, soil health is increased, and environmental pollution is reduced.

Fertilizer recommendation card

Farmers apply fertilizer to their land through Fertilizer Recommendation Card issued by SRDI. When the farmers submit the soil to SRDI, a card is issued that mentions the type of crop can be grown. SAP-II farmers now test the soil and apply fertilizers following the recommendation. In this, the cost of the farmer is less and the profit is more. We discussed the issue of soil testing in FFS, group meetings and classroom training and motivated the farmers (Photo 16).

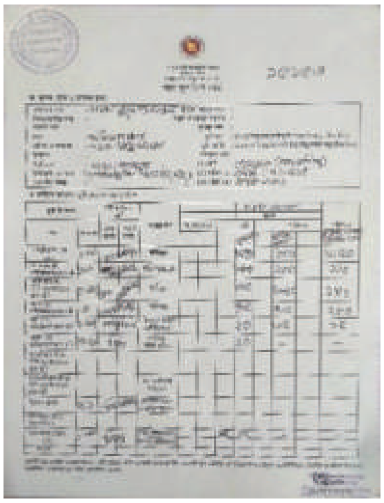


Photo 16: **Fertilizer recommendation card.**

Vermicompost and Trichocompost

During a period of one month, earthworms eat rotten cow dung and curry leaves, leaves of plants, fallen leaves of trees, weeds, various types of weeds, animal waste, poultry droppings, household garbage, eggshells, etc. A type of fertilizer that is produced by extracting chemical substances is called Vermicompost. Earthworm fertilizer has 7-10 times the nutritional value compared to other fertilizers (Photo 16).

Photo 17: **Vermicompost preparation.**

In SAP-II project, 4 charis and 1 kg of earthworms were given to 2 farmers in each group. Through FFS training, they were taught how to make vermicompost. Later they prepared their own vermicompost at home. Again, we have given chari and earthworms to those farmers who have cow dung available and the house yard is high. Besides, 158 farmers produced vermicompost in 3 upazilas, 131 people used it in their land and 27 people sold vermicompost. As a result, farmers benefited financially. Following them, other farmers have started producing vermicompost.

On the other hand, generally tri-compost is made with wood powder, gram flour, molasses and straw. It is also more profitable for the farmer to use it on their land. As a result of its use, the quality of vegetables and other crops is improved.

Homestead production

Management

Homestead is a low-cost production system where mainly family members work to grow vegetables and fruits using minimum or no agrochemicals. Farmers mainly women are engaged in this production activities. It provides various food, fodder, shelter and services. A good designed and well managed homestead can ensure food, nutrition and economic securities. SAP-II farmers were trained on homestead production systems.

1. **Quality seed management:** Good seed good yield. So good quality seeds must be ensured for homesteaded gardening. SAP-II farmers are always in touch with DAE and SAP-II staffs to get good seeds and other inputs.
2. **Pesticide management:** After training, SAP-II farmers do not use chemical pesticides in vegetable production. They now use the extracts of seeds and leaves of Neem Mahogany, Bishkatali, etc. They also follow IPM methods such as light trap, pheromone trap, yellow trap in controlling pests.
3. **Fertilizer management:** When doing homestead gardening, SAP-II farmers use organic fertilizers instead of chemical fertilizers. It improves vegetable production, quality and income. They especially use vermicompost and cow dung manure, which is free from toxicity of the products and ecology.
4. **Fair price and marketing:** Farmers don't get fair price of produce because of brokers and middleman interference. However, SAP-II farmers produced safe vegetables in their gardens for consumption by their families and sold surplus vegetables to SFC at fair prices, improving the financial status of farmers.

Photo 18: **Vegetable production in home garden.**

Photo 19: **Distribution of tree saplings.**

Benefits

The nutritional needs of the family members are being met by consuming the safe vegetables produced by the homesteaded garden, on the other hand, the farmers are benefiting financially by selling the surplus vegetables to SFC and benefited by financially. Dietary Diversity Score (DDS) is improving along with meeting the nutritional needs of family members by eating these vegetables (Photo 18).

Tree Plantation

Tree plantations are a major means of climate change adaptation. Natural disaster can be avoided by tree plantation. The Project distributed fruit and medicinal plant saplings to SAP farmers in 3 upazilas of Jhenaidah district through SAP-II project. Total 500 seedlings were distributed to farmers in 3 upazilas in the presence of LGIs (Photo 19).

Weather information and alarming

A weather information and alarming chart has been developed under SAP-II project to provide necessary information sources on weather events. SAP-II farmers get weather information and alarming through SMS, Phone Cal, Radio, TV, and Internet. If there is any abnormal weather event comes, DAE and UP disseminate the information to the farmers through miking and other means. SAP-II staffs also alerted and sensitized farmers and provided advance weather information.

Events

Project inception workshop at District level

Inception Workshop of SAP-II Project was delayed due to Covid-19 pandemic. It was held on 22 September 2021 at AID foundation, Jhenadah district with the active participation of SAP farmers, Government Agricultural Officials, LGI members, NGO representatives, different agriculture related entrepreneur groups, DTW owners and project staffs.

The SAP members presented SAP-II Project at a glance, SAP-I project outcomes, SAP-II baseline survey, SAP-II farmers group formation criteria, group location in map, climate change effects in agriculture and counter measures techniques. In the open discussion session, farmers and entrepreneurs discussed their core needs and issues to the government officials.

In the workshop, a collaborative rapport was built up among project staff, UNO, DAE, SRDI, LGIs. Besides, the government officials invited the SAP team to their meetings and seminars, which indicates good cooperation with stakeholders.

Coordination meeting with GI and University

This coordination meeting is held 2 times in a year. A total of 6 meetings were held during the SAP-II project period. University teachers, Deputy Director of DAE, Agricultural Engineer and SAP-II senior management were the participants of the meetings. Project updates were shared in the meetings. If there is any recommendations from DAE based on update, necessary steps were taken accordingly.

Upazila inception workshop

After the district inception program, the upazila inception workshops were arranged at each upazila. Inception workshops in Harinakundu, Moheshpur and Shailkupa upazilas were held on 18.01.2023, 25.01.2023 and 30.01.203, respectively.

Upazila Parishad Chairman, UNO, Mayor of Harinakundu & Shailkupa Paurashava, UAO, Agricultural Engineer DAE Jhenaidah, Scientific Officers of SRDI Jhenaidah, NGO representative, SAP farmers and staffs were present in the event.

Photo 20: **Discussion meeting with DAE.**

Recommendations for Harinakundu upazila

For fertilizer issue, UAO suggested farmers no need to pay extra price than the govt. fixed price. Farmers can complain the issue directly to Directorate of National Consumers' Right Protection, Jhenaidah or Upazila Agricultural Office through just a phone call.

Recommendations for Moheshpur upazila

UNO appreciated the results of AWD adaptation. He said that the use of groundwater should be reduced at least for the next generation. He also said that it takes 40 years to refill the water that we extract from underground.

UAO Moheshpur said climate change is the biggest challenge for the farmers of Moheshpur. The invasion of new insects and diseases like corn borer, blast etc. is mainly due to climate change. He said farmers are being trained in integrated pest management. He also suggested that farmers should increase the use of organic fertilizers such as cow dung and vermicompost.

Recommendations for Shailkupa upazola

UAO Shailkupa said water crisis in jute cultivation is an inevitable problem. Uncertain excessive rainfall also happened in last two years which is not good for crops also. He suggested to increase jute cultivation in riversides, lakesides and low land. Regarding damage of BRRI dhan-51 and BRRI dhan-49, the UAO suggested the SAAOs to collect photo evidence after then he will communicate with BRRI to identify the reason and to solve the issue.

The Fisheries Officer of Shailkupa suggested to keep the water height 3-5 feet in the mini pond for indigenous varieties fish cultivation. Snakehead murrel and catfish cultivation in mini pond are very much profitable nowadays.

Photo 21: **Inception workshop.**

Midterm Workshop

Midterm workshop was held on 5th January 2023 at the project office, Jwenaidah district. DAE, SRDI and BIRTEN officials, SAP-II farmers & project staffs, NGO representatives, were present in the midterm workshop. The main discussion in the midterm workshop was as follows:

- Water saving cropping system
- Has more space improvement
- Less use of agrochemicals
- Preparation of organic fertilizers
- Family food and nutrition securities
- Seed storage and exchange
- Climate smart agriculture
- Arsenic contamination improvement through soil and water management

Photo 22: **Midterm workshop.**

SAP farmers shared their experience in midterm workshop. By using earthworm fertilizers, their production and income increased. Their cropping intensity was increased by utilizing all fallow lands.

Shibu Podo Biswas, Executive Director of Sonar Bangla Foundation, Kaligonj, suggested, to deal with the effects of climate change, such project need to be implemented nationwide. He requested DAE to extend their proactive support to farmers.

Hasan Ali, UAO Moheshpur, appreciated the project outcomes. He said AWD, parching was very familiar in Moheshpur. He gave thanks to SAP team for AWD promotion and magic pipe support to the farmers and he recommended such project need to be implemented nationwide.

Kbd. Asgar Ali, Deputy Director DAE as the Chief Guest of the workshop, said in his speech 3.5 lac farmers got government subsidies, 81 thousand farmer received seed support, 31 thousand received mustard seeds as subsidies. Fruits and vegetables can be produced using organic fertilizer and natural pest control methods, while rice growing with AWD method are very effective in this region that can save irrigation and ensures good yield.

Final Seminar

Final Seminar is one of the best activities of SAP-II project which was held on 25 November 2023 in AKM Gias Uddin Milky Auditorium, Khamarbari, Farmgate, Dhaka. University teachers, researchers, students, representatives of Japan Embassy, high officials of central level DAE-Dhaka and DAE-Jhenaidah district, scientists of SRDI, Chairman of AANB and high officials of AAN, representative of INGO, local NGO and SAP II project staffs were present in this seminar. In this seminar, the overall achievements of SAP-I & SAP-II were presented as well as the experiences of the farmers under SAP-II


Photo 23: **Final seminar at Dhaka.**

project were shared. Open discussion was held in the seminar and some recommendations were made by the participants to make the SAP-II project sustainable (Photo 23).

The following issues are discussed:

- All strongly recommended to extend the duration of the SAP-II project and disseminate to other locations.
- Mini pond is nice idea but should be done where water is stored. It is also better not to do it where water does not accumulate.
- Underground pipeline cost is high, so it needs to be implemented through BADC.
- Smart agriculture plays an important role in saving water. Hence the use of IoT (Internet of things) can be added along with AWD.
- Japanese AWD (NARO method) is not very similar to Bangladesh, so customize a method to conduct the research in accordance with Bangladesh situation.
- More research is needed on AWD and Arsenic mitigation in agriculture. Cooperation is needed to make a comprehensive model for arsenic mitigation & use of AWD.
- Farmers get a lot of support through DAE. The support of their workforce should reach the farmers more quickly.
- Farmers are not aware of traditional campaigning methods of safe food production. So, awareness activities should be enhanced for producer, consumer and traders.

Follow up Activity of SAP-I

Three upazilas of Jhenaidah district (Kaliganj, Kotchandpur and Jhenaidah Sadar) were under follow-up as SAP-I project was implemented in those upazilas from 2017 to 2020 for sustainable agriculture promotion with less irrigation water for the fundamental solution of arsenic pollution. In SAP-II project, the followed issues were followed up:

1. AWD eye estimation
2. Increasing Robi crops
3. Seed production and sale
4. Production and use of vermicompost
5. Increase soil test
6. Use of ribbon (fita) pipe
7. Linkage develop with GOs, NGOs and farmers.

In three upazilas, 967 farmers out of 1500 were practicing AWD by estimation. A total 504 demonstration plots were given to the SAP-I farmers by DAE that are very helpful for the farmers for higher production and income generation.

Through follow-up, the following supports were given to the SAP-I farmers:

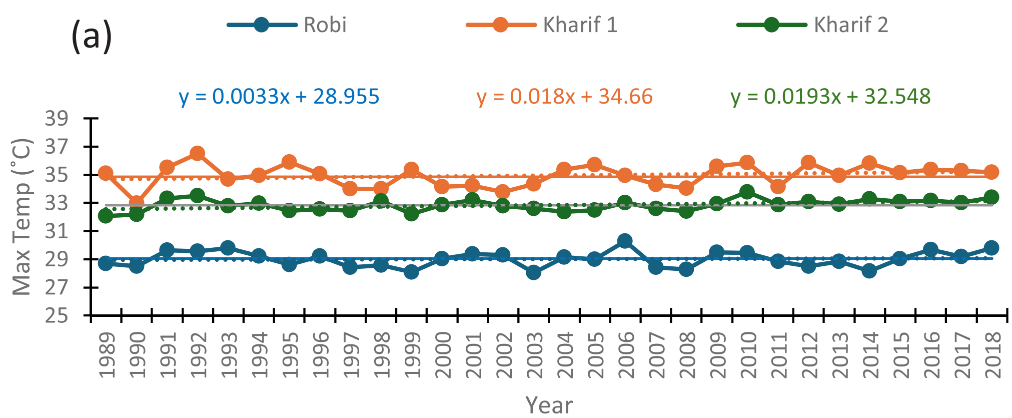
- 144 family nutrition gardens have been developed in 3 upazilas.
- Fita pipe usage has increased among 713 farmers.
- Fallow lands are brought under cultivation.
- Cropping intensity has increased.
- The use of organic fertilizers has increased.
- Pesticide use has decreased and IPM practice has increased.
- Experience sharing has increased among farmers.
- Soil test has increased for optimum fertilizer use.

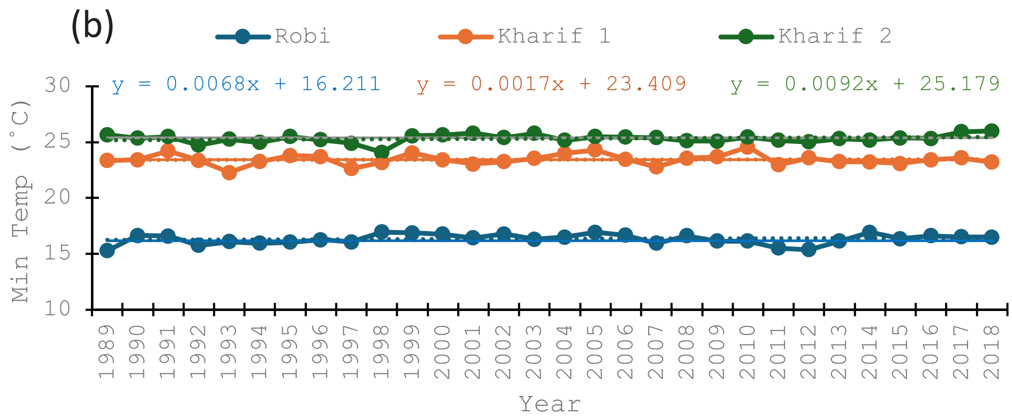
RESULTS AND ACHIEVEMENTS

Climate Change Scenario

Long-term observation

Long-term (1989 – 2018) climatic data were analyzed to understand the scenario of climate change in the project area. The data were also analyzed to observe the seasonal trends and variability. Both maximum and minimum temperatures showed increasing trends. For maximum temperature, among the seasons, Kharif-2 showed the highest increasing trend followed Kharif-1 and Robi seasons. In case of minimum temperature, although it showed similar trends, but the rate of increment was higher during Kharif-2 season followed by Robi and Kharif-1 seasons. Rainfall showed a decreasing trend regardless of season. Boro season rainfall decreased more followed by Kharif-2 and Kharif-1 seasons. It indicated that dry spell is increased for all the seasons (Figure 4).





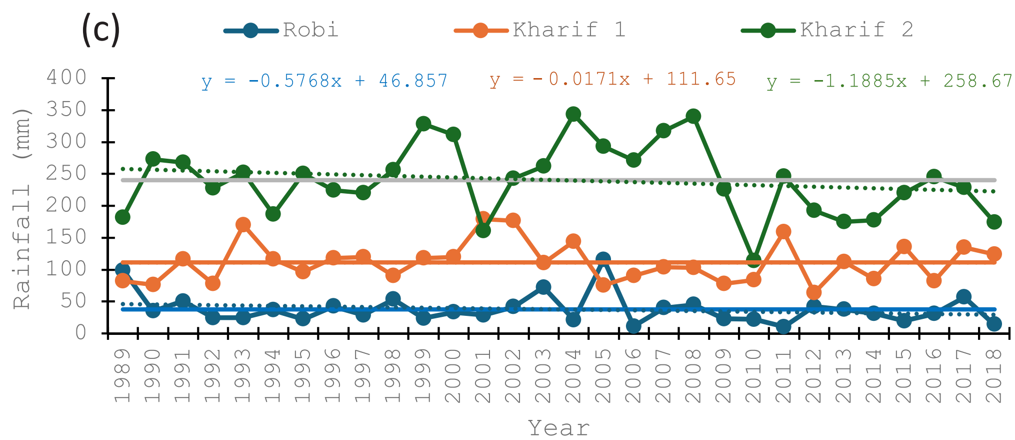
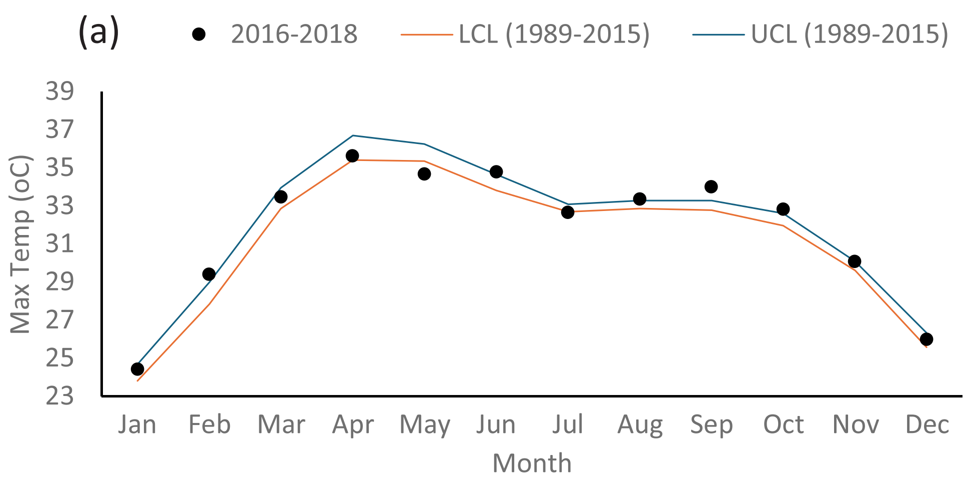
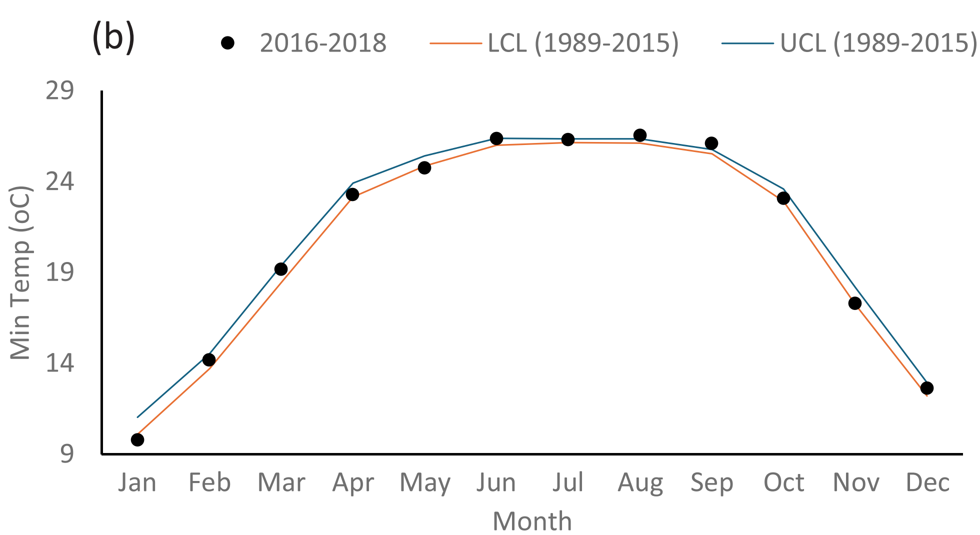


Figure 4: **Seasonal variations and trends of maximum temperature (a), minimum temperature (b) and rainfall (c) in the project area.**

Analysis showed that maximum temperature exceeded the threshold levels during February, June, August, September and November, while maximum temperature decreased during May and July, and it did not change in other months (Figure). Minimum temperature increased during the monsoon season (June to September), but it decreased in January (Figure 5) in the recent years.





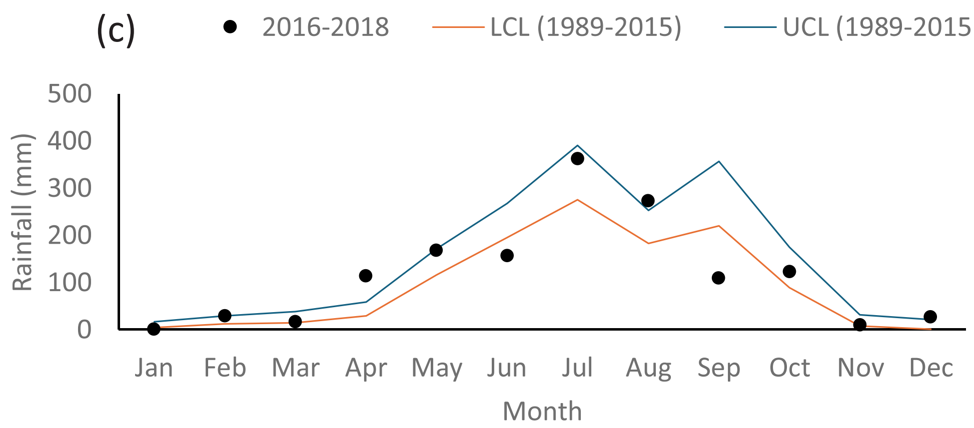


Figure 5: **Monthly distributions of maximum temperature (a), minimum temperature (b) and rainfall (c) based on long-term weather data and variations in the recent years.**

Farmers' perceptions

To know the farmers' perceptions on climate change, a survey was done using a structured questionnaire with 100 farmers (randomly selected) from the study area. Farmers were asked several questions on the current situations of climate change in comparing with 10-year ago situations.

Almost all respondent farmers experienced increasing temperature and the increment rate was higher during Aman season followed by Aus and Boro seasons. Rainfall showed an opposite trend particularly during Aman and Aus seasons. However, farmers opined that rainfall has been shifted and the distribution is not even like 10 years ago. Flood is not a problem in the project area as most of the lands are high to medium high. Therefore, farmers did not give any opinion on flood. Irrigation facility is well developed in Jhenaidah district; therefore, farmers do not face irrigation water shortage. However, many farmers opined that they were facing severe water shortage during March and April. Due to uneven distribution and decreasing trend of rainfall, farmers applied irrigation for rice cultivation in all seasons. Although, Jhenaidah is not a coastal district, but farmers mentioned that they are experiencing frequent cyclone in the recent years and Aus and Boro seasons affected mostly. Winter duration has been decreased in the recent years, but fog intensity increased, which is harmful for crop cultivation. Disease and pest infestation increased tremendously in the recent years and rate was higher during Aman season followed by Aus and Boro seasons. Farmers mentioned that water table was decreased mainly due to excess withdraw of groundwater, decreasing rainfall, increasing temperature, and disappearing pond, canal, river and other waterbodies. Due to climate change and unexpected events, farmers are facing crop damage frequently in the recent years compared to 10-year ago. However, among different crops, damage of rice was mostly mentioned followed by vegetable, rice, oil seed and pulse crops. Farmers have already some coping/adaptation strategies for crop production under changing climate. Farmers are cultivating short-duration, tolerant and resilient varieties; adjusting seasons i.e. early or late sowing based on weather condition; practicing intercropping, relay cropping, mulching; designing home garden and fruit orchard; using modern technologies for soil, water and pest managements.

Cyclone Effects

Although the project area is little far from the coastal area and the area and the area is relatively safe from cycloe, but two cyclones hit in the project area in 2011 and 2022. It indicates that eratic climatic events are occuring ferquently and their area of damage is increasing. Cyclone Jawad was occurred on 2 to 4 December

2021 during the harvest of Aman rice. Mature aman rice, Boro seed bed, mustard, potato, wheat, maize were damaged (Photo 24). Even there was a warning, but farmers did not take care, because they mentioned that clyclone or heavy rain is very unusual. However, the weather is quite fine on 2 December 2022 and the Aman rice production was satisfactory (Photo 25).

Photo 24: **Mature Aman rice, early stage of potato and maize field affected by cyclone Jawad. Photos were taken on 2 December 2021.**

Photo 25: **Harvested Aman rice. Photos were taken on 2 December 2022.**

Another cyclone (Asani) hit on 9 to 11 May 2022 during the harvet of Boro rice. Damaged crops are Boro rice, maize, banana, garlic, onion, lentil, wheat, coriander, vegetables like papaya, brinjal etc (Photo 26). It may be mentioned here that Boro rice, in general, is harvested during April. But due to heavy rain in December, seedlings were affected in seedbed and farmers had to prepare new seedlings. Therefore, the transplanting was delayed.

Photo 26: **Mature boro rice and papaya fields affected by cyclone Asani. Photos were taken on 09 May 2022.**

SAP-II initiatives

SAP-II members were active and before any disater occurred, they provided warning and necessary information to the farmers. Leaflet and poster were prepared from the SAP-2 project, which was very effective and farmers could prepared to handle any disaster.

Water Saving Techniques

Farmers' experiences on AWD method in Boro rice cultivation

Awareness campaigning, trainings, demonstrations and other activities were done on AWD. On an average each farmer obtained four days training. A survey was conducted at the second year of the project after harvesting of Boro rice (2021 – 2022). A structured interview schedule was used to collect information on different aspects of AWD practice. A total 90 AWD farmers (30 from each upazila) were selected randomly to evaluate the effectiveness of the AWD method based on farmers' opinion (Figure 6).

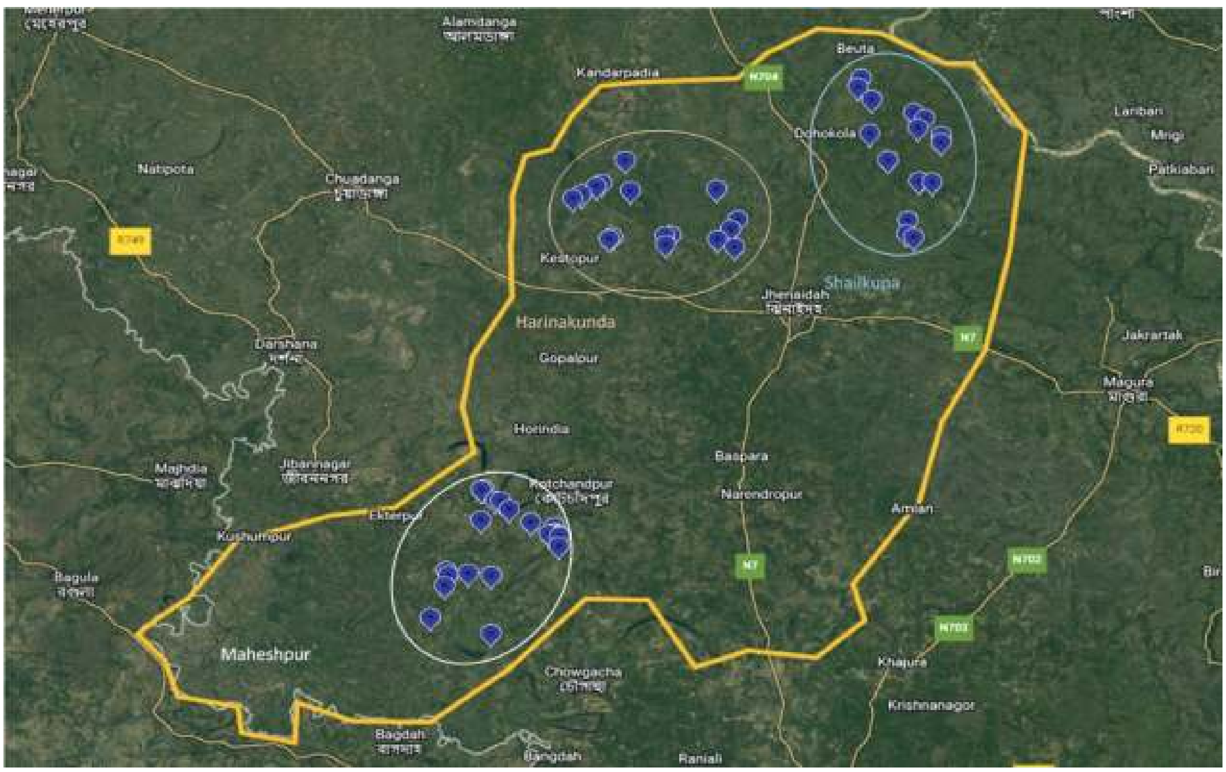


Figure 6: **Household positions of sampled AWD farmers in three upazilas of Jhenaidah district under SAP-II project.**

Key observations

On an average, each AWD farmer cultivated Boro rice on 40.10 decimal of land in Shailkupa followed by 38.03 decimal in Harinakundu and 28.93 decimal in Moheshpur. Farmers cultivated a wide range of rice varieties, and the average duration of crop was slightly longer in Moheshpur (144 days) followed by Shailkupa (139 days) and Harinakundu (135 days) (Figure 7).

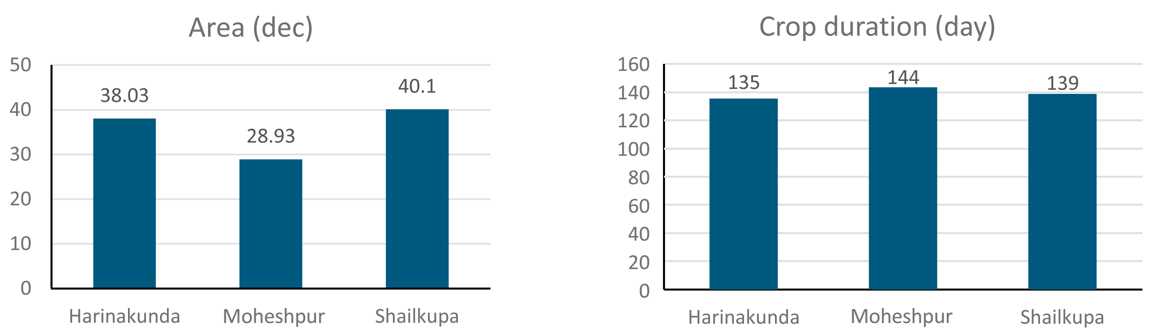


Figure 7: **Area and crop duration of rice for AWD farmers.**

AWD vs traditional irrigation

Respondent farmers were asked to compare AWD with traditional irrigation methods. Most of the respondents (76.7%) of Harinakundu opined that disease infestation was lower and the respondents of Moheshpur and Shailkupa mentioned that disease infestation was either same or lower in AWD practice compared to traditional practice. Similarly, farmers in Harinakundu and Moheshpur experienced remarkably lower insect infestation in AWD practice. In Shailkupa, on the other hand, 50% and 40% respondents mentioned same and lower insect infestation, respectively, in AWD method. Most of the farmers experienced higher weed infestation in AWD method. About 90% farmers found higher tillering in AWD compared to traditional irrigation method (Table 7).

Table 7: **Comparison between AWD and traditional irrigation methods in respect to weed infestation, disease infestation, insect infestation and tillering**

Scale	Harinakundu	Moheshpur	Shailkupa
Disease Infestation			
Same	4 (13.3%)*	15 (50%)	15 (50%)
Higher	3 (10%)	4 (13.3%)	4 (13.3%)
Lower	23 (76.7%)	11 (36.7%)	11 (36.7%)
Insect Infestation			
Same	4 (13.3%)	3 (10%)	15 (50%)
Higher	2 (6.7%)		3 (10%)
Lower	24 (80%)	27 (90%)	12 (40%)
Weed Infestation			
Same	Same 13 (43.3%)	Same 16 (53.3%)	5 (16.7)
Higher	Higher 15 (50%)	Higher 14 (46.7)	25 (83.3)
Lower	Lower 2 (6.7%)	Lower	
Tillering			
Same	1 (3.3%)		5 (6.7%)
Higher	29 (96.7%)	29 (96.7%)	25 (83.3%)
Lower		1 (3.3%)	

* Values in the parentheses indicate the percent of the respondents.

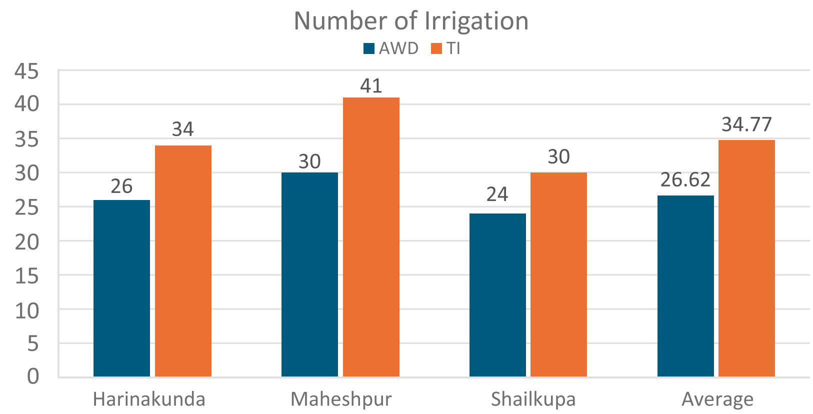


Figure 8: **Number of irrigations for AWD and traditional irrigation methods.**

The number of irrigations in AWD was 26, 30 and 24 in Harinakundu, Moheshpur and Shailkupa, respectively, while the corresponding value for traditional irrigation method was 34, 41 and 30, respectively. On an average, farmers could save 23.4% irrigation water by practicing AWD method compared to traditional irrigation method (Figure 8).

Irrigation cost and yield of Boro rice were calculated based on the information provided by the farmers and a comparison was made (Table 8). Average irrigation cost BDT. 970 per bigha (33 dec) was saved due to AWD in comparison with traditional irrigation method, while 62.5 kg yield per bigha was increased in AWD method over traditional irrigation method.

Table 8: **Irrigation cost and yield of Boro rice per bigha* area comparison between AWD and traditional irrigation methods**

Upazila	Irrigation cost (BDT bigha^{-1})		Yield (kg bigha^{-1})	
	AWD	TI	AWD	TI
Harinakundu	3281.8	4383.7	924.0	828.0
Moheshpur	2537.5	3460.0	952.7	893.3
Shailkupa	4101.3	4986.6	693.0	661.0
Average	**3306.9**	**4276.8**	**856.6**	**794.1**

** One bigha is 33 decimals of land.*

Although many benefits of AWD methods found, but some constrains of AWD method was also mentioned by the AWD farmers as: AWD pipe (magic pipe) was not available locally, as a new method it was not easy to monitor the water level and higher weed infestation.

Underground pipeline system

Irrigation water is applied to crop fields from the water sources using networks of open channels and/or pipelines. Aboveground plastic pipe (locally known as feta pipe), nowadays, is getting popularity among farmers. Underground pipeline is also considered as an effective irrigation system. Pipelines have several advantages over open channels. A properly designed pipeline system saves water, energy consumption and land used for field channels. It is also considered as a climate smart irrigation system (Photo 27).

In the project area, three deep tube-well owners from three upazilas were selected for underground pipeline construction. All the costs to construct the pipelines were supported from the SAP-II project. The number of beneficiaries, length of the underground pipeline and area coverage are presented in Figures 9, 10 and 11. A case study was conducted to know the effective usages of the underground pipelines. The owners opined that severe water crisis is encountered during the months of March and April. During this period, they experience:

- Interrupted electricity supply
- Decrease water table
- High temperature
- High requirement of the crops

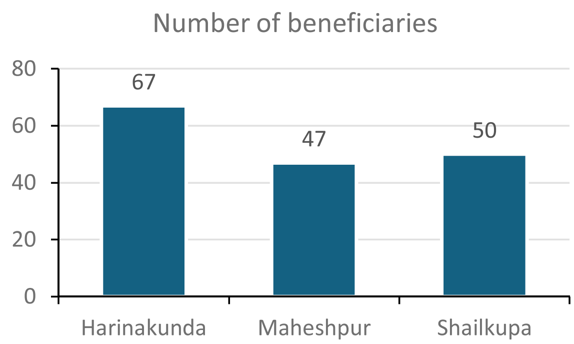


Figure 9: **Number of beneficiaries in different upazilas from underground pipeline constructed under SAP-II project.**

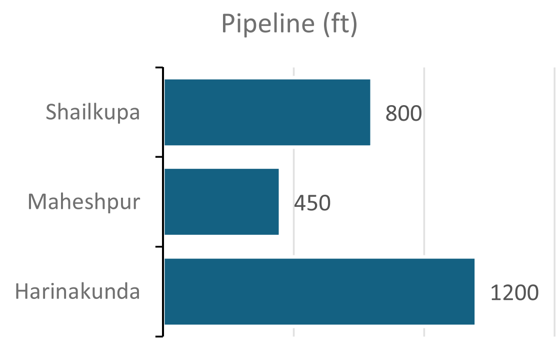


Figure 10: **Length of underground pipeline in different upazilas constructed under SAP-II project.**

The owners motioned their observations on underground pipelines:

- It requires 0.3 hour to irrigate one bigha=33 decimal of land in case of underground pipe, while it takes 0.7 hour for open drain system.
- To convey water from source (deep tube well) to crop field for a distance of 800 ft, it takes about 30 minutes in case of conventional open drain, while it takes only two minutes in case of underground pipeline.
- Electricity cost is 20 BDT per hour in case of underground pump and 34 BDT per hour for open drain system.

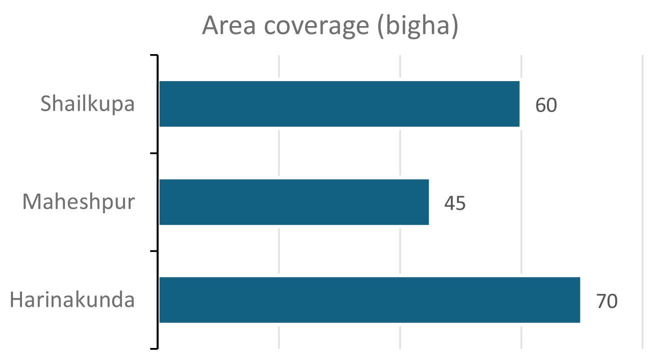


Figure 11: **Area coverage by underground pipeline in different upazilas constructed under SAP-II project.**

- The pump owner mentioned that they would increase the length and area coverage using underground pipeline by their own investment.
- Two owners said that they are charging less irrigation cost for the farmers who are following AWD method in rice cultivation.
- One progressive owner from Shailkupa was monitoring AWD method during irrigation water supply from his pump and was giving related advice.
- All the pump owners are cultivating rice and other crops. They mentioned that trainings provided under SAP-II project helped them for understanding sustainable water and crop management under changing climate.

Advantages of underground pipeline system

In general, the water distribution system of deep wells tube, which are usually owned by the government or cooperative or group farming societies, usually comprise of open channels or underground pipe. The following are the major advantages:

- The farmers get water at or near their fields.
- Reduce the water losses through seepage, evaporation and breaches in the channels.
- The quantity of water delivered from each outlet remains the same, irrespective of the elevation of the outlet.

- The pipeline can be laid with complete freedom to best suit the requirements of water supply and cost of pipelines, irrespective of the topographic features of the tube well command area.
- Outlet valves can be provided wherever desired in the pipeline, as determined in the interest of minimizing the distance from the outlet to the field, the number of cultivators served by an outlet and ensuring gravity flow from outlet to the fields.
- Water is supplied to each field plot either directly or through a field channel of short length originating from the outlet.
- Maintenance cost of the water distribution system is very low.
- There is full control of the water supply to the fields within a tube well command area.

Limitations of underground pipeline system

- Underground pipeline irrigation system requires high initial investment as compared to open channel systems.
- This also needs higher operating pressure and additional power to distributed water, whereas in open channel system do not need.
- The canal carrying the water cannot be connected with underground pipeline system as canal provide very little head and pipelines are likely to be blocked.


Photo 27: **Construction and use of underground pipe.**

Achievements of the Project: Baseline to Endline

A total 1500 farmers were engaged in this project. At the starting of the project, a baseline (BL) survey was conducted with the farmers. After completion of first year, a midline survey (ML) and at the end of the project, an endline survey (EL) survey were conducted.

Key observations

At the starting of the project (2021), per household fallow land was 2.1 decimal, which decreased to 0.42decimal in 2022 (ML) and 0.005 decimal in 2023 (EL). On the contrary, cultivated area has been increased from 159.45 decimal to 170.2 decimal (Figure 12).

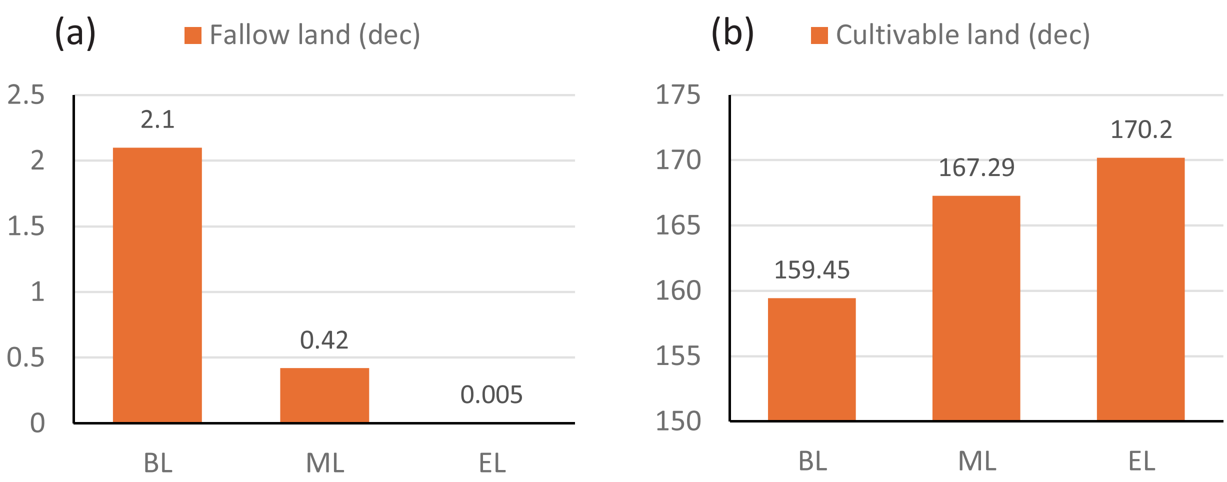


Figure 12: **Changes of average fallow land (a) and cultivated area (b) from baseline to endline (n = 1500).**

Sustainable water management in rice cultivation and other agriculture purpose was the main theme of the project. Among the SAP-II farmers (1500), only 1.3% used surface water for irrigation purpose that increased to 34.1%. Similarly, use of poly pipe and practice of AWD increased tremendously at the end of the project compared to the base year. None of the farmers practices AWD by using pipe, but at the end of the project, more than 70% farmers were using AWD pipe. Currently, 88.7% farmers manage water in rice fields by using AWD pipe and/or eye estimation of AWD (Table 9).

Table 9: **Water management during dry season**

Water Management	BL	ML	EL
	% Farmer		
Using surface water	1.3	9.3	34.1
Using poly pipe	0.0	63.2	84.2
AWD magic pipe	0.0	43.7	70.3
AWD eye estimate	22.3	31.2	70.1
AWD (Magic and/or Eye)	22.3	54.3	88.7

Boro area has been decreased in the project area, mainly due to conversion of rice field to fruit orchard and vegetable cultivation for higher income. Boro rice area decreased from 77.5 decimal to 57.73 decimal per household (Figure 13). Initially, only 22% farmers practiced AWD (mainly eye estimation) which was 100% at the end of the project. Although farmers were motivated to practice AWD as a water saving technology during Boro rice cultivation, but many of them also practiced it for Aus and Aman rice seasons. Due to uncertainly and uneven rainfall, farmers reduced irrigation water application by eye estimation of AWD. Interestingly, more than half of the farmers used AWD method in Aman rice cultivation, even it is considered as rainfed rice (Figure 14).

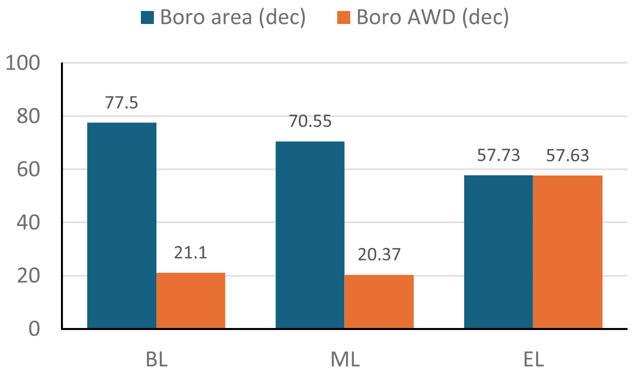


Figure 13: **Changes of Boro rice area to fallow land and cultivated area from baseline to endline. (*n* = 1500).**

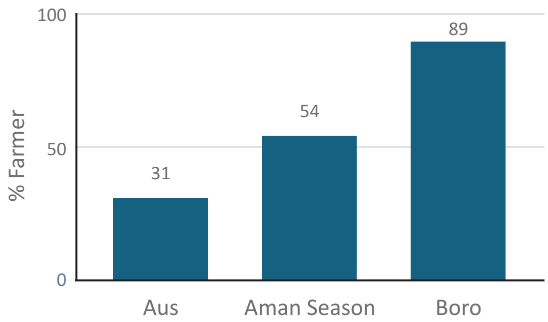


Figure 14: **AWD practice following in different rice cultivation at the end of the project (*n* = 1500).**

Jhenaidah is an agriculture intensive district, therefore farmers must apply manure in their crop fields for soil management. About 57% farmers were applying organic manure during the inception of project, but at the end of the project almost all farmers were applying organic manure. Vermicompost was not popular and available during the inception of the project. Many farmers received training and support on vermicompost production and the benefits to agriculture and soil management. At the end of the project, 22% farmers used vermicompost, while 11.2% farmers produced vermicompost in their house. Soil test was rare, and a negligible number of farmers applied fertilizer based on soil test. Under this project, soil samples of many farmers were tested and 37.5% farmers tested their soils (Table 10).

Table 10: **Changes of soil management measures by the farmers**

Measures	BL	ML	EL
	% Farmer		
Organic manure	57.8	93.6	99.6
Vermicompost	0.1	17.3	22.0
Soil test	0.1	26.8	37.5
VC production	0.0	7.3	11.2

Integrated pest management (IPM) practice has been increased tremendously after the completion of the project. At the baseline, all farmers used synthetic pesticides for pest management. At the endline, 61%, 96.8%, 78.1% and 22.8% farmers were using organic pesticides, parching, pheromone trap and yellow trap, respectively (Table 11).

Table 11: **Changes of pest management measures by the farmers**

Measures	BL	ML	EL
	% Farmer		
Chemicals	100.0	98.7	96.5
Organic	0.3	24.0	61.0
Parching	0.6	89.4	96.8
Pheromone trap	0.2	45.6	78.1
Yellow trap	0.0	17.5	22.8

Establishment of linkage between farmers and DAE is one of the strengths of this project, which is helping farmers to get various advice and supports from DAE. During baseline, 36.5% farmers got advice from DAE, which increased to 95.8% at the endline (Figure 15). Farmers got advice mostly for pest control followed by climate change impacts, water management, fertilizer management, seed management and soil management (Table 12).

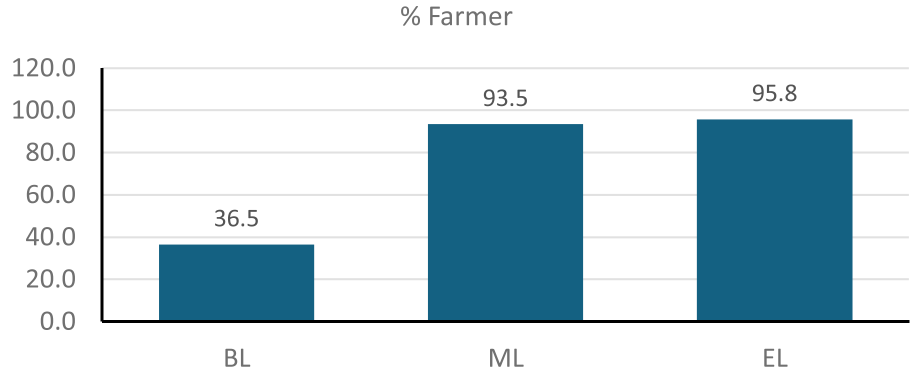


Figure 15: **DAE advice received by the farmers.**

Table 12: **Sector-wise advice received by the farmers from DAE**

Sector	BL	ML	EL
Climate change	24.5	80.3	91.5
Disease	41.9	92.2	93.4
Pest and insects	56.3	90.3	96.3
AWD	27.2	44.1	88.5
Fertilizer	49.0	93.0	88.5
Seed	29.5	91.2	76.5
Soil	32.7	68.7	72.9

During the project, two big cyclones hit in the project area, which caused huge loss of crops. A chart showing the sources of climate and other production related information was given to all the farmers and other stakeholders (Figure 16) at the second year of the project. Farmers were asked about the effectiveness of the chart. More than 60% farmers opined that the chart was very effective followed by 39% as effective (Figure 17).

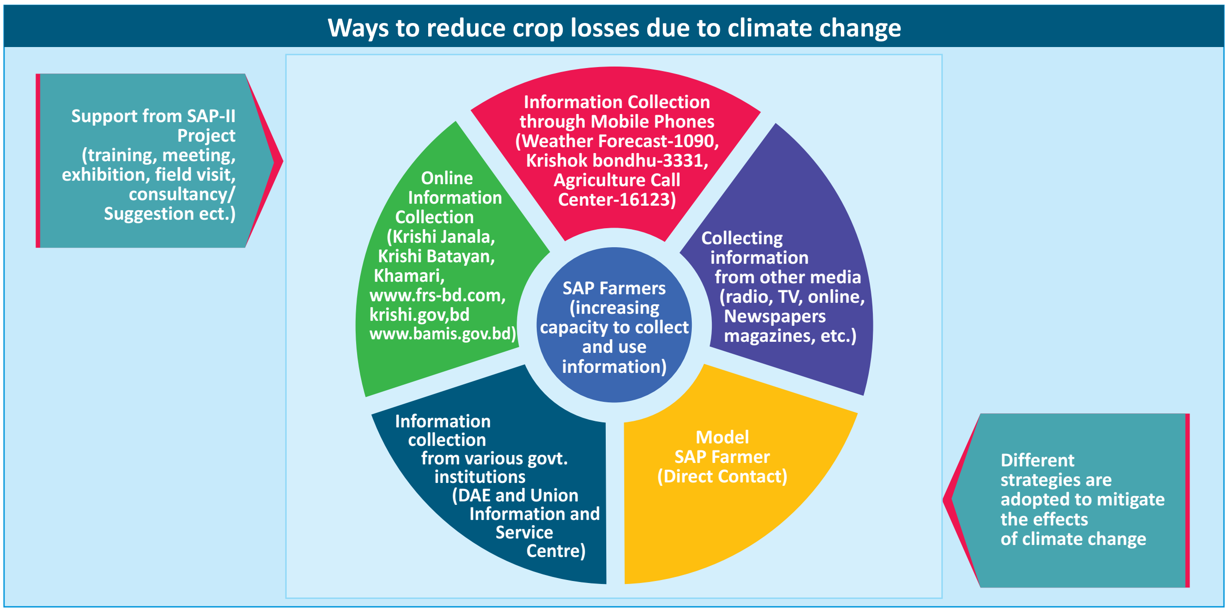


Figure 16: **Weather and production related information.**

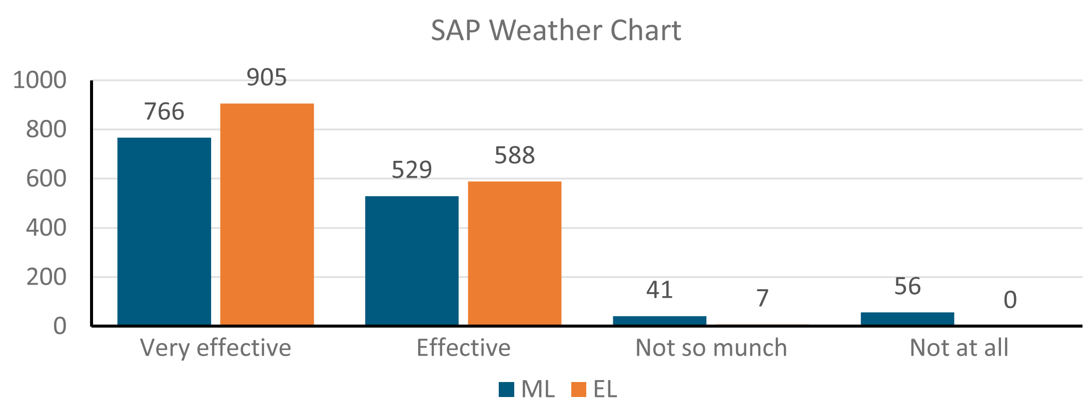


Figure 17: **Farmers' satisfaction and effectiveness of weather and production related information.**

The project emphasized on integrated farming systems as a climate change adaptation technique and water management as well. Various activities were encouraged farmers to be engaged in not only one component. Therefore, their income was increased tremendously and component-wise distributions of the farmers comparing between baseline and endline of the project (Table 13).

Table 13: **Farmer's economic benefits from different sectors from baseline to endline**

Component	Farmer (%)	
	ML	EL
Seeds/seedling production	73	93
AWD (reduce cost)	40	74
AWD (increase yield benefit)	43	73
Poly-pipe (reduce cost)	61	83
Mini-pond	2.5	3.5
Homestead gardening	90	88
Organic compost (Reduce cost and sale)	17	21
Soil test (reduce cost)	26	35
Natural Pest Management (IPM)	45	81

A balanced diet consists of foods that contain all the protein necessary for the body's energy production, energy, metabolism and fertility. It is important to have a balanced diet to ensure that you are getting all the nutrients you need.

Dietary Diversity Score is mainly used to measure balanced diet. We divide all the foods we eat into five categories and calculate the food quality by calculating a separate score for each category. If a normal adult achieves a food score of 14 or less, he is said to have an unhealthy diet score or inadequate diet, meaning he is not getting the nutrients his body needs through food intake. If a person achieves a diet score of 14 to 19, then he is said to have a good diet score or a balanced diet, and if one achieves a score of 17 to 19, he is said to have a very good diet score or a balanced diet, meaning that he has what his body needs. All nutrients are assumed to be absorbed.

A form was used to calculate the food intake using an index. It was found that the food intake score was 14.34, which indicated just over poor food intake at the starting of the project (BL). At the endline (EL), the food intake was quite good and the score was 16.9 indicate close to best diet (Figure 18).

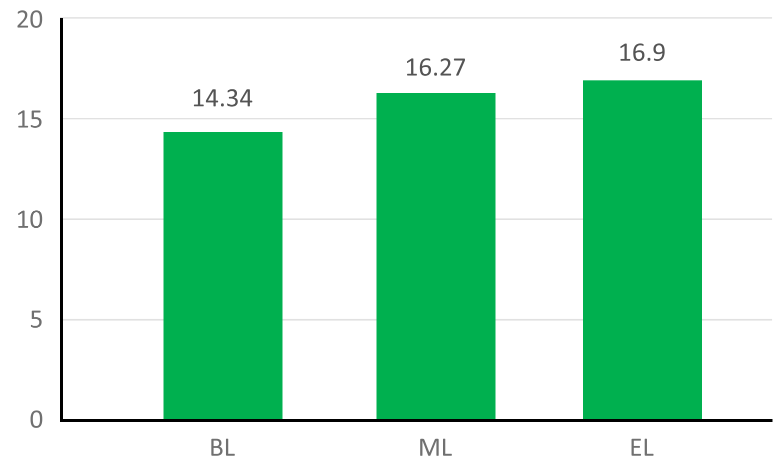


Figure 18: **Comparison of food intake status at the baseline, midline and endline of the project. (<14 = Poor food intake; 14 – 16 = Balanced diet; 17 – 19 = Best diet).**

Water Management in Rice Cultivation

Boro rice in Bangladesh is fully irrigated and farmers use huge water for rice cultivation. An estimated 3,000 to 5,000 liters of water is used to produce one kilogram of rice. Recent research at IRRI has proven that using Alternate Wetting and Drying (AWD), about 15-30%, if not more, could be saved without reduction in yield. This is now being validated in Bangladesh by BRRI, BADC, BMDA and other partners. The savings of irrigation water will have impact on environment because of reduced withdrawal of ground water, reduction in burning diesel. This may also reduce arsenic contamination in rice grain and straw. In 2022 and 2023, the project trialed rice cultivation to investigate the reduction of water use and arsenic concentration in rice through water management.

Experiment-1

In 2022, an on-Farm research was conducted in Kalicharanpur, Jhenaidah sadar to determine the water requirement for Boro rice cultivation under different irrigation methods. Suvolata, a locally popular rice cultivar, was used as test crop in the experiment. Thirty-day old seedlings were transplanted on 11 February 2022 and harvested on 08 May 2022. Transplanting was delayed due to heavy rain in December 2021 that affected the seedbed severely. The experiment was laid out in a randomized complete block design (RCBD) with three replications. There were three treatments as follows:

1. Bangladesh recommended alternate wet and dry (BD-AWD)
2. Intermittent irrigation method to reduce arsenic concentration in rice developped by Japan National Agriculture and Food Research Organization (NARO-AWD)
3. Continuous flooding irrigation practiced by farmers (FP)

BD-AWD: Started from 20 days after transplanting and irrigated until the water table goes 20 cm below the ground level. Kept 2-4 cm standing water from flowering to dough stage. The practice was continued until flowering starts.

NARO-AWD: Kept flooding for 30 days after seedling transplanting. Dried until there is no water in the AWD pipe. Continued 3 days flooding and 4 days drying (3F4D) including the heading period.

AWD pipe was used to monitor the water level in each treatment. Application of irrigation water was stopped before two weeks of harvesting.

Irrigation water was applied from a common shallow tube well and the Arsenic level in irrigation water was 0.175 (mg l-1). Date-wise irrigation water apply and amount of irrigation water in different irrigation methods and date of rainfall are shown in Figure 19.

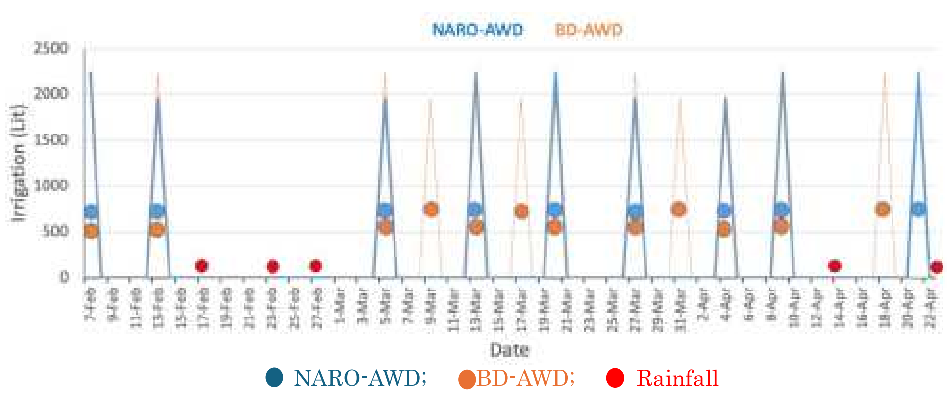


Figure 19: **Date-wise irrigation water apply and amount of irrigation water in different irrigation methods and rainfall.**

Major Findings

- A total 9, 12 and 16 irrigations were applied for NARO-AWD, BD-AWD and Farmer's Practice (FP) irrigation methods, respectively. On the other hand, 1602, 2076 and 3470 liters of water were used to produce per kilogram of rice for NARO-AWD, BD-AWD and FP irrigation methods, respectively (Figure 20).
- The highest yield (6.58 ton ha^{-1}) was recorded in BD-AWD method, which was followed by NARO-AWD (6.38 ton ha^{-1}) and FP (6.07 ton ha^{-1}) methods (Figure 21).
- The lowest Arsenic concentration was found in NARO-AWD (0.45 mg kg^{-1}) followed by BD-AWD method (0.54 mg kg^{-1}) and FP (0.61 mg kg^{-1}) (Figure 22).
- During the experimentation, rain was occurred five days rain, which helped to achieve higher yields in all the treatments. Rice grain yield increased by about 8% in BD-AWD method compared to FP, but number of irrigations can be saved by 40%. At the same time, Arsenic concentration can be reduced by 11%.

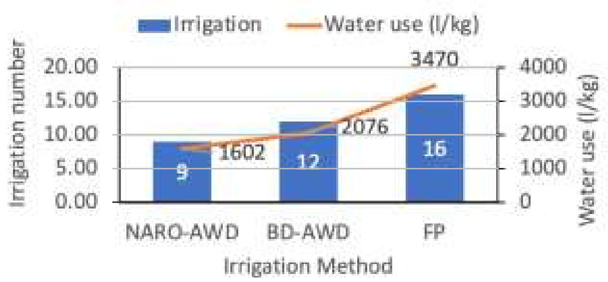


Figure 20: **Number of irrigation and irrigation water use to use produce per kg rice for different irrigation methods.**

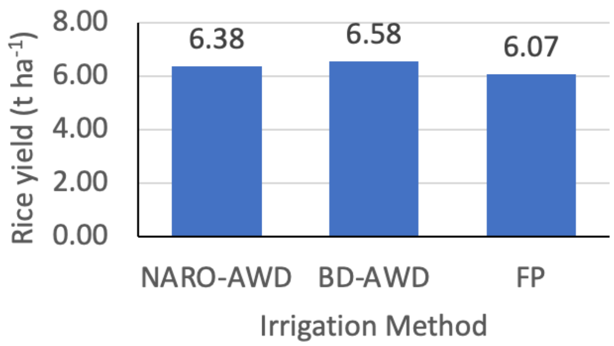


Figure 21: **Rice grain yield in different irrigation methods.**

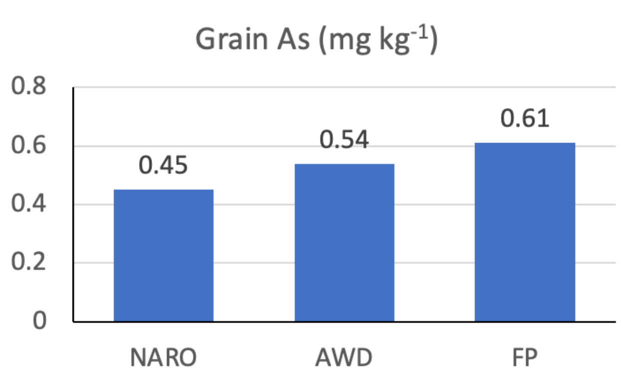


Figure 22: **Rice grain Arsenic concentrations in deferent irrigation methods.**

Experiment-2

Another research was conducted in the Robi season of 2023 at three locations namely, Moheshpur, Jhenaidah sadar and Kaliganj with different Arsenic levels. BRRI dhan 50, a modern and popular rice variety in the project area, was used as test crop. Experimental design, treatments and replications were same as Experiment-1. In this research irrigation water was applied by measuring volume water content in soil. We consider that the dry level of AWD is satisfied when the volume air content in soil is 10%. This condition is obtain from NARO tests. AWD pipe (Figure 23). Thirty-five days old seedlings were transplanted on 12 January 2023 and harvesting was done on 30 April 2023. Fertilizer application, pest management and other intercultural management practices were done as per BRRI recommendations.

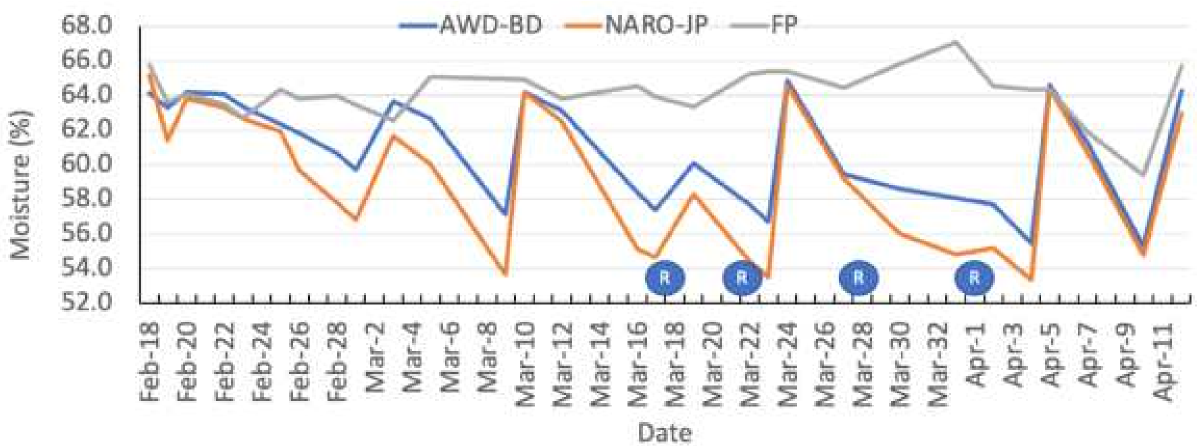


Figure 23: **Moisture level and rainfall at different dates.**

Major Findings

- A total 20, 22 and 31 irrigations were applied for NARO-AWD, BD-AWD and Farmer's Practice (FP) irrigation methods, respectively (Figure 24).
- The highest yield (7.99 ton ha^{-1}) was recorded in NARO-AWD method, which was followed by FP (7.55 ton ha^{-1}) and BD-AWD (7.13 ton ha^{-1}) methods (Figure 25). No significant difference in yield was observed between the three methods.
- The lowest Arsenic concentration was found in NARO-AWD (0.54 mg kg^{-1}) followed by BD-AWD method (0.63 mg kg^{-1}) and FP (0.83 mg kg^{-1}) (Figure 26).
- During the experimentation, rain was occurred four days rain, but the intensity and amounts were less than the previous year, therefore, more irrigation water was required for all the treatments. In BD-AWD method compared to FP, but the number of irrigation can be saved by 29%. At the same time, Arsenic concentration can be reduced by 24%.

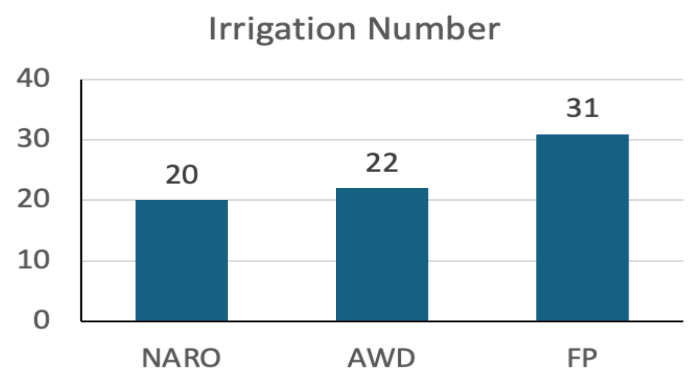


Figure 24: **Number of irrigations for different irrigation methods (Data are average of three locations and three replications).**

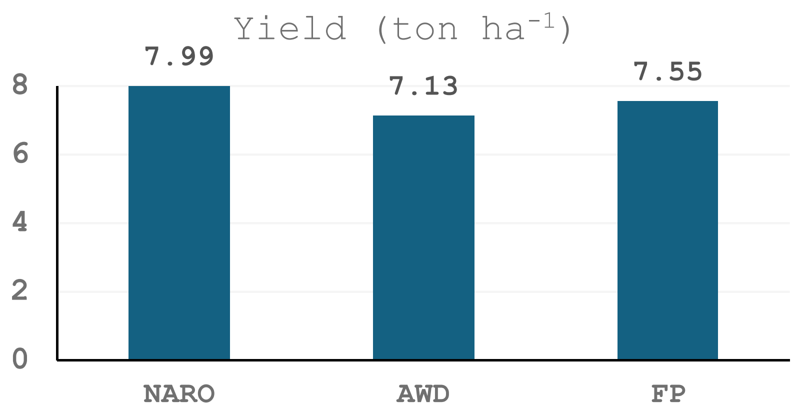


Figure 25: **Rice grain yield in different irrigation methods. (Data are average of three locations and three replications).**

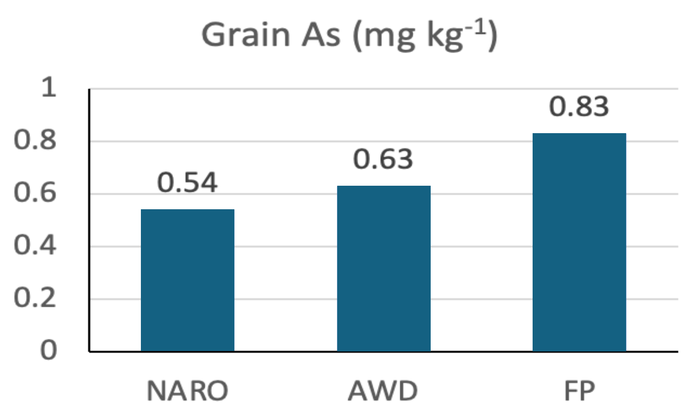


Figure 26: **Rice grain Arsenic concentrations in deferent irrigation methods.**

Overall Observation

Rice grain yield did not vary significantly among different irrigation treatments. AWD method in rice cultivation is effective for water saving without yield loss. NARO method is efficient for reduction of Arsenic concentration but as the 2022 survey results show, there is a risk of yield reduction due to water stress during heading stage. Further practical research will be required to balance productivity and sustainability.

Arsenic Screening of the Irrigation Wells

Introduction

Arsenic poisoning in groundwater is one of the most severe environmental problems and the resulting of its poisoning has caused in health and social disasters in Bangladesh. In addition to the use of groundwater for domestic purposes, a significant amount of the groundwater is used for irrigation purposes during dry season for BORO rice cultivation, because the limited rainfall occurred during the dry season. About 86% of total groundwater is utilized for crop planting. The growth of rice plants seemed to be affected negatively by the amount of arsenic in soil, and the arsenic damaged the roots of the rice plants, resulting to obstruct the uptake of nutrients by roots. The groundwater arsenic contamination poses a risk for food-chain, which threatens the health of millions of people. So, it is very important to check the groundwater arsenic concentration before utilizing it for agricultural uses.

Study Area and Survey Methodology

To know the arsenic concentration of the existing irrigation wells, a survey was conducted on randomly selected 500 irrigation wells from the 50 targeted farmer's groups under 9 Unions (Table 14). The arsenic field test was conducted in dry season in between March-May 2021. Arsenic test was conducted by Arsenic Test Kit (manufactured by HACH, USA) and the test was performed by the project field staff (Photo 28 & 29). The survey included interviews with farmers on their socio-economic status, cropping patterns, problems and their interest in SAP project and so on.

Results and Discussions

The screening result showed 19 irrigation wells (3.8%) were arsenic contaminated and 481 (96.2%) arsenic safe, according to the Bangladesh drinking water standard of arsenic 50 $\mu g\ L^{-1}$, and 76 (15.4%) irrigation wells were arsenic contaminated according to WHO drinking water standard of 10 $\mu g\ L^{-1}$. Among the 19 arsenic contaminated irrigation wells, 17 wells were identified from Manderbaria union and 1 well from SBK union of Moheshpur upazila, and another well identified from Monoharpur union of Shailkupa upazila (Table 14). The screening result was shared with pump owner to help them know this water is drinkable or not, and shared them effect of arsenic concentration in food-chain.

Photo 28: **Water sampling from irrigation wells for arsenic test.**

Photo 29: **Farmers interview on arsenic survey.**

Table14: **Union-wise arsenic concentration level**

Sl	Upazila	Union	Arsenic concentration ranges (µg/L)			Total	Contamination (%)
			0-10	11-50	51-200		
1		Azampur	17	15	0	32	0
2		Manderbaria	65	22	17	104	16.3
3	**Moheshpur**	SBK	61	5	1	67	1.5
		Total	**143**	**42**	**18**	**203**	**8.9**
4		Chandpur	41	4	0	45	0
5	**Horinakunda**	Kapasatia	34	4	0	38	0
6		Municipal	57	6	0	63	0
		Total	**132**	**14**	**0**	**146**	**0**
7		Monoharpur	52	1	1	54	2.0
8	**Shailkupa**	Nitanandapur	45	0	0	45	0
9		Municipal	52	0	0	52	0
		Total	**149**	**1**	**1**	**151**	**0.7**
	Sub-Total		**424**	**57**	**19**	**500**	**3.8**

Relationship between Arsenic concentration and well's depth

The deep of the irrigation wells are mostly situated within shallow and intermediate aquifers ranges from 15 to 82 meters. Among the tested 500 irrigation wells, only 19 were identified arsenic contaminated above Bangladesh drinking water standard, whose depth ranges from 26 to 82 meters (Figure 27). Whereas, the arsenic safe irrigation wells were also situated in same aquifers, so generally we can say these two aquifers are Arsenic safe, and some of pockets are Arsenic contaminated.

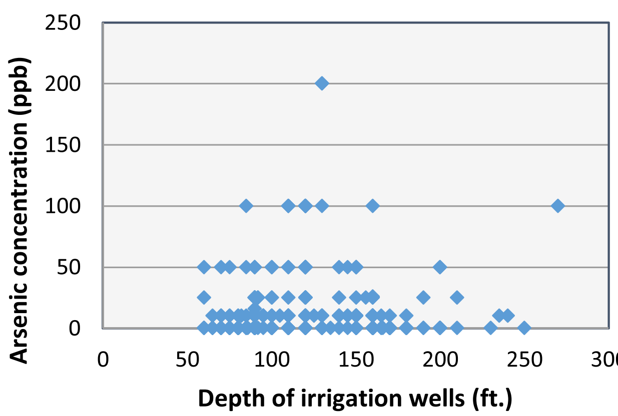
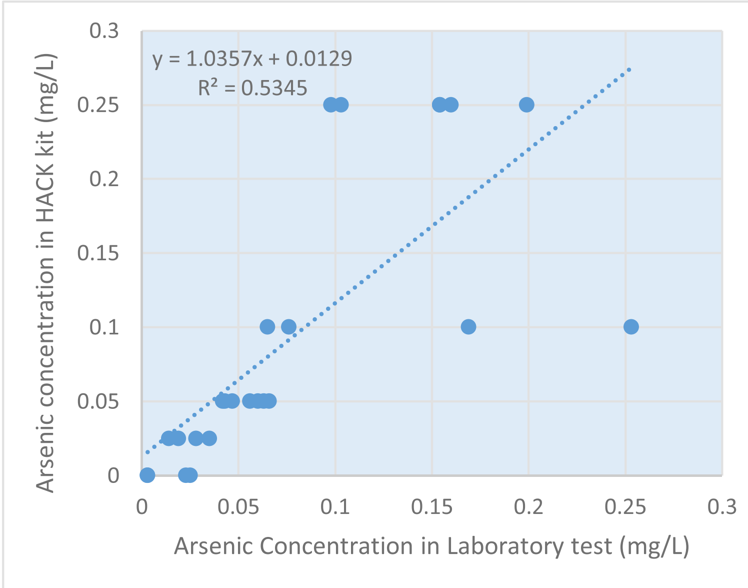


Figure 27: **Relationship between arsenic concentration and well depth.**

Relationship of Arsenic concentration between field and laboratory tests

The HACK kit results showed very effective when the arsenic concentration in groundwater is low, for example, 0.05 mg L^{-1} or less. This cross-check has been conducted during irrigation well's Arsenic screening program in the previous SAP-I project in 2018 (Figure 28 and 29).

Photo 30: **Conduct arsenic test at AAN laboratory using AAS.**



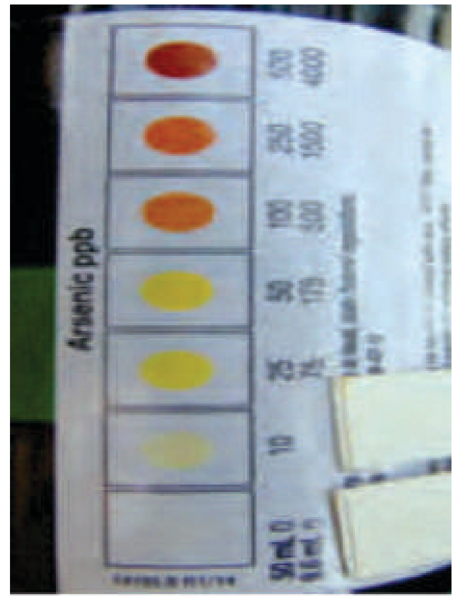


Figure 28: **Relationship of arsenic concentration between field and laboratory tests.**

Figure 29: **Arsenic test result's color chart.**

The arsenic concentration of the irrigation wells are identified relatively low in the studied areas, but it is moderately high in some pockets. So, it is very important to check the groundwater arsenic concentration before utilizing it for agricultural uses to avoid arsenic contamination in food-chain.

Residual Effects of Pesticides on Environment and Food-chain

As a tropical country, the environment of Bangladesh is favorable for many insects, pests, bacteria, fungi, and unwanted plant development. Insect and pests directly damage crop production or act as vectors for several viral diseases. Climate change hampers vegetable production by slow growth, less seed germination, unable crop environment and increases insect pests and diseases attack. As a result, farmers are facing difficulties in cultivating crops and vegetables in their farmlands. Thus, farmers use huge pesticides to protect vegetables from insects, pests, and disease attacks and increase production and aesthetic value (Photo 31 and 32). Vegetable production in Bangladesh has increased tremendously (37.63%) in the last decades by using modern varieties and technologies, along with the uses of pesticides. Pesticides are used inappropriately with huge amounts in Bangladesh, especially for commercial high-value vegetable cultivation. Nowadays, toxicity of pesticides in food-chain is a great concern due to its widespread uses in the agricultural fields. Therefore, it is very important to introduce environment-friendly and safe food production system in Bangladesh.

Photo 31: **Load of pesticides in the commercial agricultural fields (pesticides bag and bottles nearby agriculture field).**

Photo 32: **Spraying pesticides in the commercial agricultural fields.**

In SAP-II project, 1500 farmers from 50 Farmer Field School (FFS) were trained to produce safe food in their homestead. After training and necessary logistic supports, farmers mostly reduced the application of synthetic pesticides remarkably and increased the use of organic pesticides and IPM techniques for insect control along with organic fertilizers to improve soil fertility. Quality and safe vegetables are grown in homesteads with minimum agrochemicals and the vegetables are mostly consumed by the family members and the excess amount is sold at the safe food corner for income generation. As pesticide testing is expensive and only few laboratories have testing facilities in Bangladesh, so we targeted two types of vegetables (eggplant and country bean) for laboratory testing.

Sampling Method

The vegetable samples (eggplant and country bean) were collected from homestead on 23 October, 2023 from Moheshpur upazila under Jhenaidah district, collected in high density polyethylene bags with safety measures and stored in cool box to sent Bangladesh Council of Scientific and Industrial Research (BCSIR) laboratory in Dhaka for pesticides analysis (Photo 3). Based on the application of pesticides, BCSIR scientists recommended for testing 20 targeted parameters which are commonly used in the agricultural fields in Bangladesh.

Major Findings

The targeted twenty parameters and their concentrations in eggplants and country beans cultivated in homestead gardening is shown in Table 15. The chemical analysis results showed that all of the parameters were found within the acceptable level with "not detectable" ranges.

Table 15: **Residual pesticides found in eggplant and country bean grown in homesteads of Moheshpur**

Sl.	Parameters	Results	
		Eggplant	Bean
1	α-BHC	Not detectable	Not detectable
2	β-BHC	Not detectable	Not detectable
3	γ-BHC	Not detectable	Not detectable
4	δ-BHC	Not detectable	Not detectable
5	Heptachlor	Not detectable	Not detectable
6	Aldrin	Not detectable	Not detectable
7	Heptachlor Epoxide (Isome B)	Not detectable	Not detectable
8	α-Chlordane	Not detectable	Not detectable
9	γ-Chlordane	Not detectable	Not detectable
10	Endosulfan I	Not detectable	Not detectable
11	Endosulfan II	Not detectable	Not detectable
12	4, 4′-DDE	Not detectable	Not detectable
13	4, 4′-DDD	Not detectable	Not detectable
14	4, 4′-DDT	Not detectable	Not detectable
15	Dieldrin	Not detectable	Not detectable
16	Endrin	Not detectable	Not detectable
17	Endrin aldehyde	Not detectable	Not detectable
18	Endosulfan Sulphate	Not detectable	Not detectable
19	Methoxychlor	Not detectable	Not detectable
20	Endrin Ketone	Not detectable	Not detectable

The vegetables grown in the homestead is safe and free from pesticides, which may play important role to protect public health from pesticides. So, promotion of homestead gardening can be replicated in other areas to reduce pesticides loads in the environment and as well as in food-chains. The safe food corners model is recommended to replicate in other areas to make the safe vegetable locally available at consumer's level, as well as income generation.

Heavy Metal Contamination in Farmland Soils

Bangladesh is one of the most densely populated countries where industrialization and geological sources have caused widespread heavy metal contamination in the environment. Rapid industrialization, urbanization and various anthropological activities also have determined the wide spreading of heavy metals contamination. Agricultural soil contamination with heavy metals from industrial wastewater, application of chemical fertilizers and pesticides is one of the most severe ecological problems in Bangladesh. Irrigation with contaminated groundwater is also responsible for soil contamination. Heavy metal pollution of soil and crops can substantially impact food safety as well as human health. Heavy metals are non-biodegradable in nature and can affect human health directly and indirectly. Chronic exposure of heavy metals can damage various organs like kidneys, liver, lung, brain and bones.

Study area and data collection

Twelve (12) soil samples were collected from agricultural lands under six upazilas of Jhenaidah district to measure heavy metal contaminations in soils. We targeted rice and vegetable soil fields from each upazila. The soil samples were collected from top 15 cm and taken in polyethylene bags and sent to AAN laboratory at Jessore for the chemical analysis. The soil samples were air-dried at room temperature and then ground to a powder. The soil samples were first digested using the United States Environmental Protection Agency 3050B method (USEPA 1996), and then the digested solutions were analyzed for As, Pb, Cr and Cd using AAS (AA-6800).

Major findings

The Arsenic (As) concentration in rice field soil samples was relatively higher compared to vegetable soil samples. It may be due to the excess use of groundwater for Boro rice cultivation, which is contaminated with As. The concentration of Chromium (Cr) in both rice and vegetable soil samples were found relatively high, ranges from 56.36 to 97.17 mg/kg. However, concentrations of Lead (Pb) and Cadmium (Cd) were identified low (Table 16).

Table 16: **Heavy metal concentrations in rice and vegetable fields in different upazilas of Jhenaidah district**

Sl	Location	Type of Soil	As (mg/kg)	Cr (mg/kg)	Pd (mg/kg)	Cd (mg/kg)
1	Jhenaidah Sadar	Rice field	38.36	74.75	1.60	0.04
2	Jhenaidah Sadar	Vegetables field	1.57	60.84	2.66	0.15
3	Kaliganj	Rice field	2.25	83.55	1.00	0.05
4	Kaliganj	Vegetables field	1.94	68.60	1.75	0.00
5	Moheshpur	Rice field	2.01	75.66	2.53	0.00
6	Moheshpur	Vegetables field	1.54	64.33	2.37	0.08
7	Harinakundu	Rice field	2.12	72.77	2.22	0.00
8	Harinakundu	Vegetables field	1.89	65.79	3.09	0.00
9	Shailkupa	Rice field	2.43	56.36	0.00	0.09
10	Shailkupa	Vegetables field	1.83	97.17	0.00	0.00
11	Kotchandpur	Rice field	1.97	80.00	1.35	0.00
12	Kotchandpur	Vegetables field	1.86	83.83	0.62	0.00

The concentration of Cr was found high in soil samples, it may be the cause of excessive use of chemical fertilizers, which might high higher Cr. So, we collected common chemical fertilizers (MOP, TSP, DAP, Dolomite, Boron and Zinc) from the studied areas, and tested for various heavy metals such as As, Cr, Pb and Cd. Results showed that most of the chemical fertilizers were highly contaminated with Cr, which may be affecting to increasing Cr concentration in farmland soil (Figure 30).

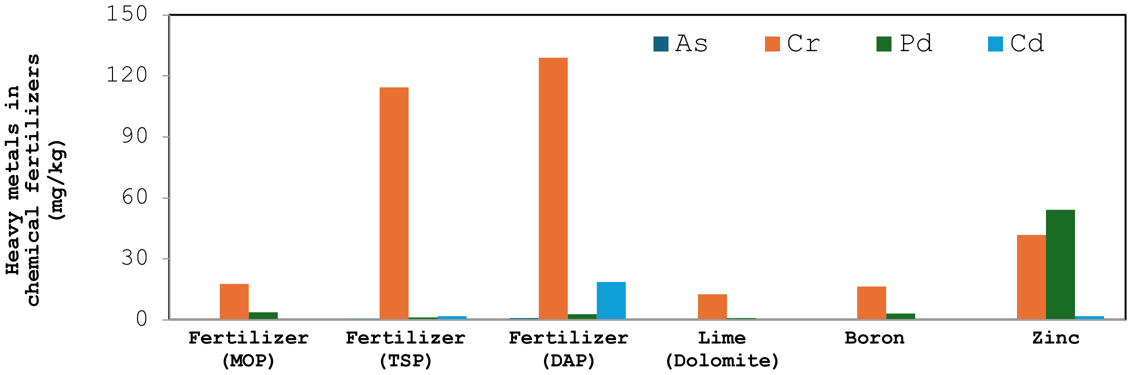


Figure 30: **Concentration of Arsenic (As), Chromium (Cr), Lead (Pb) and Cadmium (Cd) in chemical fertilizers.**

It is recommended to use optimum doses of chemical fertilizers through soil nutrient test analyzed at SRDI laboratory, and application of compost/vermicompost in soil to reduce heavy metals contamination in farmland soil as well as food-chain. It is also recommended to strengthen farmers' capacity on compost and vermin-compost production and utilization in their farmlands.

Survey on Safe Food Corner

Three safe food corners have been constructed under the project in three upazilas (Photo 33). It is now very viable and many customers are buying safe foods from the corners. To promote safe food produced by the SAP-II farmers, a total 105 respondents composing of 45 vegetable producers, 30 consumers, 15 traders and 15 LAI-LGI were surveyed. The summary of the observations are as follows:

- Farmers produced safe fruits and vegetables using IPM, GAP and organic input and sell the products to the neighbors and market.
- There is no safe food shop and farmers do not get additional benefits even they produce quality vegetables using less agrochemicals.
- All farmers opined that safe food corner is needed.
- Weather, low price, insect and pest attack are some of the major barriers for growing safe food.
- Consumers and traders agreed to pay extra money for safe food.
- Consumers like to buy safe foods from local market daily or weekly and they do not want to go far distance to busy safe food.
- LAI-LGI are more aware about safe food in terms of policy, rules and health benefits.
- LAI-LGI gave their opinion that they would monitor quality of the food and would provide supports for license, certificate, and campaign.

Photo 33: **Safe food corners established in three upazilas of Jhenaidah district under SAP-II project.**

Sabina Begum - A Model Woman Entrepreneur

Sabina Begum (40) lives in Chotasarabaria village of Chandpur union under Harinakudu upazila with two sons and husband. Both the sons are studying. Before engaging SAP project, she was dependent of her husband's income, mainly from traditional farming. They could not get desired and yields and returns due to lack of knowledge of modern agricultural techniques.

As a member of the SAP project (SAP ID: 2250732), she received various trainings and supports, and actively participated in field school and exposure visits.

She started growing vegetables, spice crops, vermicompost production, seed conservation and rearing cow, goat, duck & chickens in homestead. She is helping her husband and started agricultural works following modern technologies on 30 decimals own land and 60 decimals leased in land. They applied AWD method in paddy cultivation, used vermicompost in vegetable production and also preserved own seeds.

In 2023, Sabina's income increased 61% compared to previous year by selling crops, vegetables, cow, goat, hen and vermicompost. The additional income is helping her in constructing new homes, bearing education costs of the sons and healthcare of the family members. Now, she is well known in the society as a woman enterpreneur.

Md. Hafizur Rahman - A Seed Entrepreneur

Md. Hafizur Rahman (44) (SAP ID: 2290843) lives in Ghordah village of Kapasatia union under Harinakunu upazila with five family members. Hafizur Rahman is a farmer having a homestead and 184 decimals of arable land.

While doing traditional farming, he could not get good yield due to lack of quality seeds, natural calamities and lack of technological supports. After becoming a member of SAP, he developed idea to produce and preserve quality seed. He got supports and training from SAP, DAE and BARI and now he is a model farmer and seed entrepreneur.

He produced paddy, wheat, lentil, mung bean, sorghum, onion, garlic and various vegetables. He received a seed drier and a seed moisture meter, which are helping to maintain quality of the seeds. Last year, he earned an additional BDT 50,000 compared to the previous year. He is also selling quality seeds to the neighbor farmers at a lower price than the market. Locally, he has a good reputation as an entrepreneur in quality seed production. Beside getting good yields, he is now relatively tensionless if the crops are destroyed due to natural calamities, as he can use his own seeds. He has built a new house and living a quality life with family by using additional income from seeds.

Hafizur Rahman said, "Many farmers of my group have started seed production and storage and homestead vegetable production. Hopefully, within the next 2 years, the farmers of the SAP group will have no more problems in producing crops and will be financially self-sufficient."

Kamrul Islam - A Model in Agriculture

Md. Kamrul Islam (SAP ID: 2320931) resides in Sreerampur of Harinakudu municipalities with two daughters, a son and wife at Srirampur village of Harinakundu municipality having 3.3 acres of cultivable land.

Before becoming a member of SAP, Kamrul Islam used to cultivate in a traditional way and he was not satisfied with yields. He received agricultural inputs and technical supports from DAE, which helped him to reduce production costs by 15%, while increased yields by 20%.

With the support from the project, he dug a mini pond and produced vermicompost. He cultivated seasonal vegetables on the bank of the pond and cultured fishes in the pond. He also cultivated safe vegetables in the courtyards of the homesteads following integrated pest management (IPM) practice. He cultivates wide range of crops (paddy, maize, wheat, lentils, onion, garlic, sunflower, turmeric, banana, vegetables) rears cows, goats and poultry in the homestead. In 2023, he earned an extra one lakh taka by selling agricultural commoddities after fulfill the needs of his family. By the additional income, he purchased 16 decimal paddy land last year.

Md. Ripon - Use of Vermicompost for Safe Food Production

Md. Ripon (SAP ID: 3491457) is a resident of Matneja, Shailkupa municipality having 16.5 decimal of homestead and 49.5 decimal of agriculture land. After joining SAP project, he is getting more financial benefits by growing safe vegetables, proper seed management and cost-effective water management (AWD).

He got training and input support on safe food production, AWD method and vermicompost preparation. He is cultivating a wide range of vegetables in homestead using vermicompost and IPM methods with minimum fertilizers and pesticides. Before engaging SAP, he used to expend more than BDT 5000 per year for buying vegetables. Last year, he saved that money along with BDT 2,000 for pesticide use. He sold surplus of the vegetables and earned BDT 3000. Since he grows vegetables using vermicompost and IPM, his products are very popular in the local market. Therefore, he is getting little higher price than market. Besides, he also stores seed and practice AWD that also gives him additional benefits and income. He is quite happy with the new life with the support of SAP and DAE. Currently he is a model farmer.

Md. Mujibur Rahman – A good practitioner of water saving techniques

Md. Mujibur Rahman (SAP ID: 3371090) living in Bakshipur village of Nityanandpur under Shailkupa upazila having 15 decimal homestead and 69 decimal croplands, which was cultivated in a traditional way and he did not have much connection with modern technologies.

He was cultivating rice by flood irrigation method (traditional practice). After receiving training and support, he started AWD method in Boro rice cultivation. He observed that AWD could save water, slightly increase yield, reduce insect attach reduce fuel cost for irrigation and conserve rice field ecosystem. But he mentioned little higher weed infestation. He saved 25% electricity cost for operating irrigation pump during Boro rice cultivation. After getting advice, he started using plastic pipe to irrigate vegetables, which saved 20% irrigation cost in 2023 compared to the previous year. A mini pond has been dug with the support of the project and seeds of various vegetables are being cultivated along with grass on the banks of the mini pond. Grass helps to control erosion and increased supply of fodder. Last year, he saved BDT 5,000 for fodder purchase. It also helped him to get fodder during the lean period. He is a good practitioner of water saving for crop cultivation. Apart from these, he earned about BDT 17,000 by selling vegetables last year and saved BDT 1,500 for pesticide purchase.

Champa Begum - A Story of Success After Struggle

Champa Begum (44) (SAP ID: 1100292) lives in Khalishpur village under SBK union of Moheshpur upazila. He got married to Tabibur Rahman, a day laborer, while she was only 14 years old. A disabled daughter was born in 2001 who was also suffering from liver cirrhosis. The family had to spend BDT 1000 daily for medicine, which was very difficult for Champa Begum's family. Their daughter died in 2018 at the age of 18. Another disaster came to her family when her husband became sick in 2020, who is the only earning member in the family. Champa Begum took charge of the family and received training on vermicompost production, family model nutrition gardening and IPM from the Upazila Agriculture Office and started vegetable cultivation in homestead. She engaged with SAP project in 2021, which was the turning point of her life. As SAP farmer, she got four ring slabs and one kg of earthworms for vermicompost production. Initially, she produced 90 kg vermicompost per month, of which 30 kg used in own farming and rest 60 kg was sold at BDT 600. She regularly receives seeds and other input supports from DAE with a linkage of SAP personnel. Now she has an integrated homestead production systems having crops, livestock, poultry, fisheries and manure production. Last year, she earned around BDT 3,00,000 from her homestead. Currently, she has a cow, 4 goats, 25 chickens, 20 pigeons and 5 ducks. Champa Begum does not have to look back now. She has a dream to establish a large commercial farm She says in his smiling voice!! "I am now a model farmer of this area and many people follow me".

Md Saidur Rahman – An Entrepreneur Who Overcomes Unemployment

Md Saidur Rahman (31) (SAP ID: 1170495) lives in Maladharpur, Azompur union under Moheshpur upazila. He tried to get a job after graduation in 2017, but he failed to get a suitable job. He returned back to village and established a poultry farm and it was damaged due to disease and he lost huge money. He did not stop. He met DAE officer and got ideas on modern agricultural technology and finally became a young agri-entrepreneur. He received training on skill development and IPM and acquired knowledge about mulching paper, seedling trays, cocoa dust technology and modern new varieties.

Then in 2021, he was included as a member through group formation meeting of SAP-II project. He received classroom training of model farmers and he enriched his ideas of vegetable and fruit farming. Four ring slabs and one kg of earthworms were provided to him for production of vermi and tricho composts from SAP-II project. He established a guava orchard on 33 decimal lands but initially he could not get desired yield. With the help of SAP, he tested soil samples of crop fields and got fertilizer recommendation card. He applied optimum dose of fertilizers along with vermicompost. He intercropped watermelon using plastic mulch in association with guava trees. This technique gave him a great success and he earned BDT 50,000 from guava and BDT 30,000 from watermelon in 2022. Every month his incomes from vermicompost and vegetables are BDT 2,200. His annual savings is BDT 1,06,400 and now he is model of the young generation in his locality.

Md. Ajibor Rahman – A Model Farmer for Safe Food and Climate Resilient Agriculture

Md. Ajibor Rahman (SAP ID: 3411213) lives in Sonda village four family members. He has 20 kathas=33 decimal of homestead and two bighas=66 decimal of arable land. He has a grocery shop in front of the house besides farming for his livelihood. Before starting the SAP project, he was doing (conventional) agriculture with his own ideas and used to irrigate the land in the traditional way. He became a model farmer and has been elected as the president of the farmers' group.

As a SAP farmer, he is using plastic (fita) pipe to apply irrigation water for vegetable cultivation that helps to reduce irrigation cost and waste of water. He could save 20% irrigation cost by using plastic pipe compared to previous year (traditional irrigation).

With the support from SAP, he dug a mini pond and growing vegetables on the banks of the pond following IPM and less use of agrochemicals. He cultures fishes in the mini pond, which is sufficient for his family needs. He uses pond water to irrigate seedbed and vegetables.

Apart from this, he also cultivates vegetables in his home garden along with family members, which ensures higher production and family nutrition. He sells surplus vegetables and fish to the neighbors and/or nearby market and get income generation. He estimated that last year he could earn additional BDT 7000 from homestead after meeting the family demand of vegetables. He is keeping close contact with DAE personnel and getting various supports and advice.

CONCLUSIONS

The most serious problems in Jhenaidah district are drought and unpredictable rainfall, and inappropriate water management. Promotion of Water Management and Climate Change Adaptation in Agriculture (SAP-II) project was implemented in Jhenaidah district of Bangladesh from 2021 to 2024. The project was designed to strengthen sustainable food production system through water management and climate change adaptation in Jhenaidah district. The project was also emphasized do develop for the capacity of target farmers. Six outcomes including; 1. Building relationships between DAE and farmers, 2. Fostering farmers' understanding of issues and countermeasures related to water and climate crisis, 3. Strengthening farmers' water management capacity, 4. Improving climate change countermeasures in agriculture in the target area, 5. Verification of effectiveness of water management and climate change adaptation, 6. Dissemination were targeted under the project.

It was confirmed that 1,331 of the 1,500 target farmers had introduced AWD technique in boro rice crop, and the remaining 169 farmers had stopped growing rice during the dry season and switched to rabi crop farming. The total water-saving irrigation area was 850 ha, and the amount of water saved in the dry-season of 2023 was estimated to be 6 million tons (the amount of drinking water equivalent to three years' worth of the population of Jhenaidah district). Furthermore, all 1,500 farmers opined that their income had increased through various SAP recommended techniques including seeds/seedling production, vermicompost, soil test, saving irrigation methods, and it was confirmed that all of them had some other positive impacts, such as increased participation by female family members and improved nutrition and physical status. For these reasons, the impacts of the project would help for sustainable production under changing climate.

Photo 34: **Hand pumps water discharge rate remarkably reduced when irrigation wells are fully operated in dry season at Madhabpur village, Ganna Union, Sadar Upazila.**

Since in the target area water management and climate change adaptation measures in agriculture are spreading beyond the beneficiaries, it can be considered that the foundation for achieving the overall goals has been formed.

RECOMMENDATIONS & WAY FORWARDS

1) As the targeted area is climatic vulnerable, so it is recommended to strengthen farmer's capacity on climate change issues and how to overcome its effect for promoting sustainable agricultural. Weather forecasting information showed in flow-chart that developed under this project is very helpful for farmers to get information and effective way to reduce crops loss due to climate change.

2) Farmers are adapted with the Alternate Wetting and Drying (AWD) system to reduced water for Boro rice cultivation and farmers are the rice production is very satisfactorily. So, it is recommended to promote this technology in other areas to save groundwater and energy (electricity or diesel) consumption and reduce rice production cost. In addition, underground pipeline network, polyethylene pipe, mini-pond and surface water-based irrigation are recommended to reduce groundwater load for sustainable rice production in Bangladesh.

3) As Boro rice cultivation is required lots of water, so it is recommended to cultivate Aman rice, Rabi crops and other alternative high value crops (vegetable and fruits) to reduce groundwater load for future reservation. Less water demanding crop varieties need to be disseminated. Uncultivable lands should be brought under crop cultivation for sustainable crop production.

4) It is recommended to apply less or minimum chemical fertilizers through conducting soil nutrient test from SRDI laboratory to protect soil and food-chain from heavy metal contaminations. To reduce the load of chemical fertilizers, it is recommended to promote compost and vermi-compost production at farmer's level and their application for agricultural development.

   It is also recommended to promote pheromone trap, yellow trap, perching and herbal pesticides for insect control rather than apply chemical pesticides for safe food production.

5) Homestead gardening and mini pond based agricultural system played an important role to produce safe food and fulfill farmer's daily nutrition demand and increase their socioeconomic status by selling surplus amount at safe food corner, which can be replicated in other area to protect their health from toxic pesticides.

6) It is recommended to establish business model through entrepreneur groups to make the necessary tools/items locally available needed for sustainable agriculture practice, and also to sell farmers products at local and central level.

Sustainability

For the sustainability of the project, the following initiatives can be taken:

- DAE cooperation and supports to SAP farmers should be continued in the project area by ensuring regular communication.
- Monitor water management techniques such as AWD, underground pipeline, mini-pond and plastic pipe. Water management can help reducing greenhouse gas (GHG) emission from paddy fields.
- Organic management of soil and pests should be enhanced such as vermicompost, trico-compost, IPM etc. It will help not only to improve soil health but also conserve the agoroecology.
- Farmers should be encouraged to test the soils of their fields and apply fertilizers accordingly. It will help to reduce greenhouse gas emissions. SRDI should take initiatives.
- Ensure the availability and supply of climate resilient crop varieties.
- Support to the development of business idea/model on seed, compost, water, products, selling points etc.

Challenges Faced by the Farmers

- Low market price of quality products at farm level
- Uncertainty of the weather conditions such as drought, heat, cyclone, wind, heavy rainfall, hailstorm etc.
- High cost and unavailability of labor and other inputs
- Lower ground water level during dry season
- Lack of quality seed/seedling
- Unavailability of AWD pipe

How the Situation Changed?

- Strong linkage with DAE, SRDI and other GOs and NGOs.
- Regular follow-up & information sharing between SAP-II staffs and SAAOs.
- FFS, farmers' meeting, classroom training, survey of various issues, soil test for fertilizer recommendation card.
- Exposure visit, soil campaign, field visit, training and suggestion by resource persons.

Farmer's Benefits after the Project

- Having knowledge and awareness on different aspects of agriculture including water saving importance.
- Getting more DAE supports, weather information and taking precaution measures.
- Using resilient varieties, magic pipe (AWD), poly pipe, underground pipeline, mini pond, surface water, vermin/ Trico compost, IPM methods.
- Increased crop diversification, production with reduction of crop damage/loss.
- Preserving seeds for own use and sell.
- Testing soil samples for optimum use of fertilizers.
- Getting safe/nutritious food from homestead garden.
- Increased woman participation and family income.
- Practicing integrated farming for sustainable production and management.
- Improved linkage with GOs, NGOs and other stakeholders.

NAES and SAP-II

The goal of the National Agricultural Extension Policy is to: “Encourage the various partners and agencies within the National Agricultural Extension System (NAES) to provide efficient and effective coordinated services which complement and reinforce each other, in an effort to increase the efficiency and productivity of agriculture in Bangladesh for ensuring food security and business development”.

To achieve the above goal in relation to different agriculture related policies of Bangladesh, the NAEP includes following key pillars (out of 26 pillars):

- Targeting, mobilizing, capacity building and registration of “Farmers Group”
- Disaster management and adoption to climate change
- Specialist Extension Services (SES) for climatically distressed areas
- Strengthening supply of quality seeds and other inputs
- Emphasizing organic farming/ green farming
- Mainstreaming women in agriculture
- Emphasizing homestead gardening
- Efficient and effective dissemination of technology

SAP-II Addressed SDGs

The activities and achievements of SAP-II project would help directly or indierctly in acheieving the following Sustainable Development Goals (SDGs) (Figure 31):

Figure 31: **SDGs addressed by the SAP-II project.**

ANNEX-1

Media Coverage

ANNEX-2

Arsenic Concentrations of Irrigation Wells

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
1	Moheshpur	Mandarbaria	Srirampur	Hudapara	Akbar Ali	Shallow	130	2010	individual	Electricity	No	3	140	09.03.2021	200
2	Moheshpur	Mandarbaria	Srirampur	Hudapara	Nazir Ahmed	Shallow	130	2016	individual	Electricity	No	15	1,600	09.03.2021	100
3	Moheshpur	Mandarbaria	Srirampur	Hudapara	Taizuddin	Shallow	130	2008	individual	Oil	No	7	300	09.03.2021	200
4	Moheshpur	Mandarbaria	Srirampur	Hudapara	Motiar Rahman	Shallow	90	2010	individual	Oil	No	7	330	09.03.2021	0
5	Moheshpur	Mandarbaria	Srirampur	Hudapara	Md. Jahurul Islam	Shallow	120	2012	individual	Oil	No	3	99	09.03.2021	0
6	Moheshpur	Mandarbaria	Srirampur	Hudapara	Mizanur Rahman	Shallow	70	2007	individual	Oil	No	12	460	15.03.2021	10
7	Moheshpur	Mandarbaria	Srirampur	West para	Nur Hossain	Shallow	75	2018	individual	Oil	No	5	165	15.03.2021	50
8	Moheshpur	Mandarbaria	Srirampur	West para	Mohorom Ali	Shallow	80	2012	individual	Electricity	No	20	950	15.03.2021	0
9	Moheshpur	Mandarbaria	Srirampur	Westpara	Harej Ali	Shallow	120	2018	individual	Oil	No	4	135	15.03.2021	0
10	Moheshpur	Mandarbaria	Srirampur	Westpara	Abdul Malek	Shallow	120	1995	individual	Oil	No	8	495	15.03.2021	0
11	Moheshpur	Mandarbaria	Srirampur	Eestpara	Md. Mojid	Shallow	90	2016	individual	Oil	No	12	495	15.03.2021	0
12	Moheshpur	Mandarbaria	Srirampur	Hudapara	Bakka Islam	Shallow	90	2019	individual	Oil	No	6	264	15.03.2021	10
13	Moheshpur	Mandarbaria	Srirampur	Hudapara	Nazjrul Islam	Shallow	110	2007	individual	Oil	No	60	2,320	15.03.2021	50
14	Moheshpur	Mandarbaria	Naudagram	Northpara	Mabud Rahman	Shallow	90	2016	individual	Electricity	No	7	660	15.03.2021	10
15	Moheshpur	Mandarbaria	Naudagram	Northpara	Ohidul Islam	Shallow	85	2014	individual	Electricity	No	15	360	15.03.2021	50
16	Moheshpur	Mandarbaria	Naudagram	Northpara	Aziz	Shallow	85	2012	individual	Oil	No	12	160	15.03.2021	100
17	Moheshpur	Mandarbaria	Naudagram	Northpara	Jalil Hossain	Shallow	90	2016	individual	Oil	No	10	130	15.03.2021	50
18	Moheshpur	Mandarbaria	Naudagram	Biswaspara	Milton	Shallow	70	2007	individual	Oil	No	7	231	15.03.2021	0
19	Moheshpur	Mandarbaria	Naudagram	Biswaspara	Mithu	Shallow	70	2009	individual	Oil	No	12	660	24.03.2021	0
20	Moheshpur	Mandarbaria	Naudagram	Mathpara	Anowar	Shallow	75	2008	individual	Electricity	No	10	660	24.03.2021	0
21	Moheshpur	Mandarbaria	Naudagram	Mathpara	Rabiul Islam	Shallow	120	2009	individual	Electricity	No	45	1,200	24.03.2021	25
22	Moheshpur	Mandarbaria	Naudagram	Biswaspara	Mekail	Shallow	70	2007	individual	Oil	No	12	660	24.03.2021	0
23	Moheshpur	Mandarbaria	Naudagram	Southpara	Mintu	Shallow	190	1982	individual	Oil	No	50	2,178	24.03.2021	0
24	Moheshpur	Mandarbaria	Naudagram	Westpara	Billal Hossen	Shallow	90	1998	individual	Oil	No	6	109	24.03.2021	10
25	Moheshpur	Mandarbaria	Naudagram	Southpara	Tajuddin	Shallow	70	2009	individual	Oil	No	8	330	24.03.2021	10
26	Moheshpur	Mandarbaria	Naudagram	Southpara	Jahangir	Shallow	75	1999	individual	Oil	No	5	165	24.03.2021	10
27	Moheshpur	Mandarbaria	Naudagram	Southpara	Abdul Latif	Shallow	110	2008	individual	Oil	No	4	132	24.03.2021	10
28	Moheshpur	Mandarbaria	Naudagram	Southpara	Jakir Hosen	Shallow	110	2020	individual	Electricity	No	6	330	24.03.2021	0
29	Moheshpur	Mandarbaria	Naudagram	Southpara	Babu Mondal	Shallow	75	2009	individual	oil	No	8	297	24.03.2021	0
30	Moheshpur	Mandarbaria	Naudagram	Mondalpara	Ohidujjaman	Shallow	65	2012	individual	Electricity	No	20	990	24.03.2021	10
31	Moheshpur	Mandarbaria	Mirjapur	Northpara	Shahidul Islam	Shallow	270	1990	individual	Electricity	No	26	500	17.03.2021	100
32	Moheshpur	Mandarbaria	Mirjapur	Northpara	Kalam	Shallow	120	2005	individual	Oil	No	2	132	17.03.2021	0
33	Moheshpur	Mandarbaria	Mirjapur	Southpara	Nasiruddin	Shallow	190	2011	individual	Electricity	No	10	495	17.03.2021	25
34	Moheshpur	Mandarbaria	Mirjapur	Southpara	Montu Mia	Shallow	150	2011	individual	Electricity	No	10	330	17.03.2021	25
35	Moheshpur	Mandarbaria	Mirjapur	Southpara	Manik	Shallow	150	2009	individual	Electricity	No	7	495	17.03.2021	0

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
36	Moheshpur	Mandarbaria	Mirjapur	Southpara	Ferdous	Shallow	150	2009	individual	Electricity	No	10	396	17.03.2021	50
37	Moheshpur	Mandarbaria	Mirjapur	Southpara	Shafidul Islam	Shallow	150	2011	individual	Electricity	No	8	462	17.03.2021	0
38	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Fooj Ali	Shallow	150	2015	individual	Oil	No	8	195	17.03.2021	0
39	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Ashikur	Shallow	150	2009	individual	Electricity	No	60	3,300	17.03.2021	50
40	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Nurul	Shallow	150	2010	individual	Oil	No	8	264	17.03.2021	10
41	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Saiful Islam	Shallow	120	2019	individual	Electricity	No	30	1,500	17.03.2021	50
42	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Moshiur Rahman	Shallow	120	2005	individual	Oil	No	5	132	17.03.2021	25
43	Moheshpur	Mandarbaria	Mirjapur	Eastpara	Muktar Ali	Shallow	120	2020	individual	Oil	No	1	132	17.03.2021	0
44	Moheshpur	Mandarbaria	Mirjapur	Southpara	Mahidul Islam	Shallow	150	2011	individual	Oil	No	12	330	17.03.2021	10
45	Moheshpur	Mandarbaria	Mirjapur	Southpara	Asadul Haq	Shallow	150	2010	individual	Electricity	No	10	330	17.03.2021	0
46	Moheshpur	Mandarbaria	Babla Mathavanga	Westpara	Shiraj Uddin	Shallow	140	1998	individual	Oil	No	15	990	22.03.2021	10
47	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Anisur Rahman	Shallow	150	2005	individual	Oil	No	12	650	22.03.2021	10
48	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Shahin	Shallow	105	1994	individual	Oil	No	3	231	22.03.2021	10
49	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Kamal Hosen	Shallow	145	2003	individual	Oil	No	12	396	22.03.2021	10
50	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Alam	Shallow	150	2004	individual	Oil	No	8	495	22.03.2021	10
51	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Md. Monir Hossen	Shallow	140	2015	individual	Oil	No	5	297	22.03.2021	50
52	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Babu Mia	Shallow	140	2008	individual	Oil	No	7	330	22.03.2021	10
53	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Bakkar	Shallow	150	2014	individual	Oil	No	10	330	22.03.2021	10
54	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Taslimuddin	Shallow	125	2005	individual	Oil	No	12	450	22.03.2021	10
55	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Abdul	Shallow	140	2010	individual	Oil	No	12	521	22.03.2021	10
56	Moheshpur	Mandarbaria	Babla Mathavanga	Southpara	Kader	Shallow	145	2008	individual	Oil	No	12	380	22.03.2021	10
57	Moheshpur	Mandarbaria	Habaspur	Southpara	Pannu Mondal	Shallow	160	2010	individual	Electricity	No	20	850	18.03.2021	10
58	Moheshpur	Mandarbaria	Habaspur	Mathpara	Alauddin	Shallow	130	2010	individual	Oil	No	12	150	18.03.2021	0
59	Moheshpur	Mandarbaria	Habaspur	Southpara	Joinal	Shallow	120	2013	individual	Oil	No	6	264	18.03.2021	0
60	Moheshpur	Mandarbaria	Habaspur	Southpara	Kalachan	Shallow		2016	individual	Oil	No	4	165	18.03.2021	0
61	Moheshpur	Mandarbaria	Habaspur	Mathpara	Azim Uddin	Shallow	120	2016	individual	Oil	No	3	132	18.03.2021	10
62	Moheshpur	Mandarbaria	Habaspur	Mathpara	Md. Jahid	Shallow	120	1978	individual	Oil	No	1	330	18.03.2021	0
63	Moheshpur	Mandarbaria	Habaspur	Mathpara	Rabiul Prodhan	Shallow	120	2010	individual	Oil	No	1	330	18.03.2021	0
64	Moheshpur	Mandarbaria	Habaspur	Mathpara	Md. Rabiul Islam	Shallow	120	2010	individual	Oil	No	1	297	18.03.2021	0
65	Moheshpur	Mandarbaria	Habaspur	Mathpara	Golam Hossain	Shallow	120	2005	individual	Oil	No	3	223	18.03.2021	100
66	Moheshpur	Mandarbaria	Habaspur	Mathpara	Salim	Shallow	120	2018	individual	Oil	No	2	132	18.03.2021	100
67	Moheshpur	Mandarbaria	Habaspur	Mathpara	Dilu Mia	Shallow	120	2001	individual	Oil	No	2	66	18.03.2021	100
68	Moheshpur	Mandarbaria	Habaspur	Mathpara	Omar Ali	Shallow	120	2019	individual	Oil	No	2	66	18.03.2021	100
69	Moheshpur	Mandarbaria	Habaspur	Mathpara	Abdul Awal	Shallow	160	1979	individual	Electricity	No	25	1,980	18.03.2021	0
70	Moheshpur	Mandarbaria	Habaspur	Mathpara	Hannan	Shallow	120	2018	individual	Oil	No	2	165	18.03.2021	10
71	Moheshpur	Mandarbaria	Habaspur	Mathpara	Abdul Alim	Shallow	120	2005	individual	Oil	No	3	132	18.03.2021	100
72	Moheshpur	Mandarbaria	Habaspur	Mathpara	Kadir	Shallow	120	2010	individual	Oil	No	6	198	18.03.2021	100
73	Moheshpur	Mandarbaria	Habaspur	Mathpara	Shawkat Ali	Shallow	130	2017	individual	Oil	No	5	165	18.03.2021	0

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
74	Moheshpur	Mandarbaria	Habaspur	Northpara	Saiful Islam	Shallow	160	1993	individual	Oil	No	20	1,200	21.03.2021	10
75	Moheshpur	Mandarbaria	Shankarhuda	Schoolpara	Shamsul Alam	Shallow	100	2010	individual	Oil	No	3	99	09.03.2021	50
76	Moheshpur	Mandarbaria	Shankarhuda	Uttarpara	Md. Faruk	Shallow	120	1999	individual	Oil	No	4	6	09.03.2021	50
77	Moheshpur	Mandarbaria	Shankarhuda	Uttarpara	Md. Shariful	Shallow	120	2006	individual	Oil	No		495	09.03.2021	0
78	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Anwar Hossain	Shallow	120	1990	individual	Oil	No	5	160	16.03.2021	0
79	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Anowar	Shallow	120	1990	individual	Oil	No	4	210	16.03.2021	50
80	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Shariful Islam	Shallow	120	1992	individual	Oil	No	10	360	16.03.2021	100
81	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Salim	Shallow	120	1995	individual	Oil	No	3	120	16.03.2021	100
82	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Sabur Biswas	Shallow	110	2000	individual	Oil	No	5	190	16.03.2021	100
83	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Nazrul Islam	Shallow	120	1990	individual	Oil	No	3	120	16.03.2021	100
84	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Alim	Shallow	120	1995	individual	Oil	No	5	140	16.03.2021	100
85	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Mohsin	Shallow	110	1990	individual	Oil	No	5	120	16.03.2021	100
86	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Badiuzzaman	Shallow	120	1995	individual	Oil	No	1	66	16.03.2021	50
87	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Eakub Ali	Shallow	110	1996	individual	Oil	No	6	200	16.03.2021	25
88	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Shabuj Ali	Shallow	120	1996	individual	Oil	No	3	120	16.03.2021	10
89	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Sadek Ali	Shallow	120	1995	individual	Oil	No	4	120	16.03.2021	0
90	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Nazrul islam	Shallow	120	1999	individual	Oil	No	1	60	16.03.2021	0
91	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Jahangir Alam	Shallow	120	1999	individual	Oil	No	1	66	16.03.2021	0
92	Moheshpur	Mandarbaria	Mandarbaria	Majhpara	Tofazzel	Shallow	70	2011	individual	Oil	No	1	33	16.03.2021	0
93	Moheshpur	Mandarbaria	Bathangaschi	Eastpara	Jashim Uddin	Shallow	60	2010	individual	Oil	No	6	165	14.03.2021	25
94	Moheshpur	Mandarbaria	Bathangaschi	Eastpara	Mosharraf Hossain	Shallow	120	2010	individual	Oil	No	1	99	14.03.2021	50
95	Moheshpur	Mandarbaria	Bathangaschi	Eastpara	Tipu	Shallow	60	2011	individual	Electricity	No	30	660	14.03.2021	50
96	Moheshpur	Mandarbaria	Bathangaschi	Eastpara	Jahanara Begum	Shallow	140	2014	individual	Oil	No	8	660	14.03.2021	25
97	Moheshpur	Mandarbaria	Bathangaschi	Eastpara	Mohidul Islam	Shallow	70	2014	individual	Oil	No	5	132	14.03.2021	50
98	Moheshpur	Mandarbaria	Sankarhuda		Intajur Rahman	Shallow	90	2005	individual	Oil	No	3	66	09.03.2021	0
99	Moheshpur	Mandarbaria	Sankarhuda		Abdul Khalil	Shallow	80	2000	individual	Oil	No	3	85	09.03.2021	0
100	Moheshpur	Mandarbaria	Sankarhuda		Toriqul Islam	Shallow	150	2005	individual	Oil	No	30	990	09.03.2021	0
101	Moheshpur	Mandarbaria	Sankarhuda		Zihad Hossain	Shallow	70	2000	individual	Oil	No	3	99	09.03.2021	0
102	Moheshpur	Mandarbaria	Sankarhuda		Nur Ali	Shallow	80	2000	individual	Oil	No	2	96	09.03.2021	0
103	Moheshpur	Mandarbaria	Sankarhuda		Amzad Hossain	Shallow	80	2015	individual	Oil	No	3	32	09.03.2021	0
104	Moheshpur	Mandarbaria	Sankarhuda		Azizur Rahman	Shallow	75	1990	individual	Oil	No	3	85	09.03.2021	10
105	Moheshpur	Azampur	Biddathorpur	Vedamari	Md. Billal Hossain	Shallow	200	1995	individual	Oil	No	3	350	15.03.2021	50
106	Moheshpur	Azampur	Biddathorpur	Vedamari	Md. Sahaboddin	Shallow	150	2004	individual	Oil	No	3	300	15.03.2021	50
107	Moheshpur	Azampur	Biddathorpur	Vedamari	Md. Asadul Islam	Shallow	200	1985	individual	Oil	No	10	700	15.03.2021	50
108	Moheshpur	Azampur	Biddathorpur	Bazarpar	Md. Naeb Ali	Shallow	120	2005	individual	Oil	No	4	300	15.03.2021	25
109	Moheshpur	Azampur	Biddathorpur		Anarul Haque	Shallow	145	2006	individual	Oil	No	22	990	15.03.2021	50
110	Moheshpur	Azampur	Biddathorpur	Dafadarpara	Shahajan Ali	Shallow	90	2000	individual	Oil	No	5	250	15.03.2021	25
111	Moheshpur	Azampur	Biddadharpur	SchoolPara	Abu kalam	Shallow	90	2003	individual	Oil	No	5	133	15.03.2021	25

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
112	Moheshpur	Azampur	Biddadharpur	Collegepara	Milton	Shallow	90	2000	individual	Oil	No	5	300	15.03.2021	0
113	Moheshpur	Azampur	Biddadharpur	Collegepara	Bipul Hossen	Shallow	90	2007	individual	Oil	No	6	166	15.03.2021	0
114	Moheshpur	Azampur	Biddadharpur	Mathpara	Shafi Uddin	Shallow	120	2000	individual	Oil	No	6	200	15.03.2021	25
115	Moheshpur	Azampur	Maladharpur	Bazarpara	Jahurul lalam	Shallow	120	1999	individual	Oil	No	7	280	15.03.2021	25
116	Moheshpur	Azampur	Maladharpur	Middle para	Mizanur Khan	Shallow	90	2001	individual	Oil	No	5	200	15.03.2021	25
117	Moheshpur	Azampur	Maladharpur	Middle para	Jamir Hossain	Shallow	120	2010	individual	Oil	No	7	266	15.03.2021	25
118	Moheshpur	Azampur	Maladharpur	Beltala	Shapan	Shallow	120	2010	individual	Oil	No	7	330	15.03.2021	0
119	Moheshpur	Azampur	Maladharpur	Beltala	Siraj Molla	Shallow	120	2018	individual	Oil	No	5	300	15.03.2021	0
120	Moheshpur	Azampur	Maladharpur	Beltala	Mamun	Shallow	90	2012	individual	Oil	No	3	175	15.03.2021	0
121	Moheshpur	Azampur	Maladharpur	Thanapara	Budo	Shallow	120	2000	individual	Oil	No	7	330	15.03.2021	0
122	Moheshpur	Azampur	Maladharpur	Thanapara	Md. Shahin Alam	Shallow	120	2000	individual	Oil	No	5	133	15.03.2021	0
123	Moheshpur	Azampur	Maladharpur	Beltala	Eunus Ali	Shallow	120	2005	individual	Oil	No	5	260	15.03.2021	0
124	Moheshpur	Azampur	Maladharpur	Amtala	Alamin	Shallow	90	2005	individual	Oil	No	6	460	15.03.2021	0
125	Moheshpur	Azampur	Maladharpur	Thanapara	Md. Atiar Rahman	Shallow	120	2005	individual	Oil	No	8	4,000	15.03.2021	0
126	Moheshpur	Azampur	Maladharpur	Thanapara	Isahaq Ali	Shallow	90	2005	individual	Oil	No	4	220	15.03.2021	0
127	Moheshpur	Azampur	Maladharpur	Beltala	Sattar	Shallow	90	2010	individual	Oil	No	3	145	15.03.2021	0
128	Moheshpur	Azampur	Maladharpur	Khanpara	Abdul Hi	Shallow	156	1998	individual	Oil	No	1	220	15.03.2021	25
129	Moheshpur	Azampur	Maladharpur	Westpara	Abdul Wahab Khan	Shallow	90	2010	individual	Oil	No	2	1,502	18.03.2021	10
130	Moheshpur	Azampur	Maladharpur	Westpara	Jalal Uddin Khan	Shallow	180	2000	individual	Oil	No	7	400	18.03.2021	10
131	Moheshpur	Azampur	Maladharpur	Thanpara	Suruj Ali	Shallow	90	2010	individual	Oil	No	4	166	15.03.2021	0
132	Moheshpur	Azampur	Maladharpur	Thanpara	Zakaria	Shallow	120	2005	individual	Oil	No	10	400	15.03.2021	50
133	Moheshpur	Azampur	Maladharpur	Middlepara	Abdul Mannan	Shallow	90	2007	individual	Oil	No	6	166	15.03.2021	25
134	Moheshpur	Azampur	Maladharpur	Middlepara	Jahangir Hossain	Shallow	120	2000	individual	Oil	No	6	300	15.03.2021	10
135	Moheshpur	Azampur	Maladharpur	Middlepara	Md. Eunus Ali	Shallow	90	2000	individual	Oil	No	7	310	15.03.2021	10
136	Moheshpur	Azampur	Maladharpur	Middlepara	Md. Mokbul Hossain	Shallow	120	2003	individual	Oil	No	7	233	15.03.2021	50
137	Moheshpur	SBK	Khadda Khalishpur	Northpara	Monika	Shallow	110	2010	individual	Oil	No	7	165	21.03.2021	10
138	Moheshpur	SBK	Khadda Khalishpur	Northpara	Mostafa	Shallow	110	2013	individual	Oil	No	2	120	21.03.2021	50
139	Moheshpur	SBK	Khadda Khalishpur	Northpara	Saidur Rahman	Shallow	120	2009	individual	Oil	No	8	250	21.03.2021	10
140	Moheshpur	SBK	Khadda Khalishpur	Northpara	Khokon	Shallow	150	2016	individual	Oil	No	7	231	21.03.2021	50
141	Moheshpur	SBK	Khadda Khalishpur	Northpara	Aroj Ali	Shallow	120	2000	individual	Oil	No	8	250	21.03.2021	0
142	Moheshpur	SBK	Khadda Khalishpur	Northpara	Nazim Uddin	Shallow	120	2005	individual	Oil	No	5	330	21.03.2021	50
143	Moheshpur	SBK	Khadda Khalishpur	Northpara	Rashida Khatun	Shallow	110	2015	individual	Oil	No	5	220	21.03.2021	10
144	Moheshpur	SBK	Khadda Khalishpur	Northpara	Azizul Islam	Shallow	150	2005	individual	Oil	No	5	200	21.03.2021	10
145	Moheshpur	SBK	SBK	Northpara	Shahanara Begum	Shallow	110	2009	individual	Oil	No	8	16+5	21.03.2021	100
146	Moheshpur	SBK	SBK	Northpara	Mohabbat Ali	Shallow	110	2009	individual	Oil	No	8	16+6	18.03.2021	10
147	Moheshpur	SBK	SBK	Northpara	Sumon Ali	Shallow	110	2009	individual	Oil	No	8	16+7	18.03.2021	10
148	Moheshpur	SBK	Paranpur	Goshpara	Shanti	Shallow	80	2015	individual	Oil	No	3	132	22.03.2021	0
149	Moheshpur	SBK	Paranpur	Majhpara	Mazid	Shallow	130	2005	individual	Electricity	No	30	990	22.03.2021	10

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150	Moheshpur	SBK	Paranpur	Majhpara	Kamruzzaman	Shallow	80	2000	individual	Oil	No	2	96	22.03.2021	0
151	Moheshpur	SBK	Paranpur	Majhpara	Azmot Ali	Shallow	90	2019	individual	Oil	No	1	40	22.03.2021	10
152	Moheshpur	SBK	Paranpur	Mondalpara	Wahab Ali	Shallow	80	2013	individual	Oil	No	3	99	22.03.2021	10
153	Moheshpur	SBK	Paranpur	Goshpara	Sujon Ali	Shallow	80	2018	individual	Oil	No	1	99	22.03.2021	0
154	Moheshpur	SBK	Paranpur	Majhpara	Md. Helal Uddin	Shallow	80	2010	individual	Oil	No	1	50	22.03.2021	0
155	Moheshpur	SBK	Paranpur	Goshpara	Md. Kutub Uddin	Shallow	90	2000	individual	Oil	No	1	40	24.03.2021	10
156	Moheshpur	SBK	Paranpur	Mondalpara	Salim	Shallow	80	2005	individual	Oil	No	4	165	24.03.2021	0
157	Moheshpur	SBK	Paranpur	Mondalpara	Tuhin Alam	Shallow	80	2010	individual	Oil	No	3	99	22.03.2021	0
158	Moheshpur	SBK	Shabajpur	Goshpara	Sristi	Shallow	90	2005	individual	Oil	No	3	99	24.03.2021	0
159	Moheshpur	SBK	Shabajpur	Goshpara	Delwar	Shallow	75	1990	individual	Oil	No	1	49	24.03.2021	0
160	Moheshpur	SBK	Shabajpur	Goshpara	Abdur Rahim	Shallow	90	2010	individual	Oil	No	1	100	25.03.2021	0
161	Moheshpur	SBK	Shabajpur	Goshpara	Tarik	Shallow	75	2005	individual	Oil	No	1	99	24.03.2021	0
162	Moheshpur	SBK	Shabajpur	Goshpara	Shankar Ghosh	Shallow	75	2005	individual	Oil	No	1	49	24.03.2021	0
163	Moheshpur	SBK	Shabajpur	Goshpara	Rahman	Shallow	90	2005	individual	Oil	No	1	49	24.03.2021	0
164	Moheshpur	SBK	Shabajpur	Goshpara	Samaul	Shallow	90	2005	individual	Oil	No	1	66	24.03.2021	0
165	Moheshpur	SBK	Shabajpur	Goshpara	Modi	Shallow	60	2010	individual	Oil	No	3	165	24.03.2021	0
166	Moheshpur	SBK	Shabajpur	Goshpara	Niranjon	Shallow	75	2010	individual	Oil	No	1	49	24.03.2021	0
167	Moheshpur	SBK	Shabajpur	Goshpara	Tuku	Shallow	90	2000	individual	Oil	No	2	66	24.03.2021	0
168	Moheshpur	SBK	Shabajpur	Goshpara	Soilen Ghosh	Shallow	92	2010	individual	Oil	No	2	260	24.03.2021	0
169	Moheshpur	SBK	Khalishpur	Eastpara	Md. Shipon	Shallow	95	2003	individual	Oil	No	4	400	16.03.2021	10
170	Moheshpur	SBK	Khalishpur	Eastpara	Tabibar	Shallow	100	2010	individual	Oil	No	5	250	16.03.2021	0
171	Moheshpur	SBK	Khalishpur	Eastpara	Mofizuddin	Shallow	100	2010	individual	Oil	No	3	330	16.03.2021	0
172	Moheshpur	SBK	Khalishpur	Komorpara	Abdul Kuddus	Shallow	100	1999	individual	Oil	No	4	132	21.03.2021	0
173	Moheshpur	SBK	Khalishpur	Komorpara	Ashraful	Shallow	90	2005	individual	Oil	No	4	165	21.03.2021	0
174	Moheshpur	SBK	Khalishpur	Komorpara	Abdus Salam	Shallow	60	2000	individual	Oil	No	3	165	21.03.2021	0
175	Moheshpur	SBK	Khalishpur	Komorpara	Mofizul Islam	Shallow	60	2000	individual	Oil	No	5	165	21.03.2021	0
176	Moheshpur	SBK	Khalishpur	Komorpara	Idris Ali	Shallow	65	2000	individual	Oil	No	3	99	21.03.2021	0
177	Moheshpur	SBK	Khalishpur	Komorpara	Ramjan Ali	Shallow	100	2000	individual	Oil	No	1	66	21.03.2021	0
178	Moheshpur	SBK	Khalishpur	Komorpara	Md. Hafizul	Shallow	70	2010	individual	Oil	No	3	165	21.03.2021	0
179	Moheshpur	SBK	Khalishpur	Komorpara	Md. Shaid	Shallow	90	1985	individual	Oil	No	3	231	21.03.2021	0
180	Moheshpur	SBK	Khalishpur	Komorpara	Moshiar	Shallow	90	2020	individual	Oil	No	3	165	21.03.2021	0
181	Moheshpur	SBK	Khalishpur	Komorpara	Monirul	Shallow	90	2000	individual	Oil	No	3	132	21.03.2021	0
182	Moheshpur	SBK	Khalishpur	Komorpara	Md. Shahidul	Shallow	90	1990	individual	Oil	No	3	165	21.03.2021	0
183	Moheshpur	SBK	Khalishpur		Md. Khokon Mia	Shallow	90	2013	individual	Oil	No	3	240	16.03.2021	0
184	Moheshpur	SBK	Khalishpur		Mizanur Rahman	Shallow	90	2011	individual	Oil	No	1	280	16.03.2021	10
185	Moheshpur	SBK	Khalishpur		Raju Mia	Shallow	85	2015	individual	Oil	No	1	120	16.03.2021	0
186	Moheshpur	SBK	Khalishpur		Asadul	Shallow	90	2013	individual	Oil	No	2	170	16.03.2021	1
187	Moheshpur	SBK	Khalishpur		Abu Bakkar	Shallow	90	2012	individual	Oil	No	2	220	16.03.2021	10

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188	Moheshpur	SBK	Khalishpur		Md. Shafiqul	Shallow	80	2001	individual	Oil	No	3	300	16.03.2021	0
189	Moheshpur	SBK	Khalishpur		Md. Mostafa	Shallow	95	2011	individual	Oil	No	2	250	16.03.2021	10
190	Moheshpur	SBK	Khalishpur		Md. Moibul	Shallow	90	2010	individual	Oil	No	3	200	16.03.2021	0
191	Moheshpur	SBK	Khalishpur		Md. Monirul	Shallow	90	2015	individual	Oil	No	1	300	16.03.2021	10
192	Moheshpur	SBK	Khalishpur		Md. Imam Ali	Shallow	80	2015	individual	Oil	No	1	100	16.03.2021	10
193	Moheshpur	SBK	Khalishpur		Md. Sohag	Shallow	95	2010	individual	Oil	No	4	890	16.03.2021	10
194	Moheshpur	SBK	Khalishpur		Md. Toriqul	Shallow	95	2010	individual	Oil	No	3	300	16.03.2021	10
195	Moheshpur	SBK	Bazrapur		Md. Khalek	Shallow	85	2000	individual	Oil	No	2	200	22.03.2021	0
196	Moheshpur	SBK	Bazrapur		Md. Ullas	Shallow	90	2011	individual	Oil	No	1	200	22.03.2021	10
197	Moheshpur	SBK	Bazrapur		Zia	Shallow	82	2016	individual	Oil	No	2	120	22.03.2021	10
198	Moheshpur	SBK	Bazrapur		Md: Oslad	Shallow	92	2013	individual	Oil	No	4	140	22.03.2021	25
199	Moheshpur	SBK	Bazrapur		Moslem	Shallow	85	2017	individual	Oil	No	1	120	22.03.2021	10
200	Moheshpur	SBK	Bazrapur		Idris Ali	Shallow	92	2015	individual	Oil	No	1	180	22.03.2021	25
201	Moheshpur	SBK	Beleghat		Fozur Ali	Shallow	86	2014	individual	Oil	No	1	120	24.03.2021	0
202	Moheshpur	SBK	Beleghat		Bashar	Shallow	90	2014	individual	Oil	No	1	160	24.03.2021	10
203	Moheshpur	SBK	Beleghat		Abdur Rashid	Shallow	85	2015	individual	Oil	No	1	150	24.03.2021	0
204	Shailkupa	Monoharpur	Sondah	Northpara	Md. Saroar Mondal	Shallow	160	2000	individual	Oil	No	90	80	03.05.2021	0
205	Shailkupa	Monoharpur	Sondah	Northpara	Sirajul Islam	Shallow	160	2001	individual	Electricity	No	40	40	03.05.2021	0
206	Shailkupa	Monoharpur	Sondah	Northpara	Hasanuzzaman	Shallow	160	2010	individual	Electricity	No	50	30	03.05.2021	0
207	Shailkupa	Monoharpur	Sondah	Northpara	Saiful Islam	Shallow	160	2000	individual	Electricity	No	40	40	03.05.2021	0
208	Shailkupa	Monoharpur	Sondah	Northpara	Bhadu Biswas	Shallow	160	2000	individual	Electricity	No	40	40	03.05.2021	0
209	Shailkupa	Monoharpur	Sondah	Northpara	Anisur Rahman	Shallow	160	2005	individual	Electricity	No	40	40	03.05.2021	0
210	Shailkupa	Monoharpur	Sondah	Northpara	Ajmir	Shallow	160	2000	individual	Electricity	No	70	40	03.05.2021	0
211	Shailkupa	Monoharpur	Sondah	Northpara	Zahir Alam	Shallow	160	2010	individual	Electricity	No	60	40	03.05.2021	0
212	Shailkupa	Monoharpur	Sondah	Northpara	Bakul Mondal	Shallow	160	2000	individual	Electricity	No	70	40	03.05.2021	10
213	Shailkupa	Monoharpur	Sondah	Northpara	Samsul Islam	Shallow	160	2001	individual	Electricity	No	40	40	03.05.2021	10
214	Shailkupa	Monoharpur	Hitampur	Eastpara	Md. Kaium Ali	Shallow	160	1995	individual	Electricity	No	30	35	25.05.2021	10
215	Shailkupa	Monoharpur	Hitampur	SchoolPara	Md. Indadul Mondal	Shallow	160	2001	individual	Electricity	No	15	20	05.05.2021	0
216	Shailkupa	Monoharpur	Hitampur	SchoolPara	Md. Alfaz Hossain	Shallow	160	2000	individual	Electricity	No	30	40	04.05.2021	0
217	Shailkupa	Monoharpur	Hitampur	SchoolPara	Md. Aiub Ali	Shallow	160	2011	individual	oil	No	15	40	05.05.2021	0
218	Shailkupa	Monoharpur	Hitampur	SchoolPara	Md. Asad	Shallow	160	1990	individual	oil	No	15	20	05.05.2021	0
219	Shailkupa	Monoharpur	Hitampur	SchoolPara	Shapan Shikdar	Shallow	180	2000	individual	Electricity	No	30	40	04.05.2021	0
220	Shailkupa	Monoharpur	Hitampur	SchoolPara	Md. Siddik	Shallow	160	2019	individual	Oil	No	25	40	05.05.2021	0
221	Shailkupa	Monoharpur	Hitampur	Westpara	Md. Momin	Shallow	160	2017	individual	Oil	No	45	40	05.05.2021	0
222	Shailkupa	Monoharpur	Hitampur	Westpara	Md. Shahidul Islam	Shallow	160	2017	individual	Oil	No	15	40	05.05.2021	0
223	Shailkupa	Monoharpur	Hitampur	Westpara	Md. Abul Kalam	Shallow	160	2015	individual	Electricity	No	25	6,000	11.03.2021	0
224	Shailkupa	Monoharpur	Hitampur	Westpara	Md. Nasir Uddin	Shallow	160	2000	individual	Electricity	No	40	1,200	11.03.2021	100
225	Shailkupa	Monoharpur	Hitampur	Westpara	Md. Asadul	Shallow	160	2000	individual	Electricity	No	50	1,000	11.03.2021	0

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
226	Shailkupa	Monoharpur	Hitampur	SchoolPara	Samsul Islam	Shallow	160	2017	individual	oil	No	30	40	05.05.2021	0
227	Shailkupa	Monoharpur	Hitampur	Westpara	Emadad Ali	Shallow	160	2000	individual	Electricity	No	3	240	05.05.2021	25
228	Shailkupa	Monoharpur	Hajramina	Westpara	Md. Khalek Molla	Shallow	160	1993	individual	Oil	No	35	30	05.05.2021	0
229	Shailkupa	Monoharpur	Hajramina	Mathpara	Md. Afaz Mondal	Shallow	160	2010	individual	Oil	No	10	13	05.05.2021	0
230	Shailkupa	Monoharpur	Hajramina	Pondpara	Md.Ruhul Amin	Shallow	160	2018	individual	Oil	No	10	15	05.05.2021	10
231	Shailkupa	Monoharpur	Hajramina	Westpara	Md. Rafiqul Islam	Shallow	160	1995	individual	Oil	No	30	35	05.05.2021	0
232	Shailkupa	Monoharpur	Hajramina	Pondpara	Md. Sohel Rana	Shallow	160	2019	individual	Oil	No	30	35	05.05.2021	0
233	Shailkupa	Monoharpur	Hajramina	Eastpara	Md. Saiful Islam	Shallow	160	2005	individual	Oil	No	30	30	05.05.2021	0
234	Shailkupa	Monoharpur	Hajramina	Westpara	Eusuf Ali	Shallow	160	2020	individual	Oil	No	30	25	05.05.2021	0
235	Shailkupa	Monoharpur	Hajramina	Mathpara	Md. Kabil	Shallow	160	2000	individual	Oil	No	30	20	05.05.2021	0
236	Shailkupa	Monoharpur	Hajramina	Mathpara	Md. Golam Rasul	Shallow	160	1995	individual	Oil	No	5	15	05.05.2021	0
237	Shailkupa	Monoharpur	Hajramina	Westpara	Md. Jalal Molla	Shallow	160	2000	individual	Oil	No	40	30	05.05.2021	0
238	Shailkupa	Monoharpur	Mohisadanga	Sarkarpara	Sri Murari Mohan	Shallow	160	1992	individual	Oil	No	15	25	06.05.2021	0
239	Shailkupa	Monoharpur	Mohisadanga	Westpara	Md. Baharul Islam	Shallow	160	2001	individual	Oil	No	10	10	06.05.2021	0
240	Shailkupa	Monoharpur	Mohisadanga	Northpara	Uzzal Mondal	Shallow	160	2010	individual	Oil	No	5	10	06.05.2021	0
241	Shailkupa	Monoharpur	Mohisadanga	Southpara	Apurba Mondal	Shallow	160	1993	individual	Oil	No	3	6	06.05.2021	0
242	Shailkupa	Monoharpur	Mohisadanga	Sarkarpara	Sri Shumbhu Sarkar	Shallow	160	2000	individual	Oil	No	20	15	06.05.2021	0
243	Shailkupa	Monoharpur	Mohisadanga	Southpara	Sri Laxman Mondal	Shallow	160	2000	individual	Oil	No	10	15	06.05.2021	0
244	Shailkupa	Monoharpur	Mohisadanga	Southpara	Niranjan Mondal	Shallow	160	2011	individual	Oil	No	30	15	06.05.2021	0
245	Shailkupa	Monoharpur	Mohisadanga	Southpara	Ramproshad	Shallow	160	2000	individual	Electricity	No	10	7	06.05.2021	0
246	Shailkupa	Monoharpur	Mohisadanga	Sarkarpara	Parimal Biswas	Shallow	160	1998	individual	Oil	No	20	25	06.05.2021	0
247	Shailkupa	Monoharpur	Mohisadanga	Northpara	Sri Rup Kumar	Shallow	160	2010	individual	Oil	No	10	10	06.05.2021	0
248	Shailkupa	Monoharpur	Damukdia	Eastpara	Md. Anarul Bisaws	Shallow	160	2003	individual	Oil	No	30	40	06.05.2021	0
249	Shailkupa	Monoharpur	Damukdia	Eastpara	Md. Alim Shah	Shallow	160	2006	individual	Oil	No	20	20	06.05.2021	0
250	Shailkupa	Monoharpur	Damukdia	Eastpara	Md. Azam Shah	Shallow	160	2005	individual	Oil	No	20	22	06.05.2021	10
251	Shailkupa	Monoharpur	Damukdia	Westpara	Md. Motiar Rahman	Shallow	160	2002	individual	Oil	No	30	22	06.05.2021	0
252	Shailkupa	Monoharpur	Damukdia	Westpara	Endadul Shekh	Shallow	160	2010	individual	Oil	No	9	10	06.05.2021	0
253	Shailkupa	Monoharpur	Damukdia	Westpara	Md. Atiar Mia	Shallow	160	1995	individual	Oil	No	40	22	06.05.2021	10
254	Shailkupa	Monoharpur	Damukdia	Middlepara	Md. Barik Joardar	Shallow	160	2018	individual	Oil	No	10	10	06.05.2021	0
255	Shailkupa	Monoharpur	Damukdia	Middlepara	Md. Atiar Molla	Shallow	160	1992	individual	Oil	No	10	80	06.05.2021	0
256	Shailkupa	Monoharpur	Damukdia	Middlepara	Md. Rashidul Islam	Shallow	160	1991	individual	Oil	No	18	15	06.05.2021	0
257	Shailkupa	Monoharpur	Damukdia	Middlepara	Md. Shamim	Shallow	160	2016	individual	Oil	No	4	8	06.05.2021	0
258	Shailkupa	Pourasava	Mathpara	Eastpara	Zinnuraine	Shallow	160	1991	individual	Electricity	No	8	320	26.04.2021	0
259	Shailkupa	Pourasava	Mathpara	Eastpara	Rahman Shaikh	Shallow	160	2000	individual	Electricity	No	10	560	26.04.2021	0
260	Shailkupa	Pourasava	Mathpara	Eastpara	Abdul Mazid	Shallow	160	2008	individual	Electricity	No	8	320	26.04.2021	0
261	Shailkupa	Pourasava	Mathpara	Northpara	Musa Uddin	Shallow	160	2012	individual	Electricity	No	7	240	26.04.2021	0
262	Shailkupa	Pourasava	Mathpara	Northpara	Elahi Mondal	Shallow	160	2010	individual	Electricity	No	6	180	26.04.2021	10
263	Shailkupa	Pourasava	Mathpara	Eastpara	Karim Mia	Shallow	160	1995	individual	Electricity	No	8	200	26.04.2021	0

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264	Shailkupa	Pourasava	Mathpara	Eastpara	Motiar Mia	Shallow	160	2014	individual	Electricity	No	5	400	26.04.2021	0
265	Shailkupa	Pourasava	Mathpara	Northpara	Khokon	Shallow	160	2007	individual	Electricity	No	12	500	26.04.2021	0
266	Shailkupa	Pourasava	Mathpara	Northpara	Anwar Hossen	Shallow	160	2005	individual	Electricity	No	12	500	26.04.2021	10
267	Shailkupa	Pourasava	Mathpara	Eastpara	Akmal Mondal	Shallow	160	2009	individual	Electricity	No	7	280	26.04.2021	0
268	Shailkupa	Pourasava	Shampur	Eastpara	Dabir Mondal	Shallow	130	2011	individual	Electricity	No	5	200	27.04.2021	0
269	Shailkupa	Pourasava	Shampur	Eastpara	Motin Mia	Shallow	130	2010	individual	Electricity	No	8	320	27.04.2021	0
270	Shailkupa	Pourasava	Shampur	Northpara	Faruk Mondal	Shallow	130	2006	individual	Electricity	No	7	200	27.04.2021	10
271	Shailkupa	Pourasava	Shampur	Northpara	Rabia Khatun	Shallow	130	2006	individual	Electricity	No	10	400	27.04.2021	0
272	Shailkupa	Pourasava	Shampur	Northpara	Abdur Rashid	Shallow	130	2018	individual	Electricity	No	7	300	27.04.2021	0
273	Shailkupa	Pourasava	Shampur	Northpara	Md. Malek	Shallow	130	2005	individual	Electricity	No	4	200	27.04.2021	10
274	Shailkupa	Pourasava	Shampur	Northpara	Abdur Rab	Shallow	130	2019	individual	Electricity	No	5	200	27.04.2021	0
275	Shailkupa	Pourasava	Shampur	Eastpara	Shafi Mondal	Shallow	130	2001	individual	Electricity	No	5	200	27.04.2021	10
276	Shailkupa	Pourasava	Shampur	Eastpara	Samsher Ali	Shallow	130	2002	individual	Electricity	No	6	400	27.04.2021	0
277	Shailkupa	Pourasava	Shampur	Eastpara	Rafi Mondal	Shallow	130	2001	individual	Electricity	No	8	200	27.04.2021	10
278	Shailkupa	Pourasava	Mathneja	Eastpara	Zahidul Islam	Shallow	160	2001	individual	Electricity	No	4	300	25.04.2021	0
279	Shailkupa	Pourasava	Mathneja	Eastpara	Nuruddin Mondal	Shallow	170	1994	individual	Electricity	No	3	200	25.04.2021	0
280	Shailkupa	Pourasava	Mathneja	Eastpara	Miraj Molla	Shallow	160	2008	individual	Electricity	No	5	200	25.04.2021	0
281	Shailkupa	Pourasava	Mathneja	Eastpara	Shafiuddin	Shallow	160	2006	individual	Electricity	No	5	200	25.04.2021	0
282	Shailkupa	Pourasava	Mathneja	Eastpara	Bellal	Shallow	160	2015	individual	Electricity	No	8	300	25.04.2021	0
283	Shailkupa	Pourasava	Mathneja	Northpara	Md. Aktarul Hossain	Shallow	160	2010	individual	Electricity	No	6	200	25.04.2021	10
284	Shailkupa	Pourasava	Mathneja	Northpara	Ratan Ali	Shallow	160	2004	individual	Electricity	No	6	200	25.04.2021	0
285	Shailkupa	Pourasava	Mathneja	Northpara	Md. Ripon	Shallow	160	2015	individual	Electricity	No	8	360	25.04.2021	0
286	Shailkupa	Pourasava	Mathneja	Eastpara	Md. Shamim Biswas	Shallow	160	2000	individual	Electricity	No	4	180	25.04.2021	0
287	Shailkupa	Pourasava	Mathneja	Eastpara	Md. Faruk Hossain	Shallow	160	2018	individual	Electricity	No	5	200	25.04.2021	0
288	Shailkupa	Pourasava	Char Ausia	Northpara	Habibur Rahman	Shallow	170	2016	individual	Electricity	No	5	400	28.04.2021	0
289	Shailkupa	Pourasava	Char Ausia	Northpara	Joad Hossain	Shallow	160	2011	individual	Electricity	No	9	280	28.04.2021	0
290	Shailkupa	Pourasava	Char Ausia	Northpara	Showkat Mondal	Shallow	170	2015	individual	Electricity	No	6	400	28.04.2021	0
291	Shailkupa	Pourasava	Char Ausia	Northpara	Shamser Ali	Shallow	170	2011	individual	Electricity	No	10	305	28.04.2021	0
292	Shailkupa	Pourasava	Char Ausia	Eastpara	Monnu Mia	Shallow	170	2014	individual	Electricity	No	6	200	28.04.2021	0
293	Shailkupa	Pourasava	Char Ausia	Eastpara	Itahar Ali	Shallow	170	2006	individual	Electricity	No	12	300	28.04.2021	0
294	Shailkupa	Pourasava	Char Ausia	Eastpara	Meser Ali	Shallow	170	2006	individual	Electricity	No	6	180	28.04.2021	0
295	Shailkupa	Pourasava	Char Ausia	Eastpara	Alam	Shallow	170	2011	individual	Electricity	No	8	100	28.04.2021	0
296	Shailkupa	Pourasava	Char Ausia	Eastpara	Tuzam Mondal	Shallow	170	2012	individual	Electricity	No	10	160	28.04.2021	10
297	Shailkupa	Pourasava	Char Ausia	Eastpara	Oliar Rahman	Shallow	170	2012	individual	Electricity	No	12	300	28.04.2021	0
298	Shailkupa	Pourasava	Habibpur	Middlepara	Jahidul	Shallow	75	2010	individual	Oil	No	25	880	31.03.2021	0
299	Shailkupa	Pourasava	Habibpur	Middlepara	Billal	Shallow	70	2021	individual	Oil	No	20	1,200	31.03.2021	0
300	Shailkupa	Pourasava	Habibpur	Middlepara	Sheikh	Shallow	160	2012	individual	Oil	No	15	400	31.03.2021	0
301	Shailkupa	Pourasava	Habibpur	Middlepara	Akram	Shallow	160	2019	individual	Oil	No	10	400	31.03.2021	0

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302	Shailkupa	Pourasava	Habibpur	Middlepara	Najrul Islam	Shallow	150	2009	individual	Electricity	No	100	2,000	31.03.2021	10
303	Shailkupa	Pourasava	Habibpur	Middlepara	Mustak	Shallow	150	2002	individual	Oil	No	21	600	31.03.2021	0
304	Shailkupa	Pourasava	Habibpur	Middlepara	Bacchu	Shallow	160	2000	individual	Oil	No	20	720	31.03.2021	0
305	Shailkupa	Pourasava	Habibpur	Middlepara	Durlov	Shallow	160	2000	individual	Oil	No	15	880	31.03.2021	0
306	Shailkupa	Pourasava	Habibpur	Middlepara	Shafi Mondal	Shallow	160	2005	individual	Oil	No	16	960	31.03.2021	0
307	Shailkupa	Pourasava	Habibpur	Middlepara	Khokon	Shallow	150	1998	individual	Oil	No	8	320	31.03.2021	0
308	Shailkupa	Pourasava	Habibpur	Middlepara	Komol	Shallow	70	2005	individual	Oil	No	8	320	31.03.2021	10
309	Shailkupa	Pourasava	Habibpur	Middlepara	Meser Ali	Shallow	160	2008	individual	Oil	No	12	969	31.03.2021	10
310	Shailkupa	Nittanandapur	Bakshipur	Westpara	Jafar Ali	Shallow	160	2006	individual	Electricity	No	20	920	13.04.2021	0
311	Shailkupa	Nittanandapur	Bakshipur	Westpara	Humaun Alam	Shallow	160	2005	individual	Electricity	No	20	460	13.04.2021	0
312	Shailkupa	Nittanandapur	Bakshipur	Westpara	Monirul Islam	Shallow	160	1995	individual	Electricity	No	33	1,380	13.04.2021	0
313	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Rasel Ali	Shallow	160	2000	individual	Electricity	No	30	800	13.04.2021	0
314	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Lata Biswas	Shallow	160	1993	individual	Electricity	No	30	1,000	13.04.2021	0
315	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Chan Ali Mondal	Shallow	160	1997	individual	Oil	No	15	400	13.04.2021	0
316	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Modhusudan	Shallow	160		individual	Oil	No	25	1,200	13.04.2021	0
317	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Shadhan Kumar	Shallow	160	2002	individual	Oil	No	20	400	13.04.2021	0
318	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Abu Said	Shallow	160	2000	individual	Oil	No	40	1,200	13.04.2021	0
319	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Monnu Hossain	Shallow	160	2010	individual	Oil	No	30	1,000	13.04.2021	0
320	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Ziaur Biswas	Shallow	160	200	individual	Oil	No	25	800	13.04.2021	0
321	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Abu Khan	Shallow	160	1995	individual	Oil	No	40	1,200	13.04.2021	0
322	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Masud Ali	Shallow	160	2007	individual	Oil	No	20	600	13.04.2021	0
323	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Abdur Razzak	Shallow	160	1994	individual	Oil	No	20	400	13.04.2021	0
324	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Wahidul Islam	Shallow	160	1995	individual	Oil	No	40	1,200	13.04.2021	0
325	Shailkupa	Nittanandapur	Gopalpur	Schoolpara	Samapti Afroj Liza	Shallow	160	2000	individual	Oil	No	30	1,600	13.04.2021	0
326	Shailkupa	Nittanandapur	Vandariapara	Westpara	Shukla	Shallow	160	2000	individual	Electricity	No	3	132	11.03.2021	0
327	Shailkupa	Nittanandapur	Vandariapara	Westpara	Sumon	Shallow	160	2005	individual	Electricity	No	4	184	11.03.2021	0
328	Shailkupa	Nittanandapur	Vandariapara	Westpara	Mukto	Shallow	160	2002	individual	Electricity	No	3	200	11.03.2021	0
329	Shailkupa	Nittanandapur	Vandariapara	Westpara	Marium	Shallow	160	1998	individual	Electricity	No	10	230	11.03.2021	0
330	Shailkupa	Nittanandapur	Vandariapara	Westpara	Fazlul Haq	Shallow	160	2005	individual	Electricity	No	5	230	11.03.2021	0
331	Shailkupa	Nittanandapur	Vandariapara	Westpara	Bikash	Shallow	160	2000	individual	Electricity	No	5	200	11.03.2021	0
332	Shailkupa	Nittanandapur	Vandariapara	Westpara	Nurul Amin	Shallow	160	2000	individual	Electricity	No	4	150	11.03.2021	0
333	Shailkupa	Nittanandapur	Vandariapara	Westpara	Shamsul Haq	Shallow	160		individual	Electricity	No	3	132	11.03.2021	0
334	Shailkupa	Nittanandapur	Vandariapara	Westpara	Taposhi	Shallow	166	1990	individual	Electricity	No	5	230	11.03.2021	0
335	Shailkupa	Nittanandapur	Vandariapara	Westpara	Siddique	Shallow	160	1994	individual	Electricity	No	10	230	11.03.2021	0
336	Shailkupa	Nittanandapur	Shekra	Southpara	Nahid	Shallow	160	2017	individual	Oil	No	HSC	400	10.03.2021	0
337	Shailkupa	Nittanandapur	Shekra	Southpara	Milon	Shallow	80	2012	individual	Oil	No	4	230	10.03.2021	0
338	Shailkupa	Nittanandapur	Shekra	Southpara	Montu	Shallow	160	2020	individual	Oil	No	1	99	10.03.2021	0
339	Shailkupa	Nittanandapur	Shekra	Southpara	Rabiul Islam	Shallow	160	1991	individual	Oil	No	0	297	10.03.2021	0

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340	Shailkupa	Nittanandapur	Shekra	Southpara	Jahangir Alam	Shallow	160	2020	individual	Oil	No	25	498	10.03.2021	0
341	Shailkupa	Nittanandapur	Shekra	Southpara	Munjur Hossain	Shallow	160	2005	individual	Oil	No	3	200	10.03.2021	0
342	Shailkupa	Nittanandapur	Shekra	Southpara	Razzak Ali	Shallow	80	2008	individual	Oil	No	5	200	10.03.2021	0
343	Shailkupa	Nittanandapur	Shekra	Southpara	Tofiqul Islam	Shallow	160	2012	individual	Oil	No	20	800	10.03.2021	0
344	Shailkupa	Nittanandapur	Ashurhat	Westpara	Mizanur Mia	Shallow	65	2001	individual	Oil	No	6	231	10.03.2021	0
345	Shailkupa	Nittanandapur	Ashurhat	Westpara	Proshato Mondal	Shallow	80	2006	individual	Oil	No	5	231	10.03.2021	0
346	Shailkupa	Nittanandapur	Ashurhat	Westpara	Azim Shikdar	Shallow	85	2002	individual	Oil	No	5	330	10.03.2021	0
347	Shailkupa	Nittanandapur	Ashurhat	Westpara	Proshanto Biswas	Shallow	80	2001	individual	Oil	No	4	330	10.03.2021	0
348	Shailkupa	Nittanandapur	Ashurhat	Pittopara	Md. Shafi Mia	Shallow	75	2011	individual	Oil	No	1	165	10.03.2021	0
349	Shailkupa	Nittanandapur	Ashurhat	Westpara	Shukhdev Mondal	Shallow	75	2006	individual	Oil	No	1	198	10.03.2021	0
350	Shailkupa	Nittanandapur	Ashurhat	Eastpara	Adhir Baroi	Shallow	90	2000	individual	Oil	No	3	460	10.03.2021	0
351	Shailkupa	Nittanandapur	Ashurhat	Eastpara	SarofUddin	Shallow	150	2000	individual	Oil	No	3	320	10.03.2021	0
352	Shailkupa	Nittanandapur	Ashurhat	Eastpara	Uzzal Baroi	Shallow	110	2005	individual	Oil	No	2	184	10.03.2021	0
353	Shailkupa	Nittanandapur	Ashurhat	Eastpara	Ajel Biswas	Shallow	65	2001	individual	Oil	No	3	250	10.03.2021	0
354	Shailkupa	Nittanandapur	Ashurhat	Eastpara	Arif Mia	Shallow	90	2003	individual	Oil	No	4	598	10.03.2021	0
355	Harinakundu	Pourasava	Srirampur	Northpara	Hasan Mia	Shallow	90	1995	individual	Oil	No	10	495	21.03.2021	0
356	Harinakundu	Pourasava	Srirampur	Northpara	Salim Uddin	Shallow	90	1995	individual	Oil	No	5	330	21.03.2021	25
357	Harinakundu	Pourasava	Srirampur	Northpara	Rashidul Islam	Shallow	90	1994	individual	Oil	No	6	330	21.03.2021	0
358	Harinakundu	Pourasava	Srirampur	Northpara	Chan Ali	Shallow	90	1995	individual	Oil	No	7	330	14.03.2021	0
359	Harinakundu	Pourasava	Srirampur	Northpara	Siddik Rahman	Shallow	100	1999	individual	Oil	No	7	330	21.03.2021	50
360	Harinakundu	Pourasava	Srirampur	Northpara	Milon Uddin	Shallow	90	1995	individual	Oil	No	9	330	21.03.2021	25
361	Harinakundu	Pourasava	Srirampur	Northpara	Kamruzzaman	Shallow	90	1995	individual	Oil	No	15	495	21.03.2021	0
362	Harinakundu	Pourasava	Srirampur	Northpara	Sariful Islam	Shallow	90	2000	individual	Oil	No	7	330	21.03.2021	50
363	Harinakundu	Pourasava	Srirampur	Northpara	Razzak Ali	Shallow	90	1998	individual	Oil	No	7	330	21.03.2021	50
364	Harinakundu	Pourasava	Srirampur	Northpara	Atiar Rahman	Shallow	90	1995	individual	Oil	No	8	330	21.03.2021	10
365	Harinakundu	Pourasava	Srirampur	Northpara	Kausar Ali	Shallow	90	2000	individual	Oil	No	5	330	21.03.2021	0
366	Harinakundu	Pourasava	Srirampur	Northpara	Farid Uddin	Shallow	90	1995	individual	Oil	No	5	265	21.03.2021	10
367	Harinakundu	Pourasava	Srirampur	Northpara	Mohi Uddin	Shallow	90	1989	individual	Oil	No	7	330	21.03.2021	10
368	Harinakundu	Pourasava	Srirampur	Northpara	Akkruzzaman	Shallow	90	2000	individual	Oil	No	7	264	21.03.2021	10
369	Harinakundu	Pourasava	Srirampur	Northpara	Edris Ali	Shallow	90	1999	individual	Oil	No	12	495	22.03.2021	0
370	Harinakundu	Pourasava	Srirampur	Northpara	Alamgir Hossain	Shallow	90	2000	individual	Oil	No	5	264	22.03.2021	12
371	Harinakundu	Pourasava	Srirampur	Southpara	Serajur Islam	Shallow	90	2012	individual	Oil	No	7	264	22.03.2021	0
372	Harinakundu	Pourasava	Parbotipur	Southpara	Ainuddin	Shallow	170	1995	individual	Oil	No	7	330	14.03.2021	0
373	Harinakundu	Pourasava	Parbotipur	Southpara	Najrul Islam	Shallow	160	1995	individual	Oil	No	10	360	14.03.2021	0
374	Harinakundu	Pourasava	Parbotipur	Southpara	Pervez Imam	Shallow	250	1995	individual	electricity	No	50	1350	14.03.2021	0
375	Harinakundu	Pourasava	Parbotipur	Middlepara	Moshiur	Shallow	160	1990	individual	Oil	No	18	660	14.03.2021	0
376	Harinakundu	Pourasava	Parbotipur	Southpara	Hasan Mia	Shallow	200	2000	individual	Oil	No	12	330	14.03.2021	0
377	Harinakundu	Pourasava	Parbotipur	Southpara	Shohel	Shallow	210	1995	individual	Oil	No	25	990	14.03.2021	0

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
378	Harinakundu	Pourasava	Parbotipur	Southpara	Moniruddin	Shallow	200	1990	individual	Oil	No	15	660	14.03.2021	0
379	Harinakundu	Pourasava	Parbotipur	Southpara	Tokon	Shallow	160	2005	individual	Oil	No	12	360	14.03.2021	0
380	Harinakundu	Pourasava	Parbotipur	Southpara	Motaleb	Shallow	160	2002	individual	Oil	No	7	297	14.03.2021	0
381	Harinakundu	Pourasava	Parbotipur	Mondalpara	Palash	Shallow	180	1996	individual	Oil	No	15	660	27.03.2021	0
382	Harinakundu	Pourasava	Parbotipur	Mondalpara	Mojammel	Shallow	140	1995	individual	Oil	No	10	264	27.03.2021	0
383	Harinakundu	Pourasava	Parbotipur	Mondalpara	Aktar Mollic	Shallow	110	2010	individual	Oil	No	18	495	27.03.2021	0
384	Harinakundu	Pourasava	Parbotipur	Mondalpara	Shariful Islam	Shallow	90	2016	individual	Oil	No	12	461	27.03.2021	10
385	Harinakundu	Pourasava	Parbotipur	Mondalpara	Roich Uddin	Shallow	110	2000	individual	Oil	No	10	330	27.03.2021	10
386	Harinakundu	Pourasava	Parbotipur	Mondalpara	Shahidul Islam	Shallow	90	2012	individual	Oil	No	12	195	27.03.2021	10
387	Harinakundu	Pourasava	Parbotipur	mollikpara	Israil	Shallow	120	2007	individual	Oil	No	10	330	27.03.2021	10
388	Harinakundu	Pourasava	Parbotipur	Mondalpara	Golam Faruk	Shallow	110	2014	individual	Oil	No	8	261	27.03.2021	10
389	Harinakundu	Pourasava	Parbotipur	Mondalpara	Shohorab Hossain	Shallow	110	1997	individual	Oil	No	15	825	27.03.2021	0
390	Harinakundu	Pourasava	Parbotipur	mollikpara	Shajibor	Shallow	110	2001	individual	Oil	No	10	330	27.03.2021	0
391	Harinakundu	Pourasava	Harinakundu	tetuliapara	Motiar Rahman	Shallow	160	2000	individual	Oil	No	30	1,000	14.03.2021	10
392	Harinakundu	Pourasava	Harinakundu	Towerpara	Md. Nazmul	Shallow	180	2017	individual	Oil	No	40	1,200	14.03.2021	0
393	Harinakundu	Pourasava	Harinakundu	tetuliapara	Abu Bakkar	Shallow	160	2000	individual	Oil	No	16	720	14.03.2021	0
394	Harinakundu	Pourasava	Harinakundu	Tetultala	Boshir Uddin	Shallow	140	2000	individual	Oil	No	20	1,200	28.03.2021	10
395	Harinakundu	Pourasava	Harinakundu	Tetultala	Monjur Rahman	Shallow	230	2009	individual	Oil	No	10	400	28.03.2021	0
396	Harinakundu	Pourasava	Harinakundu	Tetultala	Shohidul Islam	Shallow	160	2010	individual	Oil	No	12	800	28.03.2021	10
397	Harinakundu	Pourasava	Harinakundu	Tetultala	Shohel Mia	Shallow	165	2009	individual	Oil	No	32	880	28.03.2021	0
398	Harinakundu	Pourasava	Harinakundu	Tetultala	Tony Biswas	Shallow	235	2005	individual	Oil	No	17	920	28.03.2021	10
399	Harinakundu	Pourasava	Harinakundu	Tetultala	Jobed Ali	Shallow	170	1998	individual	Oil	No	12	880	28.03.2021	0
400	Harinakundu	Pourasava	Harinakundu	Tetultala	Rubel	Shallow	165	1989	individual	Oil	No	30	800	28.03.2021	0
401	Harinakundu	Pourasava	Harinakundu	Tetultala	Ja Bokso	Shallow	240	2015	individual	Oil	No	5	330	28.03.2021	10
402	Harinakundu	Pourasava	Harinakundu	Tetultala	Chand Ali	Shallow	150	2016	individual	Oil	No	4	200	28.03.2021	10
403	Harinakundu	Pourasava	Mandaretala	Eastpara	Md. Mintu Islam	Shallow	170	2009	individual	Oil	No	8	200	25.03.2021	0
404	Harinakundu	Pourasava	Mandaretala	Eastpara	Johirul Islam	Shallow	160	1991	individual	Oil	No	10	660	25.03.2021	0
405	Harinakundu	Pourasava	Mandaretala	Middlepara	Robiul Islam	Shallow	160	2002	individual	Oil	No	12	670	25.03.2021	0
406	Harinakundu	Pourasava	Mandaretala	Schoolpara	Shohidul Islam	Shallow	180	1996	individual	Oil	No	10	990	25.03.2021	0
407	Harinakundu	Pourasava	Mandaretala	Eastpara	Akash	Shallow	110	2011	individual	Oil	No	6	198	25.03.2021	0
408	Harinakundu	Pourasava	Mandaretala	Middlepara	Kamrul	Shallow	160	1995	individual	Oil	No	8	330	25.03.2021	0
409	Harinakundu	Pourasava	Mandaretala	Westpara	Shagor Ali	Shallow	160	1998	individual	Oil	No	8	330	25.03.2021	0
410	Harinakundu	Pourasava	Mandaretala	Middlepara	Tofazzel Hossain	Shallow	180	1990	individual	Oil	No	10	660	25.03.2021	0
411	Harinakundu	Pourasava	Mandaretala	Middlepara	Hodder Ali	Shallow	170	1990	individual	Oil	No	10	10	25.03.2021	0
412	Harinakundu	Pourasava	Mandaretala	Middlepara	Habibur Rahman	Shallow	170	2005	individual	Oil	No	10	330	25.03.2021	0
413	Harinakundu	Pourasava	Mandaretala	Eastpara	Biplob Jahan	Shallow	180	2005	individual	Oil	No	10	660	25.03.2021	0
414	Harinakundu	Pourasava	Mandaretala	Middlepara	Rabiul Islam	Shallow	170	2005	individual	Oil	No	10	330	25.03.2021	0
415	Harinakundu	Pourasava	Mandaretala	Middlepara	Abdur Razzak	Shallow	170	2005	individual	Oil	No	10	350	25.03.2021	0

Sl. NO.	Upazila	Union	Village	Para	Name of Well Owner	Type of Irrigation Well	Well Depth (ft)	Year of Installation	Installed by	Operated by	Submercible pump attached?	How many farmers use this water	Coverage of supply area (Decimal)	Sampling Date	Arsenic by FK (ppb)
416	Harinakundu	Pourasava	Mandaretala	Middlepara	Shahidul Islam	Shallow	170	2010	individual	Oil	No	7	330	25.03.2021	0
417	Harinakundu	Pourasava	Kismotpur	Northpara	Shariful Islam	Shallow	90	2000	individual	Oil	No	6	230	21.03.2021	10
418	Harinakundu	Chandpur	Kismotpur	Southpara	Arif Ahmad	Shallow	90	2001	individual	Oil	No	6	280	21.03.2021	0
419	Harinakundu	Chandpur	Kismotpur	Southpara	Md. Shahin	Shallow	90	2005	individual	Oil	No	1	80	21.03.2021	0
420	Harinakundu	Chandpur	Kismotpur	Southpara	Said Hossain	Shallow	90	2021	individual	Oil	No	2	160	22.03.2021	0
421	Harinakundu	Chandpur	Kismotpur	Southpara	Thandu Biswas	Shallow	90	1990	individual	Oil	No	7	120	22.03.2021	0
422	Harinakundu	Chandpur	Kismotpur	Southpara	Jahid Hasan	Shallow	90	1990	individual	Oil	No	7	360	22.03.2021	16
423	Harinakundu	Chandpur	Kismotpur	Southpara	Md. Konok	Shallow	90	1980	individual	Oil	No	1	180	22.03.2021	0
424	Harinakundu	Chandpur	Kismotpur	Southpara	Liakot Ali	Shallow	90	2006	individual	Oil	No	1	180	24.03.2021	10
425	Harinakundu	Chandpur	Kismotpur	Southpara	Md. Kanak	Shallow	90	1990	individual	Oil	No	1	200	22.03.2021	0
426	Harinakundu	Chandpur	Kismotpur	Southpara	Thandu Biswas	Shallow	90	2001	individual	Oil	No	1	40	24.03.2021	0
427	Harinakundu	Chandpur	Kismotpur	Northpara	Bipul Biswas	Shallow	100	1995	individual	Oil	No	3	280	25.03.2021	0
428	Harinakundu	Chandpur	Kismotpur	Northpara	Aiub Ali Biswas	Shallow	90	2020	individual	Oil	No	1	60	25.03.2021	0
429	Harinakundu	Chandpur	Kismotpur	Northpara	Islam Biswas	Shallow	110	1980	individual	Oil	No	1	180	25.03.2021	0
430	Harinakundu	Chandpur	Kismotpur	Northpara	Bablu Mondal	Shallow	90	2004	individual	Oil	No	2	160	25.03.2021	10
431	Harinakundu	Chandpur	Kismotpur	Northpara	Md. Monjur Ali	Shallow	90	2017	individual	Oil	No	7	280	25.03.2021	0
432	Harinakundu	Chandpur	Kismotpur	Northpara	Md. Chand Ali	Shallow	100	2004	individual	Oil	No	12	640	25.03.2021	10
433	Harinakundu	Chandpur	Kismotpur	Northpara	Liton Mia	Shallow	100	2006	individual	Oil	No	12	640	25.03.2021	10
434	Harinakundu	Chandpur	Kismotpur	Northpara	Oliar Rahman	Shallow	90	2018	individual	Oil	No	10	480	25.03.2021	10
435	Harinakundu	Chandpur	Kismotpur	Northpara	Md. Anisur Rahman	Shallow	90	2000	individual	Oil	No	5	200	25.03.2021	0
436	Harinakundu	Chandpur	Talbaria	Southpara	Golzar Uddin	Shallow	160	2005	individual	electricity	No	20	800	24.03.2021	0
437	Harinakundu	Chandpur	Talbaria	Westpara	Saiful Islam	Shallow	160	2010	individual	Oil	No	3	200	24.03.2021	25
438	Harinakundu	Chandpur	Talbaria	Westpara	Majid Ali	Shallow	120	2011	individual	Oil	No	10	400	24.03.2021	10
439	Harinakundu	Chandpur	Talbaria	Westpara	Nasir Malita	Shallow	90	2005	individual	Oil	No	5	120	24.03.2021	10
440	Harinakundu	Chandpur	Talbaria	Westpara	Babul Hasan	Shallow	210	2006	individual	Oil	No	22	760	24.03.2021	25
441	Harinakundu	Chandpur	Talbaria	Westpara	Nikhil Ghos	Shallow	90	2012	individual	Oil	No	1	160	24.03.2021	10
442	Harinakundu	Chandpur	Talbaria	Westpara	Uttam Babu	Shallow	90	2011	individual	Oil	No	1	140	24.03.2021	10
443	Harinakundu	Chandpur	Talbaria	Westpara	Shamim Molla	Shallow	160	1980	individual	Oil	No	3	160	24.03.2021	0
444	Harinakundu	Chandpur	Talbaria	Westpara	Mostafa Mondal	Shallow	160	2008	individual	Oil	No	3	160	24.03.2021	26
445	Harinakundu	Chandpur	Talbaria	Westpara	Naeb Ghos	Shallow	160	1995	individual	Oil	No	3	320	24.03.2021	0
446	Harinakundu	Chandpur	Talbaria	Westpara	Kader Mondal	Shallow	160	2010	individual	Oil	No	30	1,200	24.03.2021	10
447	Harinakundu	Chandpur	Talbaria	Westpara	Indrogit Ghos	Shallow	160	2015	individual	Oil	No	4	160	25.03.2021	0
448	Harinakundu	Chandpur	Talbaria	Westpara	Shariful Islam	Shallow	160	1994	individual	Oil	No	10	400	25.03.2021	0
449	Harinakundu	Chandpur	Chotosarabaria	Westpara	Rezaul Joardar	Shallow	160	2001	individual	Oil	No	30	1,200	29.03.2021	0
450	Harinakundu	Chandpur	Chotosarabaria	Westpara	Nijam Uddin	Shallow	160	2021	individual	Oil	No	6	200	29.03.2021	0
451	Harinakundu	Chandpur	Chotosarabaria	Westpara	Masuduzzaman	Shallow	160	2009	individual	Oil	No	4	200	29.03.2021	0
452	Harinakundu	Chandpur	Chotosarabaria	Westpara	Atiar Rahman	Shallow	160	2017	individual	Oil	No	4	200	29.03.2021	0
453	Harinakundu	Chandpur	Chotosarabaria	Westpara	Kamruzzaman	Shallow	160	1995	individual	Oil	No	7	200	29.03.2021	0

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454	Harinakundu	Chandpur	Chotosarabaria	Westpara	Md. Mosharaf	Shallow	160	2009	individual	Oil	No	12	500	29.03.2021	0
455	Harinakundu	Chandpur	Chotosarabaria	Westpara	Sadar Uddin	Shallow	160	2016	individual	Oil	No	3	280	29.03.2021	0
456	Harinakundu	Chandpur	Chotosarabaria	Westpara	Abdul Mannan	Shallow	165	2001	individual	Oil	No	8	200	29.03.2021	10
457	Harinakundu	Chandpur	Basudebpur	Uttarpara	Robiul Islam	Shallow	95	2008	individual	Oil	No	1	140	24.04.2021	0
458	Harinakundu	Chandpur	Basudebpur	Uttarpara	Munjur Rahman	Shallow	90	210	individual	Oil	No	7	400	24.04.2021	0
459	Harinakundu	Chandpur	Basudebpur	Uttarpara	Bakul Hossain	Shallow	100	1995	individual	Oil	No	7	600	24.04.2021	0
460	Harinakundu	Chandpur	Basudebpur	Uttarpara	Md. Anwar Hossain	Shallow	90	2002	individual	Oil	No	7	10	24.04.2021	0
461	Harinakundu	Chandpur	Basudebpur	Uttarpara	Yunus Ali	Shallow	110	2010	individual	Oil	No	1	320	24.04.2021	0
462	Harinakundu	Chandpur	Basudebpur	Uttarpara	Abdul Kuddus	Shallow	90	1996	individual	Oil	No	1	140	24.04.2021	0
463	Harinakundu	Kapasatia	Binodpur	Westpara	Abdul Mozid	Shallow	90	2020	individual	Oil	No	8	184	31.03.2021	0
464	Harinakundu	Kapasatia	Binodpur	Westpara	Aziz Rahman	Shallow	90	2015	individual	Oil	No	1	92	31.03.2021	25
465	Harinakundu	Kapasatia	Binodpur	Westpara	Najrul Islam	Shallow	100	2015	individual	Oil	No	5	176	31.03.2021	25
466	Harinakundu	Kapasatia	Binodpur	Westpara	Modhu Mia	Shallow	110	2013	individual	Oil	No	3	230	31.03.2021	0
467	Harinakundu	Kapasatia	Binodpur	Westpara	Azad	Shallow	80	1982	individual	Oil	No	3	150	31.03.2021	0
468	Harinakundu	Kapasatia	Binodpur	Westpara	Harun Or Rashid	Shallow	110	2001	individual	Oil	No	16	460	31.03.2021	0
469	Harinakundu	Kapasatia	Binodpur	Westpara	Belal Joardar	Shallow	110	2015	individual	Oil	No	4	138	31.03.2021	0
470	Harinakundu	Kapasatia	Binodpur	Westpara	Alamgir Hossain	Shallow	110	2011	individual	Oil	No	7	276	31.03.2021	0
471	Harinakundu	Kapasatia	Binodpur	Westpara	Md. Mizanur Rahman	Shallow	110	2020	individual	electricity	No	30	920	31.03.2021	0
472	Harinakundu	Kapasatia	Binodpur	Westpara	Israfil Hossen	Shallow	90	2001	individual	Oil	No	12	920	31.03.2021	25
473	Harinakundu	Kapasatia	Binodpur	Westpara	Anarul Islam	Shallow	90	1991	individual	Oil	No	7	184	31.03.2021	0
474	Harinakundu	Kapasatia	Binodpur	Westpara	Nur Nabi	Shallow	100	2011	individual	Oil	No	7	368	31.03.2021	25
475	Harinakundu	Kapasatia	Binodpur	Westpara	Asalot Hossain	Shallow	90	2001	individual	Oil	No	6	240	22.04.2021	10
476	Harinakundu	Kapasatia	Binodpur	Westpara	Ishak Ali	Shallow	100	2012	individual	Oil	No	7	400	22.04.2021	10
477	Harinakundu	Kapasatia	Kullyagacha		Toib Ali	Shallow	90	1990	individual	Oil	No	12	490	22.04.2021	0
478	Harinakundu	Kapasatia	Kullyagacha		Shariful Islam	Shallow	150	1997	individual	Oil	No	5	460	22.04.2021	0
479	Harinakundu	Kapasatia	Kullyagacha		Tutul Biswas	Shallow	200	2020	individual	electricity	No	10	460	22.04.2021	0
480	Harinakundu	Kapasatia	Kullyagacha		Nayeb Ali	Shallow	200	2000	individual	Oil	No	6	322	22.04.2021	0
481	Harinakundu	Kapasatia	Kullyagacha		Parvej Mondal	Shallow	100	1995	individual	Oil	No	8	460	22.04.2021	0
482	Harinakundu	Kapasatia	Kullyagacha		Nazrul Islam	Shallow	90	2000	individual	Oil	No	3	230	22.04.2021	0
483	Harinakundu	Kapasatia	Ghordah		S.M. Shahin	Shallow	110	1990	individual	Oil	No	6	322	20.04.2021	0
484	Harinakundu	Kapasatia	Ghordah		Hafizur Rahman	Shallow	100	2007	individual	Oil	No	4	368	20.04.2021	0
485	Harinakundu	Kapasatia	Ghordah		Eman Ali	Shallow	100	2010	individual	Oil	No	6	230	20.04.2021	0
486	Harinakundu	Kapasatia	Ghordah		Alauddin	Shallow	110	1992	individual	Oil	No	6	340	20.04.2021	0
487	Harinakundu	Kapasatia	Ghordah		Mostafizur Rahman	Shallow	110	1990	individual	electricity	No	8	440	20.04.2021	0
488	Harinakundu	Kapasatia	Ghordah		Balaram	Shallow	190	2003	individual	electricity	No	4	460	20.04.2021	0
489	Harinakundu	Kapasatia	Ghordah		Sohel Rana	Shallow	100	1992	individual	Oil	No	10	460	22.04.2021	0
490	Harinakundu	Kapasatia	Ghordah		Romjan Ali	Shallow	200	1990	individual	Oil	No	4	230	22.04.2021	0
491	Harinakundu	Kapasatia	Ghordah		Abdul Mannan Loskar	Shallow	160	2001	individual	electricity	No	4	920	22.04.2021	0

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492	Harinakundu	Kapasatia	Ghordah		Shahjahan Molla	Shallow	145	2000	individual	Oil	No	2	140	22.04.2021	0
493	Harinakundu	Kapasatia	Ghordah		Shoeb Ali	Shallow	150	2000	individual	Oil	No	3	460	22.04.2021	0
494	Harinakundu	Kapasatia	Ghordah		Ajijul Mondal	Shallow	100	2017	individual	Oil	No	2	140	22.04.2021	0
495	Harinakundu	Kapasatia	Raipara		Rashadul Islam	Shallow	180	2007	individual	Oil	No	12	690	23.04.2021	0
496	Harinakundu	Kapasatia	Raipara		Azizur Rahman	Shallow	135	2000	individual	Oil	No	8	460	23.04.2021	0
497	Harinakundu	Kapasatia	Raipara		Oliar Rahman	Shallow	200	2020	individual	Oil	No	15	1,000	23.04.2021	0
498	Harinakundu	Kapasatia	Raipara		Shimul	Shallow	100	2005	individual	Oil	No	7	350	23.04.2021	0
499	Harinakundu	Kapasatia	Raipara		Masud Rana	Shallow	150	2000	individual	Oil	No	10	460	23.04.2021	0
500	Harinakundu	Kapasatia	Raipara		Mukhlesur Rahman	Shallow	150	2002	individual	Oil	No	5	230	23.04.2021	0

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