A Special Study:
Commercialization of BRRI dhan34 in Kaharol and Birganj Upazilas of Dinajpur District

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20 April 2020

Contents

List of Table

List of Figure

List of Annex

List of Appendix

Acronyms and Abbreviations

AAS	Agricultural Advisory Society
BADC	Bangladesh Agricultural Development Corporation
BINA	Bangladesh Institute of Nuclear Agriculture
Boro	Winter Rice, Transplanting: December-February
BPH	Brown Plant Hopper
BRRI	Bangladesh Rice Research Institute
CCB	Cash Cost Basis
CPI	Consumer Price Index
DAE	Department of Agricultural Extension
FCB	Full Cost Basis
FGD	Focus Group Discussion
GDP	Gross Domestic Product
ha	Hectare
kg	Kilogram
MS Excel	Microsoft Excel
MT	Metric Ton
No.	Number
NSB	National Seed Board of the Ministry of Agriculture
SAAO	Sub-Assistant Agriculture Officer of Department of Agricultural Extension
SPSS	Statistical Package for Social Science
T. Aus	Early Summer Rice, Transplanting: March-April
T.Aman	Late Summer Rice, Transplanting: July-August / September
t/ha	Ton per Hectare
Tk.	Taka(BDT-Bangladesh Currency Taka)
Tk/ha	Taka per Hectare (BDT-Bangladesh Taka)

Acknowledgement

Author expresses his gratefulness to 55 respondent farmers of four villages (Ramchandrapur, Sundail, Gandara and Modonpur villages) in Kaharol and Birganj Upazilas of Dinajpur District for providing relevant data and information for the study during 30-31 December 2019. Author is also grateful to Mr. Anowar Hossain, Director, Anowara Auto Rice Mills, Dinajpur for providing relevant information and data for the study. Without their inputs, support and follow-up feedbacks over cell phonic discussion it would not be possible to this study accomplishment successfully.

I gratefully acknowledge to Mr. Monoranjon Roy, progressive farmer of Ramchandrapur village in Kaharol Upazila of Dinajpur District for his generous support for conducting four focus group discussions (FGD) meetings at four villages in two Upazilas of Dinajpur District and without his generous support this study would not be accomplished. Author is also grateful to Mr. Probir Nath Roy, Proprietor, Araany Enterprise, Dinajpur for his generous support for arranging meeting with Anowara Auto Rice Mills, Dinajpur on 30 December 2019.

Author specially acknowledges to **Mr. Shahjahan Ali**, Seed Technologist and Seed Regulation Specialist for the great contribution in **editing** the report and his contribution is invaluable.

Author specially acknowledge to Mr. Ibrahim Hossain AAS for his great support in data entry, analysis, summary tables preparation and report preparation.

Executive Summary

A study was conducted to assess the performance of BRRI dhan34 on commercial basis in Kaharol and Birganj Upazilas of Dinajpur District for T.Aman season through focus group discussion (FGD) and meeting with an auto rice mills during 30-31 December 2019 by Dr. Harun-Ar-Rashid, Executive Director of Agricultural Advisory Society (AAS).

(a) Total of four FGDs were conducted at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 30-31 December 2019. Total of 55 farmers involved for BRRI dhan34 rice cultivation participated at four FGDs, of which 52 participants (95%) were male farmers and 3 participants (5%) were female farmers.

(b) Total of 3,948 ha land documented for 4,300 farm families at four villages, of which 3,138 ha land (80%) reported under agriculture. Of the total 3,138 ha agriculture land, of which the highest agriculture land reported for Ramchandrapur village (1,215 ha) followed by Modonpur village (810 ha), Sundail village (607 ha) and Gandara village (506 ha). Out of a total of 3,138 ha agriculture land, of which about 2,933 ha of land calculated (94%) under 2019 T.Aman rice cultivation with four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District .

(c) Shortage possible period required for adoption of BRRI dhan34 as large scale cultivation at Gandara village (6 years) followed by Modonpur village (9 years), Ramchandrapur village (10 years) and Sundail village (11 years).

(d) Total of 28 major crops grown at four villages, of which the highest number of crops grown at Ramchandrapur village (10) followed by Modonpur village (7), Gandara village (6) and Sundail village (5). Top three crops grown at four villages and they are according to their rank: Rice (1), Maize (2) and Potato (3).

(e) Total of 13 existing major cropping patterns recorded for four villages, of which the highest number of existing major cropping patterns reported at Ramchandrapur village (5) followed by sundial village (4) and Gandara village/Modonpur village (2). Top two major cropping patterns accounted at four villages and they are (i) T.Aman-Maize and (ii) T.Aman-Boro

(f) Of the total 2,933 ha land reported under four rice varieties at four villages during 2019 T.Aman season, of which the highest proportion of the land area calculated for BRRI dhan34 (79.37%) followed by Swarna (9.58%), BRRI dhan51 (5.80%) and BRRI dhan49 (5.25%). Out of a total of 2,328 ha area recorded for BRRI dhan34 at four villages, of which the highest area calculated for Modonpur village (769 ha) followed by Sundail village (567 ha), Ramchandrapur village (506 ha) and Gandara village (486 ha).

(g) Among the four rice varieties during 2019 T.Aman season, the highest average paddy yield calculated for BRRI dhan51 and Swarna (5.71 t/ha) followed by BRRI dhan49 (5.48 t/ha) and BRRI dhan34 (4.21 t/ha).

(h) Among the four rice varieties during 2019 T.Aman season, the highest average paddy price calculated for BRRI dhan34 (Tk.45.67/kg) followed by BRRI dhan49 (Tk.17.25/kg), BRRI dhan51 (Tk.16.67/kg) and Swarna (Tk.15.77/kg).

(i) Total of four fine and aromatic rice varieties accustomed to cultivate at four villages in Kaharol and Birganj Upazilas of Dinajpur District before large scale introduction of BRRI dhan34 and they are according to their rank: Kataribhog (1), Kalijira (2), Golaobhog (2) and Kalosur (3).

(j) Among the four rice varieties, the highest seed used rate calculated for Swarna (37.65 kg/ha) followed by BRRI dhan51 (30.50 kg/ha), BRRI dhan49 (30.00 kg/ha) and the least seed used rate calculated for BRRI dhan34 (20.00 kg/ha).

(k) Among the three enlisted sources of seed supply for BRRI dhan34, the highest average proportion of seed supplied of BRRI dhan34 during 2019 T.Aman season was calculated for seed dealers (83%) followed by farmers' own saved seed (10%) and other farmers saved seed (7%).

(l) Among the three involved paddy buyers of BRRI dhan34, of which the highest average proportion of paddy is purchased by Arothdar (86%) followed by village Foria (11%) and market foria (3%).

(m) Among the four involved T.Aman rice varieties, of which the highest average proportion of milling outturn calculated for BRRI dhan51 and Swarna (66.21%) followed by BRRI dhan49 (65.88%) and least for BRRI dhan34 (52.92%).

(n) Among the four involved T.Aman rice varieties, of which the highest average retail price of milled rice calculated for BRRI dhan34 (Tk.97.25 kg) followed by BRRI dhan49 and BRRI dhan51 (Tk.26.75/kg) and Swarna (Tk.25.75/kg).

(o) Among the farmers' claimed 16 reasons for large scale cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District, of which the eight reasons (higher sales price of paddy and milled rice, higher yielding than other fine and aromatic rice varieties, no problem with sales of paddy, higher market demand of paddy, good eating taste, good quality polao, khichuri and traditional rice cake can be made, comparatively higher return with BRRI dhan34 than bold rice, and comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties) were observed as top ranking (20) for large scale cultivation of BRRI dhan34 at four villages followed by less fertilizers is required for BRRI dhan34 than bold rice varieties (18), good grains knitting of the panicle (14), easy for threshing the paddy (11), better quality straw as cattle feed (10), low cost of production (9), higher price of straw (8), less number of labor is needed for harvesting/straw is the good material for house roof preparation (3).

(p) Total of eight challenges for commercial cultivation of BRRI dhan34 documented from the respondent farmers of four villages in Kaharol and Birganj Upazilas of Dinajpur District and challenges are: (i) blast disease infection, (ii) delayed in maize sowing due to late harvesting of BRRI dhan34, (iii) cost of production increase due to blast disease infection, (iv) scarcity of labor during transplanting and harvesting of BRRI dhan34, (v) BPH (Brown Plant hoper) infestation, (vi) stem borer infestation, (vii) cost of production increase due to disease infection and insect infestation and (viii) Foot rot disease infection with variable priority for the involved challenges

(q) Total of six suggestions for commercial cultivation of BRRI dhan34 documented from the respondent farmers of four villages in Kaharol and Birganj Upazilas of Dinajpur District and suggestion are: (i) blast disease resistant, short duration and high yielding, fine and aromatic T. Aman rice variety, (ii) diseases and insects resistant, high yielding, fine and aromatic T.Aman rice variety, (iii) quality fungicide against rice blast fungal disease availability in the market, (iv) quality seed of BRRI dhan34 availability in the market, (v) fair price of paddy of BRRI dhan34 during harvesting, and (vi) quality fungicides and insecticides availability in the market

(r) Among the five sources of agricultural advices for fertilizer management, the highest score of rank calculated for own farmer (15) as the source of agricultural advice for fertilizer management followed by other farmers (10), agri-input dealers (4) and none claimed for

such agricultural advice from public extension workers and private extension workers at four villages.

(s) Among the five sources of agricultural advices for seed management, the highest score of rank calculated for own farmer (16) as the source of agricultural advice for seed management followed by agri-input dealers (11), other farmers (8), public extension workers (3) and private extension workers (1).

(t) Among the five sources of agricultural advices for pest management, the highest score of rank calculated for agri-input dealers (20) as the source of agricultural advice for pest management followed by private extension workers (10), other farmers (9), public extension workers (7) and other farmers (6) at four villages in two Upazilas of Dinajpur District.

(u) Among the five sources of agricultural advices for disease management, the highest score of rank calculated for agri-input dealers (14) as the source of agricultural advice for disease management followed by own farmer (8), private extension workers (5), other farmers/public extension workers (4) at four villages.

(v) Among the five sources of agricultural advices for marketing of paddy of BRRI dhan34, the highest score of rank calculated for own farmer (19) as the source of agricultural advice for marketing of paddy of BRRI dhan34 followed by other farmers (7) and none claimed for source agricultural advice from agri-input dealers, public extension workers and private extension workers at four villages.

(w) Among the four rice varieties, the highest gross return calculated for BRRI dhan34 (Tk.219,411/ha) followed by BRRI dhan51 (Tk.125,963/ha), BRRI dhan49 (Tk.124,814/ha) and Swarna (Tk.121,575/ha).

Among the four rice varieties, the highest and positive net-return calculated for BRRI dhan34 (Tk.65,530/ha) on full cost basis. Among the rest three rice varieties, the highest negative net-return calculated for BRRI dhan49/Swarna (-Tk.7,747/ha) followed by BRRI dhan51 (-Tk.6,598/ha) on full cost basis. Among the four rice varieties, the highest net-return calculated for BRRI dhan34 (Tk.141,214/ha) followed by Swarna (Tk.58,905/ha), BRRI dhan51 (Tk.43,460/ha) and BRRI dhan49 (Tk.42,311/ha) on cash cost basis.

Among the eight cost items for four rice varieties cultivation during 2019 T.Aman season, the highest proportion of the average total cost on full cost basis (Tk.139,584/ha) calculated for labor used (34.33%) followed by land rent for T.Aman season (33.20%), crop protection for insects, diseases and weed control (11.41%), fertilizer used for both chemical and organic fertilizers (10.10%), land preparation (4.91%), interest on working capital (4.31%), seed used (1.64%) and supplement irrigation (0.10%).

(x) Paddy of BRRI dhan34 marketing channels as informal system are documented, and they are: (a) farmer→ arothdar→ auto rice mills, (b) farmers→ market foria→ arothdar→ auto rice mills, (c) farmers→ village foria→ arothdar→ auto rice mills, (d) farmers→ village foria→ auto rice mills, and (e) exceptionally auto rice mills buy paddy directly from farmers at village and at the market and they buy some paddy from market foria from the local markets.

For unparboiled milled rice (Atop) of BRRI dhan34 marketing channels, four major flow of marketing channels as informal system are documented, and they are: (a) Auto rice mills→ arothdar→ Bepari→ retailers→ consumers, (b) Auto rice mills→ bepari→ retailers→ consumers, (c) Auto rice mills→companies (Rupchada, Ispahani, ACI, Square, Fresh etc) →own sale centers→consumers, and (d) Auto rice mills→companies (Rupchada, Ispahani, ACI, Square, Fresh etc) →Export. Auto rice mills is found as the hub for marketing of paddy and unparboiled milled rice of BRRI dhan34 in the domestic and export markets.

1. Background

Bangladesh prominently is an agricultural country. Most inhabitants of the country are involved directly in agricultural activities for their livelihood. The sector (agricultural) dominants the economy 13%-14% of country's Gross Domestic Product (GDP. In earlier decades, the sector contributed more than 50% of GDP. Due to gradual transformation of the economy from agriculture to industry and service sector, this has fallen from around 50% in the 1970 to 13.82 % in 2017-2018 and 13.32 % recent year 2018-2019 but it is the single largest manpower engaged in sector. Total of 79 million MT produces harvested with 10 major field crops from 16.65 million hectare of land during 2018-19 cropping seasons, of which the highest proportion of land area observed with rice (70.13%) followed in order by vegetables (5.16%), pulses (4.71%), oilseeds (4.58%), jute (3.91%), spices (3.44%), maize (3.04%), potato (2.82%), wheat (1.98%) and sweet potato (0.23%). Of the total 11.68 million hectare rice land calculated during three rice cropping seasons(Boro, Aman and Aus), of which the highest proportion of rice land calculated during 2019 Aman season (48.15%) followed by 2018-19 Boro season (42.05%) and 2019 Aus season (9.80%). Out of a total of 37.36 million MT of milled rice produced from 11.68 million hectare of land during three rice cropping seasons, of which the highest proportion of milled rice produced during 2018-19 Boro season (54.57%) followed by 2019 Aman season (37.62%) and 2019 Aus season (7.81%). Total of 322 rice varieties approved by the National Seed Board (NSB) for commercial cultivation in Bangladesh, of which 121 rice inbreeds and 201 rice hybrids. Of the total 121 approved rice inbreeds, of which 95 rice inbreeds approved from BRRI, 22 rice inbreds from BINA and 4 from Agricultural Universities. Out of a total of 201 rice hybrids registered and notified by NSB, of which 186 rice hybrids from private sector and 15 rice hybrids from public sector.

BRRI dhan34 is a fine and aromatic rice variety. It is a photo-sensitive variety. Bangladesh Rice Research Institute (BRRI) collected the seed of Khaskani a local fine and aromatic rice variety from Jashore District and then BRRI developed as BRRI dhan34 a fine and aromatic rice variety through using a selection process. National Seed Board approved BRRI dhan34 rice variety for commercial cultivation in the country during T.Aman season from 1997. Good quality polao (fried rice) can be prepared from BRRI dhan34 and similar to Chinigura and Kalijira the fine and aromatic rice varieties. It can produce double yield than the existing fine and aromatic rice varieties in the country. Plant height of BRRI dhan34 is about 117 cm and its growth duration is about 135 days. Its average yield is about 3.5 MT per hectare. This variety is susceptible to Tungro disease (Rice Tungro virus disease).

Rice is Bangladesh's largest crop and the main staple food for 160 million people in the country; it supplies 69.80% of the total caloric intake and more than 58% of the protein intake. Rice production is the largest contributor to farm income, while related trade and commerce are important sources of rural non-farm income. Bangladesh has achieved the self-sufficiency in production of rice. Bangladesh is the third largest rice producer in the world. The rice sector (production) has benefited immensely from green revolution, tripling production in three decades and continuing to play a significant role in employment creation and food security. Its role in the economy is huge both at the macro level and at the micro level given the volume of production, employment (of both men and women in production), trade and processing, food security and nutrition, and potential macro effects on prices, inflation and poverty the large weight of food and rice in the CPI, and potentially on the balance of payments and on the reserves. Rice cultivation accounts for 48 percent of the total rural employment-a figure that is expected to rise even more if rice trading, transport and processing activities are also taken into account. The contribution / share of Agriculture to GDP is around 13-14 percent while its share a national income is one-sixth. Today, more than 13 million farmers grow rice covering some 10.5 million hectares-figures that has generally been stable over the last three decades. Rice production takes place in all districts and in all kinds of agro-ecological zones.

2. Methodology

2.1 Type of study and location

This is an exploratory and explanatory study to assess the performance of BRRI dhan34 on commercial basis in Kaharol and Birganj Upazilas of Dinajpur District during T.Aman season. The study implemented in Kaharol Upazila (Ramchandrapur and Sundail villages), Birganj Upazila (Gandara and Modonpur villages) and Dinajpur Sadar Upazila of Dinajpur District (Figure.I).

2.2 Commercialization of BRRI dhan34

Dinajpur District is one of the important Districts of Bangladesh for producing fine and aromatic rice varieties cultivation during T.Aman season. Recently, BRRI dhan34 has been cultivating in large scale in most of the Upazilas of Dinajpur District, of which BRRI dhan34 has been cultivating on commercial basis from around 2014 T.Aman season in Kaharol and Birganj Upazilas of Dinajpur District.Thus, BRRI dhan34 is found as a profitable crop among farmers in Kaharol and Birganj Upazilas of Dinajpur District during T.Aman season. Mainly, auto rice mills are making profit through processing and marketing of un-parboiled milled rice of BRRI dhan34 for its domestic and export markets through procuring the harvested paddy using their well established existing paddy procurement channels in Dinajpur District. Accordingly, BRRI dhan34 is found as a commercial fine and aromatic rice variety in Dinajpur District.

2.3 Sampling procedure

Two stage sampling procedure was followed to select the sample farmers for this study. At the first stage, two Upazilas(Kaharol and Birganj were purposively selected in Dinajpur District from northern region of Bangladesh on the basis of large scale cultivation status of BRRI dhan34 during T.Aman season. In the second stage, four villages were selected purposively in two selected Upazilas: (a) Kaharol Upazila (Ramchandrapur and Sundail villages) and Birganj Upazila (Gandara and Mohonpur villages) on the basis of availability of large number of BRRI dhan34 growers in the villages for the study.

2.4 Sample size

The number of sample farmers to be selected for the study is an important concern among the researchers and statisticians. However, a total of at least 10 BRRI dhan34 growers involvement per focal group discussion (FGD) purposively decided by the researcher of the study before implementation of four FGDs at four villages in Kaharol and Birganj Upazilas of Dinajpur District.

2.5 Approach for the study

2.5.1 Focus group discussion (FGD)

The relevant data and information were collected from participated 55 respondent farmers at four FGD events at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 30-31 December 2019. FGD is a well established approach to collect data and information for the study and thus researcher used AAS's developed process and approach of FGD along with the relevant implementation strategy. Total of 55 respondent farmers participated and contributed at four FGDs to provide data and information relevant to the study. For these four FGD events, between 10-19 respondent farmers were used for each FGD event as a homogenous of people, who have similar homogenous characteristics such as same professional (farmer) background, same cultural background, similar socio-economic status, within same community with same goal and objectives around BRRI dhan34.

A total of 55 farmers (BRRI dhan34 growers) including three female farmers participated at four villages in two Upazilas of Dinajpur District. These half day long four FGDs were conducted at four villages at three type of venues (Tea stall, Courtyard and Shop) of four selected villages in two Upazilas of Dinajpur District through open discussion at plenary and in participatory manner. During open discussion at plenary, the relevant data/information collected and finalized through validation and documented on the basis of participated farmers' opinion, claim, suggestion, recommendations etc on the provided checklist at four FGDs at four villages. Thus, most of the relevant data and information were collected from 55 respondent farmers through administering four FGDs events at four villages in two Upazilas of Dinajpur District under the facilitation of Dr. Harun-Ar-Rashid, Executive Director, AAS, and FGD-wise venue, type of venue and participants are provided in Table.2.5.1.

Table.2.5.1: Number of participants at four FGD venues and type of venues at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	FGD Venue	Participants (No.)			Type of venue
		Male	Female	Total	
1	Bobita's Tea Stall, Village: Ramchandrapur, Union: Ramchandrapur, Upazila: Kaharol	18	1	19	Tea Stall
2	Laltu Tea Stall, Village: Sundail, Union: Mukundapur, Upazila: Kaharol	9	1	10	Tea Stall
3	Courtyard of Aktar Hossain, Village: Gandara, Union: Bhognagar, Upazila: Birganj	13	0	13	Courtyard
4	Fertilizer Shop, Village: Modonpur, Union: Sujalpur, Upazila: Birganj	12	1	13	Shop
Total		**52**	**3**	**55**	**-**

2.5.2 Meeting with Miller

A face to face meeting was administered with Mr. Anowar Hossain, Director, Anowara Auto Rice Mills on 30 December 2019 and relevant information/data was collected on the procurement of harvested paddy on BRRI dhan34 during T.Aman season from farmers using their existing paddy procurement channels, processing and marketing of milled rice of BRRI dhan34 through their established existing fine and aromatic milled rice marketing channels for the domestic and export markets.

2.6 Data analysis and report preparation

Collected data and information of FGDs were reviewed and clean before calculation and analysis. After review and clean, data/information entered in MS Excel spread sheet and analysis was done using MS Excel and SPSS and finally prepared summary table for report preparation.

Report summarizing costs and returns analysis for the performance of BRRI dhan34 along with BRRI dhan49, BRRI dhan51 and Swarna in Dinajpur District through using the following data categorization and definitions:

(a) Cost of production (Tk./ha) for BRRI dhan34 along with BRRI dhan49, BRRI dhan51 and Swarna during 2019 T.Aman season includes land preparation, labor, seed, organic fertilizer, chemical fertilizer, pesticide, irrigation, land rent, and interest on working capital. The total cost is calculated on full cost basis (FCB) and cash cost basis (CCB) in Tk per hectare.

(i) Full cost basis: 1. Land Preparation, 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent 9. Interest on working capital.

(ii) Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide, 6. Irrigation, 7. Interest on working capital.

(b) Gross return (Tk./ha) is calculated by valuing harvested paddy at local market price along with estimated valuing the harvested straw.

(c) Net-return (Tk./ha) is calculated through subtracting the total cost from the gross return on full cost basis and cash cost basis.

(d) Benefit-cost ratios are calculated through dividing the Gross return by the total cost on full cost basis and cash cost basis.

(e) Paddy yields (t/ha) are calculated from the respondent farmers at four FGDs at four villages.

(f) Paddy production cost (Tk./kg) is calculated through dividing the total cost by the harvested yield in kg per hectare on full cost basis and cash cost basis.

(g) Paddy sale price (Tk./kg) is calculated from the respondent farmers at four FGDs at four villages.

3. Findings

3.1 Respondent at FGD events

Table.3.1 presents the distribution of 55 respondents by sex involved through four focus group discussion (FGD) meetings at four villages in Kaharol and Birganj Upazilas of Dinajpur District in Northwest region of the country. Among the 55 participants, 95% (52 participants) represents as male and 5% (3 participants) represents as female at four villages in two Upazilas of Dinajpur District.

Table.3.1: Number of participants at four FGD villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	Participant (No.)		
		Male	Female	Total
1	Ramchandrapur, Kaharol	18	1	19
2	Sundail, Kaharol	9	1	10
3	Gandara, Birganj	13	0	13
4	Modonpur, Birganj	12	1	13
Total		**52**	**3**	**55**

3.2 Family engaged in agriculture and land information

Table.3.2 provides number of total farm families, number of farm families engaged in agriculture, total land area in hectare and land area in hectare under agriculture for four villages in two Upazilas of Dinajpur District. Total of 4,300 farm families documented for four villages, of which the highest number of farm families documented for Sundail village (2,000) followed by Ramchandrapur village (1,200), Gandara village (600) and Modonpur village (500). All most all families (4,300 farm families) are engaged in agricultural activities in four involved villages in two Upazilas of Dinajpur District.

Total of 3,948 ha land recorded for four villages, of which 3,138 ha (80%) land reported under agriculture. Of the total 3,948 ha total land recorded for four villages, of which the highest land area calculated for Ramchandrapur village (1,579 ha) followed by Mohonpur village (1,012 ha), Sundail village (810 ha) and Gandara village (547 ha). Total of 3,138 ha agriculture land reported for four villages, of which the highest agriculture land calculated for Ramchandrapur village (1,215 ha) followed by Modonpur village (810 ha), Sundail village (607 ha) and Gandara village (506 ha). Among the four villages, the highest proportion of agriculture land was calculated for Gandara village (92.51%) followed by Modonpur village (80.04%), Ramchandrapur village (76.95%) and Sundail village (74.94).

Table.3.2: Number of total family and number of family engaged in agriculture and land information of four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	Family (No.)		%	Land area (ha)		%
		Total	Engaged in Agriculture		Total	Agriculture	
1	Ramchandrapur Kaharol	1,200	1,200	100	1579	1215	76.95
2	Sundail, Kaharol	2,000	2,000	100	810	607	74.94
3	Gandara, Birganj	600	600	100	547	506	92.51
4	Modonpur, Birganj	500	500	100	1012	810	80.04
Total		4,300	4,300	100	3,948	3,138	79.48

3.3 Starting and large scale cultivation year of BRRI dhan34

Table.3.3 shows starting year of cultivation and starting year for large scale cultivation of BRRI dhan34 in four villages of two Upazilas of Dinajpur District. Shortage possible period reported for adoption of BRRI dhan34 as large scale cultivation at Gandara village (6 years) followed by Mohonpur village (9 years), Ramchandrapur village (10 years) and Sundail village (11 years) Earliest stating year of cultivation of BRRI dhan34 reported for Ramchandrapur village (2004) followed by Sundail village (2005), Gandara village (2007) and Mohonpur village (2008). Similarly, earliest stating year for large scale cultivation of BRRI dhan34 reported for gandara village (2013) followed by Ramchandrapur village (2014), Sundail village (2016) and Modonpur village (2017).

Table.3.3: Starting year of cultivation and starting year for large scale cultivation for BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	BRRI dhan34 cultivation status		
		Starting year of cultivation	Starting year of large scale cultivation	Difference (Year)
1	Ramchandrapur, Kaharol	2004	2014	10
2	Sundail, Kaharol	2005	2016	11
3	Gandara, Birganj	2007	2013	6
4	Modonpur, Birganj	2008	2017	9

3.4 Major crops grow and their rank

Table.3.4 presents the list of major crops and their rank at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Total of major 28 crops grown in four villages with replication of involved crops for four villages, of which the highest number of crops grown in Ramchandrapur village (10) followed by Modonpur village (7), Gandara village (6) and Sundail village (5). Total of 10 crops grown in Ramchandrapur village, of which the first rank claimed for Rice (1) followed by Maize (2), Potato (3), Brinjal (4), Onion (5), Wheat (6), Jute (7), Banana (8), Mustard (9) and Bottle gourd (10). Total of five crops grown in Sundail village, of which the first rank claimed for Rice (1) followed by Maize (2), Potato (3), Onion (4) and Garlic (5). Total of six crops grown in Gandara village, of which the first rank claimed for Rice (1) followed by maize (2), Potato (3), Brinjal (4), Cauliflower (5) and Cabbage (6). Total of seven crops grown in Modonpur village, of which the first rank claimed for Rice (1) followed by Maize (2), Potato (3), Mustard (4), Jute (5), Garlic (6) and Onion (7).

Table.3.4: List of major crops cultivation with their rank at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	List of major crops (Accordingly to rank)	Total Crop
1	Ramchandrapur, Kaharol	1. Rice, 2. Maize, 3. Potato, 4. Brinjal, 5. Onion, 6. Wheat, 7. Jute, 8. Banana, 9. Mustard, 10. Bottle gourd	10
2	Sundail, Kaharol	1. Rice, 2. Maize, 3. Potato, 4. Onion, 5. Garlic	5
3	Gandara, Birganj	1. Rice, 2. Maize, 3. Potato, 4. Brinjal, 5. Cauliflower, 6. Cabbage	6
4	Modonpur, Birganj	1. Rice, 2. Potato, 3. Maize, 4. Mustard, 5. Jute, 6. Garlic, 7. Onion	7
Total		**-**	**28**

3.5 Existing major cropping patterns and their rank

Table.3.5 illustrates the major cropping patterns and their rank in four villages in Kaharol and Birganj Upazilas of Dinajpur District. Total of 13 existing major cropping patterns documented for four villages, of which the highest number of existing major cropping patterns reported at Ramchandrapur village (5) followed by Sundail village (4) and gandara village/Modonpur village (2). Total of five existing major cropping patterns reported at Ramchandrapur village, of which the first rank claimed for T.Aman-Maize (1) followed by T.Aman-Boro (2), T.Aman-Potato-T. Aus (3), T.Aman-Potato-Maize (4) and T.Aman-Potato-Jute (5). Total of four existing major cropping patterns reported at Sundail village, of which the first rank claimed for T.Aman-Boro (1) followed by T.Aman-Maize (2), T.Aman-Potato (3) and T.Aman-Onion (4). Total of two existing major cropping patterns reported at Gandara village, of which the first rank claimed for T.Aman-Boro (1) followed by T.Aman Maize (2). Similarly, total of two existing major cropping patterns reported at Modonpur village, of which the first rank claimed for T.Aman-Boro (1) followed by T.Aman-Maize (2).

Table.3.5: List of existing major cropping patterns and their rank at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	Major cropping pattern and rank within parentheses	Total (No.)
1	Ramchandrapur, Kaharol	(i) T.Aman*-Maize (1) (ii) T.Aman*-Boro (2) (iii) T.Aman*-Potato-T.Aus (3) (iv) T.Aman*-Potato-Maize (4) (v) T.Aman*-Potato-Jute (5)	5
2	Sundail, Kaharol	(i) T.Aman*-Boro (1) (ii) T.Aman*-Maize (2) (iii)T.Aman*-Potato (2) (iv) T.Aman*-Onion (4)	4
3	Gandara, Birganj	(i) T.Aman*-Boro (1) (ii) T.Aman*-Maize (2)	2
4	Modonpur, Birganj	(i) T.Aman*-Boro (1) (ii) T.Aman*-Maize (2)	2
Total			**13**

* Highest area under BRRI dhan34 during T.Aman season

3.6 Land area under rice varieties

Table.3.6 provides land area under four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Of the total 2,933 ha land area reported under four rice varieties during 2019 T.Aman season at four villages, of which the highest proportion of the land area calculated for BRRI dhan34 (79.37%) followed by Swarna (9.58%), BRRI dhan51 (5.80%) and BRRI dhan49 (5.25%). Out of a total of 2,933 ha land area reported under four rice varieties, of which the highest land area calculated for BRRI dhan34 (2,328 ha) followed by Swarna (281 ha), BRRI dhan51 (170 ha) and BRRI dhan49 (154 ha). Total of 2,328 ha land area reported for BRRI dhan34 at four villages, of which the highest land area calculated for Modonpur village (769 ha) followed by Sundail village (567 ha), Ramchandrapur village (506 ha) and Gandara village (486 ha). Of the total 154 ha land area documented for BRRI dhan49 at four villages, of which the highest land area calculated for Ramchandrapur village (122 ha) followed by Sundail village (20 ha), Modonpur village (8 ha) and Gandara village (4 ha). Total of 170 ha land area documented for BRRI dhan51 at four villages, of which the highest land area calculated for Ramchandrapur village (142 ha) followed by Sundail village (12 ha), Modonpur village (10 ha) and Gandara village (6 ha). Of the total 281 ha land area documented for Swarna at four villages, of which the highest land area calculated for Ramchandarapur village (243 ha) followed by Modonpur village (20 ha), Gandara village (10 ha) and Sundail village (8 ha).

Table.3.6: Rice variety wise land area of four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season

SL #	Variety	Village					
		Ramchandrapur (ha)	Sundail (ha)	Gandara (ha)	Modonpur (ha)	Total (ha)	%
1	BRRI dhan34	506	567	486	769	2,328	79.37
2	BRRI dhan49	122	20	4	8	154	5.25
3	BRRI dhan51	142	12	6	10	170	5.80
4	Swarna	243	8	10	20	281	9.58
Average		**1,013**	**607**	**506**	**807**	**2,933**	**100.00**

3.7 Paddy yield of rice varieties

Table.3.7 presents the paddy yield (t/ha) of four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Among the four rice varieties, the highest average paddy yield calculated for BRRI dhan51 and Swarna (5.71 t/ha) followed by BRRI dhan49 (5.48 t/ha) and BRRI dhan34 (4.21 t/ha). Of the average calculated 4.21 t/ha paddy yield for BRRI dhan34 at four villages, of which the highest calculated average paddy yield recorded for Modonpur village/Gandara village (4.81 t/ha) followed by Sundail village (3.71 t/ha) and Ramchandrapur village (3.52 t/ha). Of the average calculated 5.48 t/ha paddy yield for BRRI dhan49 at four villages, of which the highest calculated average paddy yield recorded for Modonpur village (6.50 t/ha) followed by Gandara village (6.30 t/ha), Sundail village (4.65 t/ha) and Ramchandrapur village (4.45 t/ha). Of the average calculated 5.71 t/ha paddy yield for BRRI dhan51 at four villages, of which the highest calculated average paddy yield recorded for Modonpur village (6.50 t/ha) followed by Gandara village (6.50 t/ha), Ramchandrapur village (5.19 t/ha) and Sundail village (4.85 t/ha). Of the average calculated 5.71 t/ha paddy yield for

Swarna at four villages, of which the highest calculated average paddy yield recorded for Modonpur village (6.50 t/ha) followed by Gandara village (6.50 t/ha), Ramchandrapur village (5.19 t/ha) and Sundail village (4.85 t/ha).

Table.3.7: Rice variety wise average paddy yield of four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season

SL #	Variety	Village				
		Ramchandrapur (t/ha)	Sundail ((t/ha)	Gandara (t/ha)	Modonpur (t/ha)	Average (t/ha))
1	BRRI dhan34	3.52	3.71	4.81	4.81	4.21
2	BRRI dhan49	4.45	4.65	6.30	6.50	5.48
3	BRRI dhan51	5.19	4.85	6.30	6.50	5.71
4	Swarna	5.19	4.85	6.30	6.50	5.71
Average		**4.54**	**4.26**	**6.02**	**6.17**	**5.25**

3.8 Paddy price of rice varieties

Table.3.8 provides the average paddy price (Tk./kg) for four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Among the four rice varieties, the highest average paddy price calculated for BRRI dhan34 (Tk.45.67/kg) followed by BRRI dhan49 (Tk.17.25/kg), BRRI dhan51 (Tk.16.67/kg) and Swarna (Tk.15.77/kg). Of the average calculated Tk.45.67/kg paddy price for BRRI dhan34 at four villages, of which the highest calculated average paddy price recorded for Gandara village/Modonpur village. (Tk.47.33/kg) followed by Sundail village/Ramchandrapur village (Tk.44.00/kg). Of the average calculated Tk.17.25/kg paddy price for BRRI dhan49 at four villages, of which the highest calculated average paddy price recorded for Ramchandrapur village (Tk.18.67/kg) followed by Modonpur village (Tk.17.33/kg), Gandara village (Tk.17.00/kg) and Sundail village (Tk.16.00/kg). Of the average calculated Tk.16.67/kg paddy price recorded for BRRI dhan51 at four villages, of which the highest calculated average paddy price recorded for Modonpur village (Tk.17.33/kg) followed by Gandara village/Ramchandrapur village (Tk.16.67/kg) and Sundail village (Tk.16.00/kg). Of the average calculated Tk.15.77/kg paddy price recorded for Swarna at four villages, of which the highest calculated average paddy price recorded for Modonpur village/Gandara village (Tk.16.00/kg) followed by Sundail village/Ramchandrapur village (Tk.15.33/kg).

Table.3.8: Average paddy price of four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season

SL #	Variety	Village				
		Ramchandrapur (Tk./Kg.)	Sundail (Tk./Kg.)	Gandara (Tk./Kg.)	Modonpur (Tk./Kg.)	Average (Tk./Kg.)
1	BRRI dhan34	44.00	44.00	47.33	47.33	45.67
2	BRRI dhan49	18.67	16.00	17.00	17.33	17.25
3	BRRI dhan51	16.67	16.00	16.67	17.33	16.67
4	Swarna	15.73	15.33	16.00	16.00	15.77
Average		**23.77**	**22.83**	**24.45**	**24.50**	**23.84**

3.9 Previously cultivated fine and aromatic rice varieties

Table.3.9 presents the list of fine and aromatic rice varieties, those were used to cultivate before introduction of BRRI dhan34 and their rank at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Total of three fine and aromatic rice varieties used to cultivate before introduction of BRRI dhan34 at Ramchandrapur village, of which Kataribhog used to cultivate as rank1 at Ramchandrapur village followed by Kalijira as rank 2 and Kalosur as rank 3. Of the total two fine and aromatic rice varieties used to cultivate before introduction of BRRI dhan34 at Sundail village, of which Kataribhog used to cultivate as rank 1 at Sundail village followed by Kalojira as rank 2. Similarly, total of two fine and aromatic rice varieties used to cultivate before introduction of BRRI dhan34 at Gandara village, of which Kataribhog used to cultivate as rank 1 at Gandara village followed by Kalijira as rank 2. Of the total three fine and aromatic rice varieties used to cultivate before introduction of BRRI dhan34 at Modonpur village, of which Kataribhog used to cultivate as rank 1 at Modonpur village followed by Golabbhog as rank 2 and Kalosur as Rank 3. Total of four fine and aromatic rice varieties used to cultivate at four villages in Kaharol and Birganj Upazilas of Dinajpur District before introduction of BRRI dhan34 and they are according to their rank: Kataribhog (1), Kalijira (2)/ Golabbhog (2) and Kalosur (3).

Table.3.9: List of fine and aromatic rice varieties used to cultivate before introduction of BRRI dhan34 and their rank at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village, Upazila	Fine and aromatic rice variety		
		Rank 1	Rank 2	Rank 3
1	Ramchandrapur, Kaharol	Kataribhog	Kalijira	Kalosur
2	Sundail, Kaharol	Kataribhog	Kalijira	-
3	Gandara, Birganj	Kataribhog	Kalijira	-
4	Modonpur, Birganj	Kataribhog	Golabbhog	Kalosur

3.10 Seed used rate

Table.3.10 provides seed used rate (kg/ha) for four rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Among the four rice varieties, the highest seed used rate calculated for Swarna (37.65 kg/ha) followed by BRRI dhan51 (30.50 kg/ha), BRRI dhan49 (30.00 kg/ha) and the least seed used rate calculated for BRRI dhan34 (20.00 kg/ha). Of the average calculated 20.00 kg/ha seed used rate for BRRI dhan34 at four villages, of which the highest calculated seed used rate observed for Sundail village (22.23 kg/ha) followed by Gandara village (20.22 kg/ha), Modonpur village (19.76 kg/ha) and Ramchandrapur village (17.79 kg/ha). Of the average calculated 30.00 kg/ha seed used rate for BRRI dhan49 at four villages, of which the highest calculated seed used rate observed for Modonpur village (32.15 kg/ha) followed by Gandara village (30.24 kg/ha), Sundail village (30.14 kg/ha) and Ramchandrapur village (27.56 kg/ha). Of the average calculated 30.50 kg/ha seed used rate for BRRI dhan51 at four village, of which the highest calculated seed used rate observed for Modonpur village (32.50 kg/ha) followed by Gandara village (30.75 kg/ha), Sundail village (30.70 kg/ha) and Ramchandrapur village (28.05 kg/ha). Of the average calculated 37.65 kg/ha seed used rate for Swarna at four villages, of which the highest calculated seed used rate observed for Sundail village/Modonpur village (39.50 kg/ha) followed by Gandara village/Ramchandrapur village (35.80 kg/ha).

Table.3.10: Comparative seed used rate (Kg/ha) for four rice varieties during T.Aman season at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village	Seed used rate (Kg/ha)				
		BRRI dhan34	BRRI dhan49	BRRI dhan51	Swarna	Average
1	Ramchandrapur	17.79	27.56	28.05	35.80	27.30
2	Sundail	22.23	30.14	30.70	39.50	30.64
3	Gandara	20.22	30.24	30.75	35.80	29.25
4	Modonpur	19.76	32.15	32.50	39.50	30.98
Average		**20.00**	**30.00**	**30.50**	**37.65**	**24.54**

3.11 Seed sources and availability of BRRI dhan34

Table.3.11 presents sources of seed supply for BRRI dhan34 and source wise its seed availability proportion at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Among the three enlisted sources of seed supply, the highest average proportion of seed supplied of BRRI dhan34 during 2019 T.Aman season calculated for seed dealers (83%) followed by farmers' own saved seed (10%) and other farmers saved seed (7%). Of the total average 83% seed of BRRI dhan34 supplied from seed dealers at four villages, of which the highest proportion of seed supplied from seed dealers at Ramchandrapur village (90%) followed by Modonpur village (88%), Sundail village (80%) and Gandara village (75%). Of the total average 10% seed of BRRI dhan34 supplied from farmer's own saved seed at four villages, of which the highest proportion of seed supplied from farmer's own saved seed at Sundail village (15%) followed by Gandara village/Modonpur village (10%) and Ramchandrapur village (6%). Of the total average 7% seed of BRRI dhan34 supplied from other farmers' saved seed at four villages, of which the highest proportion of seed supplied from other farmers' saved seed at Gandara village (15%) followed by Sundail village (5%), Ramchandrapur village (4%) and Modonpur village (2%).

Table.3.11: Sources for seed of BRRI dhan34 and their seed availability proportion at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season

FGD #	Village	Seed Availability (%)			
		Seed dealer[1/]	Own seed	Other farmer seed	Total
1	Ramchandrapur	90	6	4	100
2	Sundail	80	15	5	100
3	Gandara	75	10	15	100
4	Modonpur	88	10	2	100
Average		**83**	**10**	**7**	**100**

[1/] Seed dealers collect seed of BRRI dhan34 from BADC and private seed companies for selling among the farmers

3.12 Buyers and their proportion of paddy purchasing

Table.3.12 provides type of buyers for paddy of BRRI dhan34 and their proportion of paddy purchasing at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Among three involved paddy buyers of BRRI dhan34, of which the highest average proportion of paddy is purchased by Arothdar (86%) followed by Village Foria (11%) and Market Foria (3%). Of the total average 86% paddy of BRRI dhan34 is purchased by the Arothdars at four villages, of which the highest proportion of paddy is purchased by the Arothdars from Sundail village (96%) followed by Ramchandrapur village (95%), Gandara village (80%) and Modonpur village (75%). Of the total average 3% paddy of BRRI dhan34 is purchased by Market Foria at four villages, of which the highest proportion of paddy is purchased by the Market foria from Modonpur vuillage/Gandara village (5%) followed by Sundail village (2%) and Ramchandrapur village (1%). Of the total average 11% paddy of BRRI dhan34 is purchased by Village Foria at four villages, of which the highest proportion of paddy is purchased by the Village Foria from Modonpur village (20%) followed by Gandara village (15%) and Ramchandrapur village/Sundail village (4%).

Table.3.12: Buyers for paddy of BRRI dhan34 and their proportion of paddy purchasing at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District.

FGD #	Village	Paddy Purchased (%)			
		Arothdar	Market Foria	Village Foria	Total
1	Ramchandrapur	95	1	4	100
2	Sundail	96	2	4	100
3	Gandara	80	5	15	100
4	Modonpur	75	5	20	100
Average		**86**	**3**	**11**	**100**

3.13 Comparative milling outturn and price of milled rice

Table.3.13 shows the comparative proportion of milling outturn and price of milled rice of four T.Aman rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Among the four involved T.Aman rice varieties, of which the highest average proportion of milling outturn calculated for BRRI dhan51 and Swarna (66.2%) followed by BRRI dhan49 (65.88%) and BRRI dhan34 (52.92%). Of the average proportion of milling outturn (52.92%) of BRRI dhan34 at four villages, of which the highest proportion of milling outturn calculated for Ramchandrapur village/Sundail village (53.33%) followed by Modonpur village/Gandara village (52.50%). Of the average proportion of milling outturn (65.88%) of BRRI dhan49 at four villages, of which the highest proportion of milling outturn calculated for Ramchandrapur village/Sundail village (68.00%) followed by Modonpur village (65.00%) and Gandara village (62.50%). Of the average proportion of milling outturn (66.21%) of BRRI dhan51 at four villages, of which the highest proportion of milling outturn calculated for Ramchandrapur village (69.33%) followed by Sundail village (68.00%), Modonpur village (65.00%) and Gandara village (62.50%). Of the average proportion of milling outturn (66.21%)

of Swarna at four villages, of which the highest proportion of milling outturn calculated for Ramchandrapur village (69.33%) followed by Sundail village (68.00%), Modonpur village (65.00%) and Gandara village (62.50%).

Among the four involved T.Aman rice varieties, of which the highest average milled rice retail price calculated for BRRI dhan34 (Tk.97.25/kg) followed by BRRI dhan49/BRRI dhan51 (Tk.26.75/kg) and Swarna (Tk.25.75/kg). Of the average milled rice retail price of BRRI dhan34 (Tk.97.25/kg) of four villages, of which the highest milled rice price calculated for Gandara village (Tk.100/kg) followed by Modonpur village (Tk.98/kg), Sundail village (Tk.96/kg) and Ramchandrapur village (Tk.95/kg). Of the average milled rice retail price of BRRI dhan49 (Tk.26.75/kg) of four villages, of which the highest milled rice price calculated for Ramchandrapur village/Sundail village (Tk.28/kg) followed by Modonpur village (Tk.26/kg) and Gandara village (Tk.25/kg). Similarly of the average milled rice retail price of BRRI dhan51 (Tk.26.75/kg) of four villages, of which the highest milled rice price calculated for Ramchandrapur village/Sundail village (Tk.28/kg) followed by Modonpur village (Tk.26/kg) and Gandara village (Tk.25/kg). Of the average milled rice retail price of Swarna (Tk.25.75/kg) of four villages, of which the highest milled rice price calculated for Ramchandrapur village/Sundail village/Modonpur village (Tk.26/kg) followed by Gandara village (Tk.25/kg).

Table.3.13: Comparative proportion of milling outturn and price of milled rice of four T.Aman rice varieties at four villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village	Milling Outturn (%)					Milled Rice Price (Tk./Kg)				
		BRRI dhan34[1/]	BRRI dhan49[2/]	BRRI dhan51[2/]	Swarna[2/]	Average	BRRI dhan34[1/]	BRRI dhan49[2/]	BRRI dhan51[2/]	Swarna[2/]	Average
	Ramchandrapur	53.33	68.00	69.33	69.33	65.00	95	28	28	26	44.25
2	Sundail	53.33	68.00	68.00	68.00	64.33	96	28	28	26	44.50
3	Gandara	52.50	62.50	62.50	62.50	60.00	100	25	25	25	43.75
4	Modonpur	52.50	65.00	65.00	65.00	61.88	98	26	26	26	44.00
Average		**52.92**	**65.88**	**66.21**	**66.21**	**62.80**	**97.25**	**26.75**	**26.75**	**25.75**	**44.13**

[1/] Un-parboil rice
[2/] Parboil rice

3.14 Reasons for large scale cultivation of BRRI dhan34

Table.3.14 presents the list of 16 reasons and their levels (rank/score) for large scale cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Respondent farmers claimed 16 reasons for large scale cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District of which the eight reasons (higher sales price of paddy and milled rice, higher yielding than other fine and aromatic rice varieties, no problem with sales of paddy, higher market demand of paddy, good eating taste, good quality pilao, khicuri and

traditional rice cake can be made, comparatively higher return with BRRI dhan34 than bold rice and comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties) were observed as top ranking (20) for large scale cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District followed by less fertilizers is required for BRRI dhan34 than bold rice varieties (18), good grains knitting of the panicle (14), easy for threshing the paddy (11), better quality straw as cattle feed (10), low cost of production (9), higher price of straw (8), less number of labor is needed for harvesting/straw is the good material for house roof preparation (3).

Respondent farmers at Ramchandrapur village claimed the highest score for the reasons of higher sales price of paddy and milled rice/higher yielding than other fine and aromatic rice varieties/no problem with sales of paddy/higher market demand of paddy/good eating taste/good quality polao, khichuri and traditional rice cake can be made/comparative higher return with BRRI dhan34 than bold rice/comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties/less fertilizer is required for BRRI dhan34 than bold varieties (5) followed by good grains knitting of the panicle (4) and easy for threshing the paddy /less number of labor is needed for harvesting/low cost of production/better quality straw as cattle feed (3). Respondent farmers did not claim for two reasons at Ramchandrapur village.

Respondent farmers at Sundail village claimed the highest score for the reasons of higher sales price of paddy and rice/higher yielding than other fine and aromatic rice varieties/no problem with sales of paddy/higher market demand of paddy/good eating taste/good quality polao, khichuri and traditional rice cake can be made/comparative higher return with BRRI dhan34 than bold rice/comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties (5) followed by higher price of straw/less fertilizers is required for BRRI dhan34 than bold rice varieties (4) and good grains knitting of the panicle/low cost of production/better quality straw as cattle feed (3). Respondent farmers did not claim for three reasons at Sundail village.

Respondent farmers at Gandara village claimed the highest score for the reasons of higher sales price of paddy and milled rice/higher yielding than other fine and aromatic rice varieties/ no problem with sales of paddy/higher market demand of paddy/good eating taste/good quality polao, khichuni and traditional rice cake can be made/ comparative higher return with BRRI dhan34 than bold rice/comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties/less fertilizers is required for BRRI dhan34 than bold rice varieties (5) followed by easy for threshing the paddy (4) and good grains knitting of the panicle (3). Respondent farmers did not claim for five reasons at Gandara village.

Respondent farmers at Modonpur village claimed the highest score for the reasons of higher sales price of paddy and milled rice/higher yielding than other fine and aromatic rice varieties/no problem with sales of paddy/higher market demand of paddy/good eating taste/good quality polao, khichuri and traditional rice cake can be made/comparative higher return with BRRI dhan34 than bold rice/comparative higher return with BRRI dhan34 than other fine and aromatic rice varieties (5) followed by good grains knitting of the panicle/easy for threshing the paddy/higher price of straw/better quality straw as cattle feed/less fertilizers is required for BRRI dhan34 than bold rice varieties (4) and low cost of production/straw is the good materials for house roof preparation (3). Respondent farmers did not claim for one reason at Modonpur village.

Table.3.14: List of reasons and their levels for large scale cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District

SL #	Reason	Score (1-5 scale)[1/]				
		Ramchandrapur	Sundail	Gandara	Modonpur	Total
1	Higher sales price of paddy and milled rice	5	5	5	5	20
2	Higher yielding than other fine and aromatic rice varieties	5	5	5	5	20
3	Good grains knitting of the panicle	4	3	3	4	14
4	No problem with sales of paddy	5	5	5	5	20
5	Higher market demand of paddy	5	5	5	5	20
6	Easy to threshing the paddy	3	-	4	4	11
7	Less number of labor is needed for harvesting	3	-	-	-	3
8	Good eating taste	5	5	5	5	20
9	Good quality polao, khichuri and traditional rice cake can be made	5	5	5	5	20
10	Comparative higher return than bold rice	5	5	5	5	20
11	Low cost of production	3	3	-	3	9
12	Comparative higher return than other fine and aromatic rice	5	5	5	5	20
13	Higher price of straw	-	4	-	4	8
14	Better quality straw as cattle feed	3	3	-	4	10
15	Straw is the good material for house roof preparation	-	-	-	3	3
16	Less fertilizers is required for BRRI dhan34 than bold rice varieties	5	4	5	4	18

[1/] Scale (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.15 Challenges for cultivation of BRRI dhan34

Table.3.15 provides the list of challenges for cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Respondent farmers of Ramchandrapur village claimed for three challenges for cultivation of BRRI dhan34 during T.Aman season, of which (i) blast disease infection reported as first priority, (ii) delayed in maize sowing due to late harvesting of BRRI dhan34 reported as first priority and (iii) cost of production increase due to blast disease infection reported as third priority. Respondent farmers of Sundail village claimed for three challenges for cultivation of BRRI dhan34 during T.Aman season, of which (i) blast disease infection reported as first priority; (ii) delayed in maize sowing due to late harvesting of BRRI dhan34 reported as second priority, (iii) scarcity of labor during transplanting and harvesting of BRRI dhan34 reported as third priority. Respondent farmers of Gandara village claimed for five challenges for cultivation of BRRI dhan34 during T.Aman season, of which (i) blast disease infection reported as first priority; (ii) BPH (Brown Planthoper) infestation reported as first priority; (iii) stem borer infestation reported as first priority; (iv)

delayed in maize sowing due to late harvesting of BRRI dhan34 during T.Aman season reported as second priority and (v) cost of production increase due to disease infection and insect infestation reported as second priority. Respondent farmers of Modonpur village claimed for four challenges for cultivation of BRRI dhan34 during T.Aman season, of which (i) blast disease infection reported as first priority, (ii) BPH (Brown Planthoper) infestation reported as second priority, (iii) stem borer infestation reported as second priority and foot root disease infection reported as third priority.

Total of eight challenges for cultivation of BRRI dhan34 reported from the respondent farmers of four villages in Kaharol and Birganj Upazilas of Dinajpur District and challenges are: (i) blast disease infection, (ii) delayed in maize sowing due to late harvesting of BRRI dhan34, (iii) cost of production increase due to blast disease infection (iv) scarcity of labor during transplanting and harvesting of BRRI dhan34, (v) BPH (Brown Planthoper) infestation, (vi) Stem borer infestation, (vii) cost of production increase due to disease infection and insect infestation, and (viii) Foot rot disease infection with variable priority for the challenges.

Table.3.15: List of Challenges for cultivation of BRRI dhan34 at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village	Challenges
1	Ramchandrapur	(i) Blast disease infection (1), (ii) Delayed in maize sowing due to late harvesting of BRRI Dhan34 (1), (iii) Cost of production increase due to blast disease infection (3)
2	Sundail	(i) Blast disease infection (1), (ii) Delayed in maize sowing due to late harvesting of BRRI Dhan34 (2), (iii) Scarcity of labor during transplanting and harvesting of BRRI dhan34 (3)
3	Gandara	(i) Blast disease infection (1), (ii) BPH (Brown Planthoper) infestation (1), (iii) Stem borer infestation (1), (iv) Delayed in maize sowing due to late harvesting of BRRI Dhan34 (2), (v) Cost of production increase due to disease infection and insect infestation (2)
4	Modonpur	(i) Blast disease infection (1), (ii) BPH(Brown Planthoper) infestation (2), (iii) Stem borer infection (2), (iv) Foot rot disease infection (3)

[1/] Priority of challenges provided within parenthesis and priority (1-3 scale): 1 = First priority, 2 = Second priority, 3 = Third priority

3.16 Suggestions for commercial cultivation of BRRI dhan34

Table.3.16 presents the list of suggestions for commercial cultivation of BRRI dhan34 at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Total of six suggestions for commercial cultivation of BRRI dhan34 reported from the respondent farmers of four villages in Kaharol and Birganj Upazilas of Dinajpur District and suggestions are: (i) blast disease resistant, short duration and high yielding, fine and aromatic T.Aman rice variety, (ii) quality blasticide availability in the market, (iii) quality seed of BRRI dhan34 availability in the market; (iv) fair price of paddy of BRRI dhan34 during harvesting, (v) quality fungicides and insecticides availability in the market and (vi) diseases and insects resistant, high yielding, fine and aromatic T.Aman rice variety.

Respondent farmers of Ramchandrapur village placed for total of four suggestions for commercial cultivation of BRRI dhan34 during T.Aman season and they are (i) blast disease resistant, short duration and high yielding, fine and aromatic T.Aman rice variety, (ii) quality fungicide against rice blast disease availability in the market, (iii) quality seed of BRRI dhan34 availability in the market and (iv) fair price of paddy of BRRI dhan34 during harvesting.

Respondent farmers of Sundail village placed for total of three suggestions for commercial cultivation of BRRI dhan34 during T.Aman season and they are: (i) blast disease resistant and high yielding, fine and aromatic T.Aman rice variety, (ii) quality fungicides and insecticides availability in the market and (iii) fair price of paddy of BRRI dhan34 during harvesting.

Respondent farmers of Gandara village placed for total of four suggestions for commercial cultivation of BRRI dhan34 during T.Aman season and they are: (i) diseases and insects resistant and high yielding, fine and aromatic T.Aman rice variety, (ii) quality insecticides and fungicides availability in the market, (iii) quality seed of BRRI dhan34 availability in the market and (iv) Fair price of paddy of BRRI dhan34 during harvesting.

Respondent farmers of Modonpur village placed for total of three suggestions for commercial cultivation of BRRI dhan34 during T.Aman season and they are: (i) diseases and insects resistant, high yielding, fine and aromatic T.Aman rice variety; (ii) fair price of paddy of BRRI dhan34 during harvesting and (iii) quality fungicides and insecticides availability in the market.

Table.3.16: List of suggestions for commercial cultivation of BRRI dhan34 at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

FGD #	Village	Suggestions
1	Ramchandrapur	(1) Blast disease resistant, short duration and high yielding, fine and aromatic T.Aman rice variety, (2) Quality fungicide against rice blast disease availability in the market, (3) Quality seed of BRRI dhan34 availability in the market, (4) Fair price of paddy of BRRI dhan34 during harvesting
2	Sundail	(1) Blast disease resistant, short duration and high yielding, fine and aromatic T.Aman rice variety, (2) Quality fungicide and insecticide availability in the market, (3) Fair price of paddy of BRRI dhan34 during harvesting
3	Gandara	(1) Diseases and insects resistant, high yielding, fine and aromatic T.Aman rice variety, (2) Quality insecticides and fungicides availability in the market, (3) Quality seed of BRRI dhan34 availability in the market. (4) Fair price of paddy of BRRI dhan34 during harvesting
4	Modonpur	(1) Diseases and insects resistant, high yielding, fine and aromatic T.Aman rice variety, (2) Fair price of paddy of BRRI dhan34 during harvesting, (3) Quality fungicide and insecticide availability in the market

3.17 Sources of agricultural advice for fertilizer management and their rank

Table.3.17 provides number of villages (FGDs) claimed and scored of ranking for five sources of agricultural advices for fertilizer management at four villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District. Among the five sources of agricultural advices for fertilizer management, of which the highest number of villages claimed for own farmers/other farmers (3) as the sources of agricultural advice for fertilizer management followed by agri-input dealer (2) and none claimed for such agricultural advice for public extension workers and private extension workers at four villages. Among the five sources of agricultural advices for fertilizer management, the highest score of rank calculated for own farmers (15) as the source of agricultural advice for fertilizer management followed by other farmers (10), agri-input dealers (4) and none claimed for such agricultural advice for public extension workers and private extension workers at four villages in two Upazilas of Dinajpur District.

Respondent farmers of Ramchandrapur village claimed for other farmers and own farmers as the sources of agricultural advice for fertilizer management and none claimed for the rest of three sources of agricultural advices. Accordingly, the highest score of rank recorded for other farmers (5) for fertilizer management followed by own farmers (3) and none claimed the rank for the rest of the three sources of agricultural advices for Ramchandrapur village.

Respondent farmers of Sundail village claimed for agri-input dealers, other farmers and own farmers as the sources of agricultural advice for fertilizer management and none claimed for the rest of two sources of agricultural advices. Thus, the highest score of rank recorded for own farmers (4) followed by agri-input dealers/other farmers (2) and none claimed the rank for the rest of two sources of agricultural advices for Sundail village.

Respondent farmers of Gandara village claimed only for own farmers as the source of agricultural advice for fertilizer management and none claimed for the rest of four sources of agricultural advices. Accordingly, the only source of rank recorded for own farmers (4) and none claimed the rank for the rest of four sources of agricultural advices for Gandara village.

Respondent farmers of Modonpur village claimed for agri-input dealers, other farmers and own farmers as the sources of agricultural advice for fertilizer management and none claimed for the rest of two sources of agricultural advices. Accordingly, the highest source of rank recorded for own farmers (4) followed by other farmers (3) and agri-input dealers (2) and none claimed the rank for the rest of two sources of agricultural advices for Modonpur village.

Table.3.17: Sources of advice related to fertilizer management and their rank at 4 villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District

Source of Agricultural Advice	FGD 1		FGD 2		FGD 3		FGD 4		Total	
	Yes	Rank	Yes	Rank	Yes	Rank	Yes	Rank	FGD	Rank
(a) Agri-Input dealers	-	0	✓	2	-	0	✓	2	2	4
(b) Other farmers	✓	5	✓	2	-	0	✓	3	3	10
(c) Public extension workers	-	0	-	0	-	0	-	0	0	0
(d) Private extension workers	-	0	-	0	-	0	-	0	0	0
(e) Own farmers	✓	3	✓	4	✓	4	✓	4	3	15
Total	**2**	**8**	**3**	**8**	**1**	**4**	**3**	**9**	**8**	**29**

FGD1 = Ramchandrapur village, FGD2 = Sundail village, FGD3 = Gandara village, FGD4 = Modonpur village
✱ Rank (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.18 Sources of agricultural advice for seed management and their rank

Table.3.18 presents the number of villages (FGDs) claimed and score of ranking for five sources of agricultural advices for seed management at four villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District. Among the five sources of agricultural advices for seed management, of which the highest number of villages claimed for own farmers (4) as the sources of agricultural advice for seed management followed by agri-input dealers/other farmers (3), public extension workers (2) and private extension workers (1). Among the five sources of agricultural advices for seed management, the highest score of rank calculated for own farmers (16) as the source of agricultural advice for seed management followed by agri-input dealers (11), other farmers (8), Public extension workers (3) and private extension workers (1) at four villages in two Upazilas of Dinajpur District.

Respondent farmers of Ramchandrapur village claimed for all involved five sources of agricultural advice as the sources of agricultural advice for seed management. Accordingly, the highest score of rank reported for other farmers (4) for seed management followed by agri-input dealers/ own farmers (3), public extension workers/private extension workers (1) for Ramchandrapur village.

Respondent farmers of Sundail village claimed for agri-input dealers, other farmers, public extension workers and own farmers as the sources of agricultural advice for seed management and none claimed for private extension workers as a source of agricultural advice. Thus, the highest score of rank reported for agri-input dealers (4) for seed management followed by own farmers (3), other farmers/public extension workers (2) and none claimed for the rank for private extension workers for Sundail village.

Respondent farmers of Gandara village claimed for agri-input dealers, other farmers and own farmers as the sources of agricultural advice for seed management and none claimed for private extension workers as a source of agriculture advice. Accordingly, the highest score of rank reported for own farmers (5) for seed management followed by agri-input dealers (4), other farmers (2) and none claimed for rank for public extension workers and private extension workers for Gandara village.

Respondent farmers of Modonpur village claimed for own farmers as the source of agricultural advice for seed management and none claimed for the rest of four sources of agricultural advices. Thus, the only source of rank reported for own farmers (5) and none claimed the rank for the rest four sources of agricultural advices for Modonpur village.

Table.3.18: Sources of advice related to seed management and their rank at 4 villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District

Source of Agricultural Advice	FGD 1		FGD 2		FGD 3		FGD 4		Total	
	Yes	Rank	Yes	Rank	Yes	Rank	Yes	Rank	FGD	Rank
(a) Agri-Input dealers	✓	3	✓	4	✓	4	-	0	3	11
(b) Other farmers	✓	4	✓	2	✓	2	-	0	3	8
(c) Public extension workers	✓	1	✓	2	-	0	-	0	2	3
(d) Private extension workers	✓	1	-	0	-	0	-	0	1	1
(e) Own farmers	✓	3	✓	3	✓	5	✓	5	4	16
Total	**5**	**12**	**4**	**11**	**3**	**11**	**1**	**5**	**13**	**39**

FGD1 = Ramchandrapur village, FGD2 = Sundail village, FGD3 = Gandara village, FGD4 = Modonpur village

✳ Rank (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.19 Sources of agricultural advice for pest management and their rank

Table.3.19 provides the number of villages (FGDs) claimed and score of ranking for five sources of agricultural advices for pest management at four villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District. Among the five sources of agricultural advices for pest management, of which the highest number of villages (FGDs) claimed for agri-input dealers/public extension workers/private extension workers/own farmers (4) as the sources of agricultural advice for pest management followed by other farmers (3). Among the five sources of agricultural advices for pest management, the highest score of rank calculated for agri-input dealers (20) as the source of agricultural advice for pest management followed by private extension workers (10), other farmers (9), public extension workers (7) and own farmers (6) at four villages in two Upazilas of Dinajpur District.

Respondent farmers of Ramchandrapur village claimed for all involved five sources of agricultural advice as the sources of agricultural advice for pest management. Accordingly, the highest score of rank recorded for agri-input dealers (5) for pest management followed by other farmers (4), own farmers (2) and public extension workers/private extension workers (1) at Ramchandrapur village.

Respondent farmers of Sundail village claimed all involved five sources of agricultural advice as the sources of agricultural advice for pest management. Thus, the highest score of rank recorded for agri-input dealers (5) followed by other farmers/private extension workers (3), public extension workers (2) and own farmers (1) at Sundail village.

Respondent farmers of Gandara village claimed for agri-input dealer, public extension workers, private extension workers and own farmers as the sources of agricultural advice for pest management and none claimed for other farmers as sources of agricultural advice. Thus, the highest score of rank reported for agri-input dealers (5) followed by private extension workers (3), public extension workers (2) and own farmers (1) and none claimed the rank for other farmers as a source of agricultural advice at Gandara village.

Respondent farmers of Modonpur village claimed all involved five sources of agricultural advice as the sources of agricultural advice for pest management. Accordingly, the highest score of rank recorded for agri-input dealers (5) followed by private extension workers (3) and other farmers/public extension workers/own farmers (2) at Modnonpur village.

Table.3.19: Sources of advice related to pest management and their rank at 4 villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District.

Source of Agricultural Advice	FGD 1		FGD 2		FGD 3		FGD 4		Total	
	Yes	Rank	Yes	Rank	Yes	Rank	Yes	Rank	FGD	Rank
(a) Agri-Input dealers	✓	5	✓	5	✓	5	✓	5	4	20
(b) Other farmers	✓	4	✓	3	-	0	✓	2	3	9
(c) Public extension workers	✓	1	✓	2	✓	2	✓	2	4	7
(d) Private extension workers	✓	1	✓	3	✓	3	✓	3	4	10
(e) Own farmers	✓	2	✓	1	✓	1	✓	4	4	6
Total	**5**	**13**	**5**	**14**	**4**	**11**	**5**	**14**	**19**	**52**

FGD1 = Ramchandrapur village, FGD2 = Sundail village, FGD3 = Gandara village, FGD4 = Modonpur village
✳ Rank (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.20 Sources of agricultural advice for disease management and their rank

Table.3.20 presents the number of villages (FGDs) claimed and scored of ranking for five sources of agricultural advices for disease management at four villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District.. Among the five sources of agricultural advices for disease management, of which the highest number of villages claimed for agri-input dealers/public extension workers/private extension workers/own farmers (4) as the sources of agricultural advice for disease management followed by other farmers (3). Among the five sources of agricultural advices for disease management, the highest score of rank claimed for agri-input dealers (14) as the source of agricultural advice for disease management followed by own farmers (8), private extension workers (5), and other farmers/public extension workers (4) at four villages in two Upazilas of Dinajpur District.

Respondent farmers of Ramchandrapur village claimed for all five involved sources of agricultural advice as the sources of agricultural advice for disease management. Accordingly, the highest score of rank reported for own farmer (3) as a source of agricultural advice for disease management followed by agri-input dealers/other farmers/private extension workers (2) and public extension worker (1) at Ramchandrapur village.

Respondent farmers at Sundail village claimed for all five involved sources of agricultural advice as the sources for agricultural advice for disease management. Thus the highest score of rank reported for agri-input dealers (4) as a source of agricultural advice for disease management followed by own farmers (2) and other farmers/public extension workers/private extension workers (1) at Sundail village.

Respondent farmers at Gandara village claimed for agri-input dealers, public extension workers, private extension workers and own farmers as the sources of agricultural advice for disease management and none claimed for other farmers as the source of agricultural advice. Accordingly, the highest score of rank reported for agri-input dealers (4) as a source of agricultural advice for disease management followed by own farmer (2), public extension workers/private extension workers (1) and none claimed for the ranks for other farmers for Gandara village.

Respondent farmers at Modonpur village claimed for all five involved sources of agricultural advice as the source of agricultural advice for disease management. Thus, the highest score of rank reported for agri-input dealers (4) as source of agricultural advice for disease management followed by other farmers/public extension workers/private extension workers/own farmers (1) at Modonpur village.

Table.3.20: Sources of advice related to disease management and their rank at 4 villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District.

Source of Agricultural Advice	FGD 1		FGD 2		FGD 3		FGD 4		Total	
	Yes	Rank	Yes	Rank	Yes	Rank	Yes	Rank	FGD	Rank
(a) Agri-Input dealers	✓	2	✓	4	✓	4	✓	4	4	14
(b) Other farmers	✓	2	✓	1	-	0	✓	1	3	4
(c) Public extension workers	✓	1	✓	1	✓	1	✓	1	4	4
(d) Private extension workers	✓	2	✓	1	✓	1	✓	1	4	5
(e) Own farmers	✓	3	✓	2	✓	2	✓	1	4	8
Total	**5**	**10**	**5**	**9**	**4**	**8**	**5**	**8**	**19**	**35**

FGD1 = Ramchandrapur village, FGD2 = Sundail village, FGD3 = Gandara village, FGD4 = Modonpur village

✳ Rank (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.21 Sources of agricultural advice for marketing of paddy and their rank

Table.3.21 provides the number of villages (FGDs) claimed and scored of ranking for five sources of agricultural advices for marketing of paddy of BRRI dhan34 during 2019 T.Aman season at four villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District.. Among the five sources of agricultural advices for the marketing of paddy of BRRI dhan34, the respondent farmers of four villages claimed for other farmers and own farmers (4) as the sources of agricultural advice for marketing of paddy of BRRI dhan34 and none claimed for such agricultural advice for agri-input dealers, public extension workers and private extension workers. Among the five sources of agricultural advice for the marketing of paddy of BRRI dhan34, of which the highest score of rank calculated for own farmers (19) as the source of agriculture advice for marketing of paddy of BRRI dhan34 followed by other farmers (7) and none claimed for such agricultural advice for agri-input dealers, public extension workers and private extension workers at four villages in two Upazilas of Dinajpur District.

Respondent farmers of Ramchandrapur village claimed for other farmers and own farmers as the source of agricultural advice for marketing of paddy of BRRI dhan34 and none claimed for agri-input dealers, public extension workers and private extension workers as the sources of agricultural advice for marketing of paddy of BRRI dhan34 at Ramchandrapur village. Accordingly, the highest score of rank reported for own farmers (5) for marketing of paddy of BRRI dhan34 followed by other farmers (2) and none claimed the rank for the rest of three sources of agricultural advices for Ramchandrapur village.

Respondent farmers of Sundail village claimed for other farmers and own farmers as the source of agricultural advice for marketing of paddy of BRRI dhan34 and none claimed for agri-input dealers, public extension workers and private extension workers as the sources of agricultural advice for marketing of paddy of BRRI dhan34 at Sundail village. Thus, the highest score of rank reported for own farmer (4) for marketing of paddy of BRRI dhan34 followed by other farmers (2) and none claimed the rank for the rest of three sources of agricultural advices for Sundail village.

Respondent farmers of Gandara village claimed for other farmers and own farmers as the source of agricultural advice for marketing of paddy of BRRI dhan34 and none claimed for agri-inputs dealers, public extension workers and private extension workers as the sources of agricultural advice for marketing of paddy of BRRI dhan34 at Gandara village. Accordingly, the highest score of rank reported for own farmer (5) for marketing of paddy of BRRI dhan34 followed by other farmers (1) and none claimed the rank for the rest of three sources of agricultural advices for Gandara village.

Respondent farmers of Modonpur village claimed for other farmers and own farmers as the source of agricultural advice for marketing of paddy of BRRI dhan34 and none claimed for agri-input dealers, public extension workers and private extension workers as the sources of agricultural advice for marketing of paddy of BRRI dhan34 at Modonpur village. Thus, the highest score of rank reported for own farmers (5) for marketing of paddy of BRRI dhan34 followed by other farmers (2) and none claimed the rank for the rest of the three sources of agricultural advices for Modonpur village.

Table.3.21: Sources of advice related to marketing of paddy of BRRI dhan34 and their rank at 4 villages (4 FGDs) in Kaharol and Birganj Upazilas of Dinajpur District.

Source of Agricultural Advice	FGD 1		FGD 2		FGD 3		FGD 4		Total	
	Yes	Rank	Yes	Rank	Yes	Rank	Yes	Rank	FGD	Rank
(a) Agri-Input dealers	-	0	-	0	-	0	-	0	0	0
(b) Other farmers	✓	2	✓	2	✓	1	✓	2	4	7
(c) Public extension workers	-	0	-	0	-	0	-	0	0	0
(d) Private extension workers	-	0	-	0	-	0	-	0	0	0
(e) Own farmers	✓	5	✓	4	✓	5	✓	5	4	19
Total	**2**	**7**	**2**	**6**	**2**	**6**	**2**	**7**	**8**	**26**

FGD1 = Ramchandrapur village, FGD2 = Sundail village, FGD3 = Gandara village, FGD4 = Modonpur village

✳ Rank (1-5): 1 = Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

3.22 Cost and return of rice varieties

Table.3.22 presents the summary cost and returns, benefit-cost ratios, paddy production cost (Tk./kg), paddy sale price (Tk./kg) and paddy yield (Kg/ha) and Annex. I-IV provides item-wise summary cost and returns of paddy of four rice varieties during 2019 T.Aman season at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Appendix I-VII shows item-wise cost and returns, benefit- cost ratios and paddy production cost (Tk./kg) of four rice varieties at four villages in two Upazilas of Dinajpur District.

Among the four rice varieties, the highest gross return calculated for BRRI dhan34 (Tk.219,411/ha) followed by BRRI dhan51 (Tk.125,963/ha), BRRI dhan49 (Tk.124,814/ha) and Swarna (Tk.121,575/ha). Among the four rice varieties, the highest total cost calculated for BRRI dhan34 (Tk.153,881/ha) followed by Swarna (Tk.139,322/ha) and BRRI dhan49/BRRI dhan51 (Tk.132,561/ha) on full cost basis. Among the four rice varieties, the highest total cost calculated for BRRI dhan49/BRRI dhan51 (Tk.82,503/ha) followed by BRRI dhan34 (Tk.78,197/ha) and Swarna (Tk.62,670/ha) on cash cost basis.

Among the four rice varieties, the highest and positive net-return calculated for BRRI dhan34 (Tk.65,530/ha) on full cost basis. Among the rest three rice varieties, the highest negative net-return calculated for BRRI dhan49/Swarna (-Tk.7,747/ha) followed by BRRI dhan51 (-Tk.6,598/ha) on full cost basis. Among the four rice varieties, the highest net-return calculated for BRRI dhan34 (Tk.141,214/ha) followed by Swarna (Tk.58,905/ha), BRRI dhan51(Tk.43,460/ha) and BRRI dhan49 (Tk.42,311/ha) on cash cost basis.

Among the four rice varieties, the highest and positive benefit-cost ratio calculated for BRRI dhan34 (1:1.43) on full cost basis. Among the rest three rice varieties, the lowest negative benefit-cost ratio calculated for Swarna (1:0.87) followed by BRRI dhan49 (1:0.94) and BRRI dhan51 (1:0.95) on full cost basis. Among the four rice varieties, the highest benefit-cost ratio

calculated for BRRI dhan34 (1:2.81) followed by Swarna (1:1.94), BRRI dhan51 (1:1.53) and BRRI dhan49 (1:1.51) on cash cost basis.

Among the four rice varieties, the highest paddy yield reported for Swarna (5,800 kg/ha) followed by BRRI dhan51 (5,750 kg/ha), BRRI dhan49 (5,500 kg kg/ha) and BRRI dhan34 (4,213 kg/ha). Among the four rice varieties, the highest paddy production cost calculated for BRRI dhan34 (Tk.36.53/kg) followed by BRRI dhan49 (Tk.24.10/kg), Swarna (Tk.24.02/kg) and BRRI dhan51 (Tk.23.05/kg) on full cost basis. Among the four rice varieties, the highest paddy production cost calculated for BRRI dhan34 (Tk.18.56/kg) followed by BRRI dhan49 (Tk.15.00/kg), BRRI dhan51 (Tk.14.35/kg) and Swarna (Tk.10.81/kg) on cash cost basis. Among the four rice varieties, the highest per kg paddy sale price observed for BRRI dhan34 (Tk.46.00/kg) followed by BRRI dhan49 (Tk.17.25/kg), BRRI dhan51 (Tk.16.70/kg) and Swarna (Tk.15.80/kg).

Table.3.22: Summary cost and returns analysis of the four rice varieties during 2019 T.Aman season in Kaharol and Birganj Upazilas of Dinajpur District.

Item	BRRI dhan34	BRRI dhan49	BRRI dhan51	Swarna
Gross return (Tk/ha)	219,411	124,814	125,963	121,575
Total Cost (Tk/ha)				
(i) Full cost basis	153,881	132,561	132,561	139,322
(ii) Cash cost basis	78,197	82,503	82,503	62,670
Net return (Tk/ha)				
(i) Full cost basis	65,530	(7,747)	(6,598)	(7,747)
(ii) Cash cost basis	141,214	42,311	43,460	58,905
Benefit-Cost Ratio				
(i) Full cost basis	1.43	(0.94)	(0.95)	(0.87)
(ii) Cash cost basis	2.81	1.51	1.53	1.94
Yield, Cost & Price (Kg/ha)				
(a) Yield (Kg/ha)	4,213	5,500	5,750	5,800
b) Production Cost (Tk./Kg				
(i) Full cost basis	36.53	24.10	23.05	24.02
(ii) Cash cost basis	18.56	15.00	14.35	10.81
(c) Sale Price (Tk/Kg)	46.00	17.25	16.70	15.80

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

3.23 Proportion of cost item of the average total cost

Table.3.23 Provides item-wise cost proportion of the average total cost (Tk.139,584) on full cost basis for four rice varieties cultivation at four villages in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season. Among the eight cost items for four rice varieties cultivation during 2019 T.Aman season, of which the highest proportion of the average total cost on full cost basis (Tk.139,584/ha) calculated for labor used (34.33%) followed by land rent for T.Aman season (33.20%), crop protection for insects, diseases and weed control (11.41%), fertilizers used for both chemical and organic fertilizers (10.10%), land preparation (4.91%), interest on working capital (4.31%), seed used (1.64%) and supplement irrigation (0.10%). Of the total 10.10% fertilizer cost, of which 7.55% cost for chemical fertilizers and 2.55% cost for organic fertilizer. Out of a total of 11.41% plant protection cost, of which the highest cost calculated for fungicide (6.17%) followed by insecticide (4.70%) and weedicide (0.54%).

Table.3.23: Item-wise cost proportion of the average total cost on full cost basis of four rice varieties in Kaharol and Birganj Upazilas of Dinajpur District.during 2019 T.Aman season

SL #	Cost item	Average cost (Tk./ha)	%
1	Land Preparation	6,849	4.91
2	Labor	47,927	34.33
3	Seed	2,293	1.64
4	Fertilizer	14,098	10.10
	(a) Chemical Fertilizer	10.538	7.55
	(b) Organic Fertilizer	3,560	2.55
5	Crop Protection	15,920	11.41
	a) Insecticide	6,563	4.70
	b) Fungicide etc	8,608	6.17
	c) Weedicide	749	0.54
6	Irrigation	141	0.10
7	Land rent	46,345	33.20
8	Interest on working capital	6,011	4.31
Total		**139,584**	**100**

3.24 Comparative proportion of cost item of total cost

Table.3.24 Presents item-wise comparative cost proportion of the total cost on full cost basis for four rice varieties cultivation during 2019 T.Aman season at four villages in Kaharol and Birganj Upazilas of Dinajpur District. Among the four rice varieties, the highest proportion of cost on land preparation observed for BRRI dhan49/BRRI dhan51 (5.08%) followed by Swarna (4.84%) and BRRI dhan34 (4.67%). Among the four rice varieties, the highest proportion of cost on labor

used observed for Swarna (36.53%) followed by BRRI dhan49/BRRI dhan51 (36.14%) and BRRI dhan34 (29.25%). Among the four rice varieties, the highest proportion of cost on seed used observed for BRRI dhan49/BRRI dhan51 (1.69%) followed by Swarna (1.61%) and BRRI dhan34 (1.58%). Among the four rice varieties, the highest proportion of cost on fertilizers (Organic and Chemical fertilizers) used observed for BRRI dhan49/BRRI dhan51 (10.43%) followed by Swarna (10.27%) and BRRI dhan34 (9.37%). Among the four rice varieties, the highest proportion of cost on chemical fertilizers used observed for BRRI dhan49/BRRI dhan51 (8.18%) followed by Swarna (8.12%) and BRRI dhan34 (5.95%). Among the four rice varieties, the highest proportion of cost on organic fertilizer used observed for BRRI dhan34 (3.42%) followed by BRRI dhan49/BRRI dhan51 (2.26%) and Swarna (2.15%). Among the four rice varieties, the highest proportion of cost on crop protection measure observed for BRRI dhan34 (17.55%) followed by Swarna (10.21%) and BRRI dhan49/BRRI dhan51 (8.47%). Among the four rice varieties, the highest proportion of cost on insecticide used observed for BRRI dhan49/BRRI dhan51 (5.65%) followed by Swarna (5.37%) and BRRI dhan34 (2.47%). Among the four rice varieties, the highest proportion of cost on fungicide used observed for BRRI dhan34 (14.59%) followed by Swarna (4.30%) and BRRI dhan49/BRRI dhan51 (2.26%). Among the four rice varieties, the highest proportion of cost on weedcide used observed for BRRI dhan49/BRRI dhan51 (0.57%) followed by Swarna (0.54%) and BRRI dhan34 (0.49%). Among the four rice varieties, the cost on irrigation as supplemental used observed only for BRRI dhan34 (Tk.562/ha) at Modonpur village in Birganj Upazila of Dinajpur District. Among the four rice varieties, the highest proportion of cost on land rent observed for BRRI dhan49/BRRI dhan51 (33.88%) followed by BRRI dhan34 (32.92%) and Swarna (32.33%). The average proportion of cost on interest on working capital calculated as 4.31% for BRRI dhan34, BRRI dhan49, BRRI dhan51 and Swarna varieties of rice during 2019 T.Aman season.

Table.3.24: Item-wise cost proportion of the total cost on full cost basis of four rice varieties in Kaharol and Birganj Upazilas of Dinajpur District during 2019 T.Aman season

SL #	Cost item	BRRI dhan34		BRRI dhan49		BRRI dhan51		Swarna	
		Amount (Tk/ha)	%	Amount (Tk/ha)	%	Amount (Tk/ha)	%	Amount (Tk/ha)	%
1	Land Preparation	7,186	4.67	6,736	5.08	6,736	5.08	6,736	4.84
2	Labor	45,003	29.25	47,903	36.14	47,903	36.14	50,897	36.53
3	Seed	2,433	1.58	2,246	1.69	2,246	1.69	2,246	1.61
4	Fertilizer	14,416	9.37	13,832	10.43	13,832	10.43	14,312	10.27
	(a) Chemical Fertilizer	9,158	5.95	10,838	8.18	10,838	8.18	11,318	8.12
	(b) Organic Fertilizer	5,258	3.42	2,994	2.26	2,994	2.26	2,994	2.15
5	Crop Protection	27,002	17.55	11,227	8.47	11,227	8.47	14,222	10.21
	a) Insecticide	3,798	2.47	7,485	5.65	7,485	5.65	7,485	5.37
	b) Fungicide etc	22,455	14.59	2,994	2.26	2,994	2.26	5,988	4.30
	c) Weedicide	749	0.49	749	0.57	749	0.57	749	0.54
6	Irrigation	562	0.37	0	0	0	0	0	0
7	Land rent	50,654	32.92	44,909	33.88	44,909	33.88	44,909	32.33
8	Interest on working capital	6,627	4.31	5,708	4.31	5,708	4.31	6,000	4.31
Total		**153,883**	**100**	**132,561**	**100**	**132,561**	**100**	**139,322**	**100**

3.25 Marketing channels for BRRI dhan34

Figure.II illustrates the flows of mapping of paddy and milled rice marketing channels for BRRI dhan34 in Dinajpur District. Auto rice mill is the hub for marketing of paddy and milled rice of BRRI dhan34 in the domestic and export markets. For paddy marketing channels of BRRI dhan34, total of five major flows and one optional flow of marketing channels are documented and they are: (a) Farmers→Arothdar→Auto rice mills, (b) Farmers→Market foria→Arothdar→Auto rice mills, (c) Farmers→Village foria→Arothdar→Auto rice mills, (d) Farmers→Village foria→Auto rice mills, (e) Farmers→Market foria→Auto rice mills and (f) exceptionally auto rice mills buy paddy directly from farmers at the village and at the market. All presented paddy marketing channels for BRRI dhan34 are considered as informal marketing channels in Dinajpur District.

For unparboiled milled rice (Atop rice) of BRRI dhan34 marketing channels, four major flows of marketing channels as informal are documented, and they are: (a) Auto rice mills→ Arothdar→Bapari→Retailers→Consumers, (b) Auto rice mills→Bapari→Retailers→Consumers, (c) Auto rice mills→Companies (Rupchada, Ispahani, ACI, Square, Fresh etc) →Own sale centers→Consumers, and (d) Auto rice mills→Companies (Rupchada, Ispahani, ACI, Square, Fresh etc) →Export markets.

Owners of auto rice mills sell the milled rice of BRRI dhan34 on the basis of production cost, they mainly make profit margin about Tk.2,000 per ton paddy of BRRI dhan34 through selling the by-products (Bran, Polish, Khud, Husk etc) during milling the same. Auto rice mills make moderate profit margin with slow payment system using the existing marketing channels: (a) Auto rice mills→ Arothdar→ Bapari →Retailers→ Consumers and they make low profit margin with good payment system using the existing marketing channels: (b) Auto rice mills→ Companies→Company’s own sale centers→Consumers.

4. Conclusions and Recommendations

4.1 Conclusions

1. BRRI dhan34 is found as a well adopted commercial, fine and aromatic rice variety during T.Aman season in Kaharol and Birganj Upazilas of Dinajpur District.due to its large scale cultivation (about 79% of the total 2019 T.Aman rice area is calculated for BRRI dhan34) in Upazilas of Dinajpur District.

2. BRRI dhan34 is observed as a higher yielding variety (4.21 t/ha) than other available fine and aromatic rice varieties during T.Aman season in Kaharol and Birganj Upazilas of Dinajpur District.

3. Much higher price of paddy of BRRI dhan34 (Tk.46/kg) is documented than non fine and aromatic bold rice varieties during 2019 T.Aman season in Dinajpur District.

4. High market demand for the paddy of BRRI dhan34 is observed in Dinajpur District using the existing market channels for the paddy.

5. BRRI dhan34 is highly adopted in Kaharol and Birganj Upazilas of Dinajpur District through fitting with two major cropping patterns: (a) T.Aman-Boro & (b) T.Aman-Maize.

6. Good quality Polao, Khichuri and traditional cake (Pitha) can be made from BRRI dhan34 with good taste.

7. Higher gross return and net-returns on full cost basis and cash cost basis are observed for BRRI dhan34 than other fine and aromatic rice and non aromatic bold rice

8. BRRI dhan34 cultivation is found as labor intensive and higher cost for labor use (29% labor cost of the total cost) and over all costly.

9. Auto rice mill is found as the hub for marketing of paddy and milled rice of BRRI dhan34 and several existing marketing channels are documented for paddy and milled rice in Dinajpur District.

10. Among the documented challenges for cultivation of BRRI dhan34, the susceptibility to blast disease is found as a crucial challenge and calculated as much as 15% cost of the total cost that farmer's need to pay for managing blast disease for cultivation of BRRI dhan34.

11. Total of four FGDs implemented for the study and which is found very small number to make solid conclusion and recommendation for the same.

4.2 Recommendations

1. Blast disease resistant in particular, diseases and insects resistant, short duration, high yielding, fine and aromatic rice variety need to be developed for T.Aman season.

2. Quality fungicide, insecticide, and weedicide against rice blast disease, insect-pests and weeds need to make available in general in the market through existing pesticide marketing network in the country.

3. Quality seed of BRRI dhan34 need to make available in the market through established public and private rice seed marketing network in the country.

4. Fair price of paddy of BRRI dhan34 need to make ensure during harvesting under its large scale production through motivation of the relevant value chain actors of fine and aromatic rice, giving especial emphasis on auto rice millers for domestic and export markets.

5. Contact between SAAOs of DAE and farmers one way and SAAOs of DAE and Pesticides (Fungicide, Insecticide, Weedicide) dealers in another way need to be enhanced for plant health management in general and blast disease management for BRRI dhan34 in particular.

6. At least 30 FGDs need to be conducted in top 10 BRRI dhan34 growing District in the country for such kind of study to make solid conclusions and recommendations.

Figure. I: Location Map of Dinajpur District

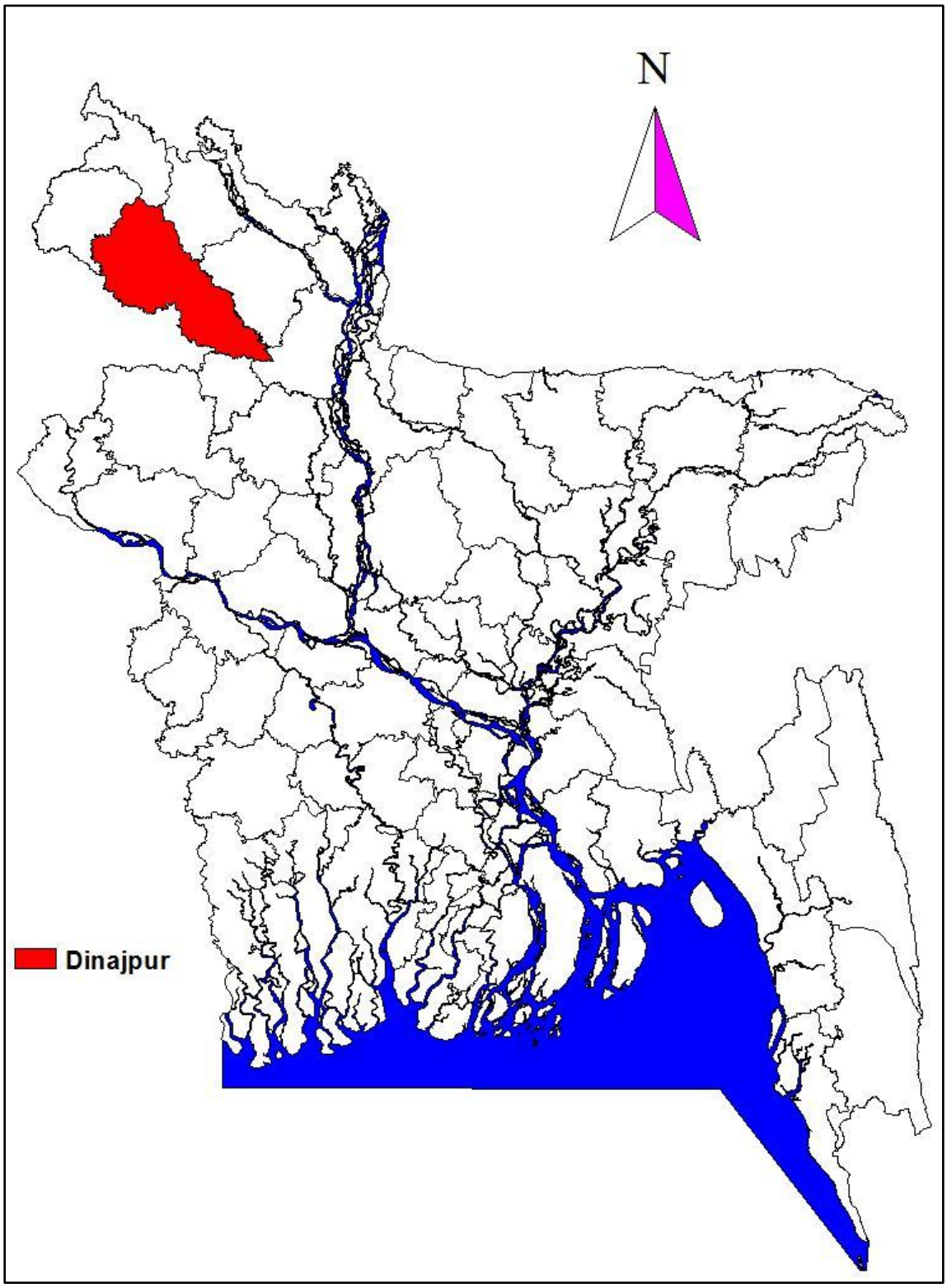
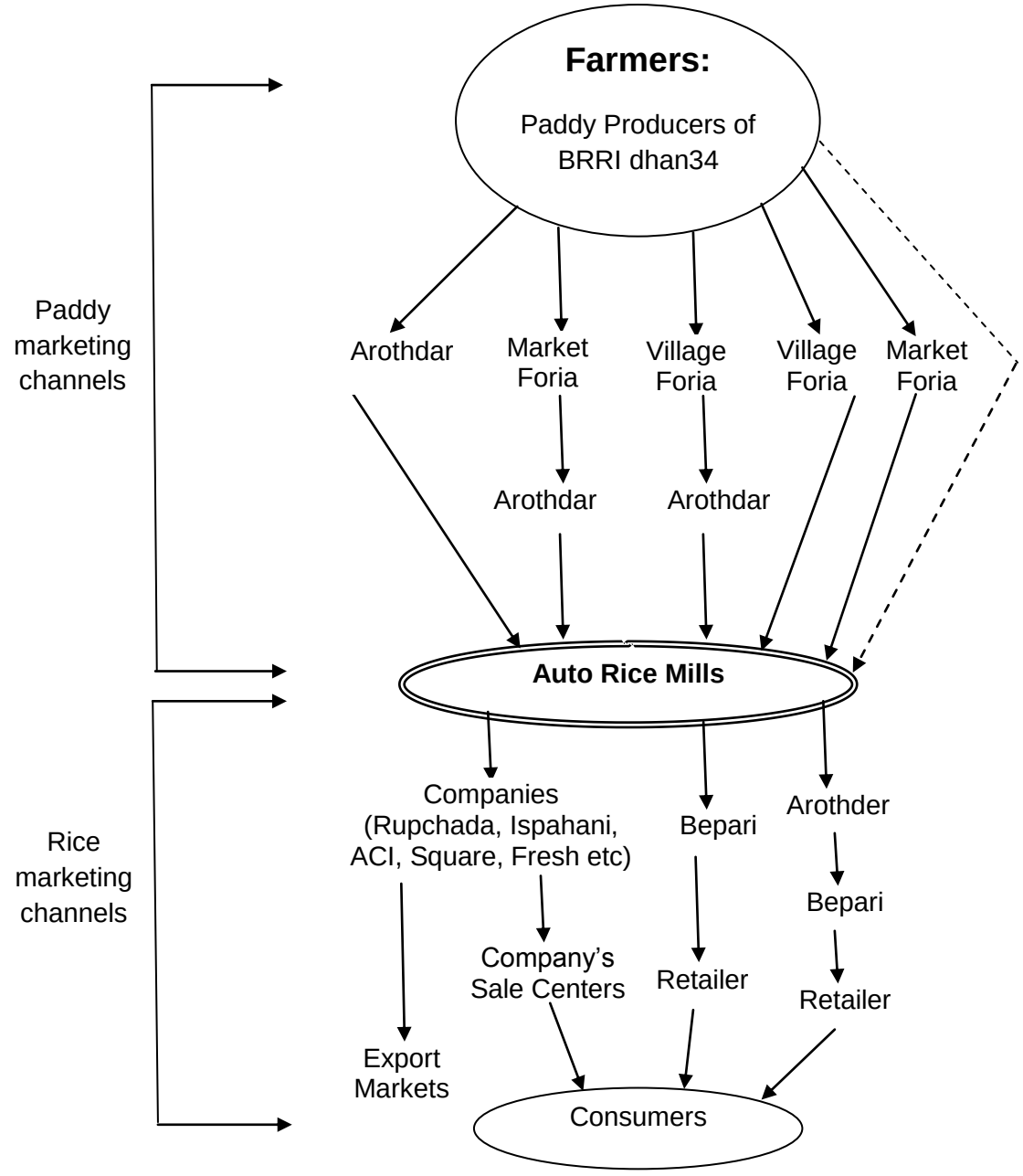


Figure II: Flows of Mapping of paddy and milled rice marketing channels for BRRI dhan34 in Dinajpur District



Annex.I: Summary cost and return analysis of BRRI Dhan34 during 2019 T.Aman season at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

SL #	Item	Average Cost-return (Tk/ha)
1	Land Preparation	7,186
2	Labor	45,003
3	Seed	2,433
4	Fertilizer	14,416
5	Crop Protection	27,002
6	Irrigation	562
7	Land rent	50,654
8	Interest on working capital	
	a) Full cost basis	6,627
	b) Cash cost basis	3,368
	Total Cost (A)	
	a) Full cost basis	153,881
	b) Cash cost basis	78,197
B. Gross and Net return:		
	Gross return (Tk./ha)	
	a) Main product	193,775
	b) By-product	25,636
	Total Gross return (Tk./ha)	219,411
	Net return (Tk./ha)	
	a) Full cost basis	65,530
	b) Cash cost basis	141,214
C. Benefit-Cost Ratio		
	a) Full cost basis	1.43
	b) Cash cost basis	2.81
D. Yield, cost & price		
	(a) Paddy Yield (Kg/ha)	4,213
	(b) Paddy Production Cost (Tk./kg)	
	a) Full cost basis	36.53
	b) Cash cost basis	18.56
	(c) Paddy Sale Price (Tk/kg)	46.00

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Annex.II: Summary cost and return analysis of BRRI Dhan49 during 2019 T.Aman season at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

SL #	Item	Average Cost-return (Tk/ha)
1	Land Preparation	6,736
2	Labor	47,903
3	Seed	2,246
4	Fertilizer	13,832
5	Crop Protection	11,227
6	Irrigation	-
7	Land rent	44,909
8	Interest on working capital	
	a) Full cost basis	5,708
	b) Cash cost basis	3,553
	Total Cost (A)	
	a) Full cost basis	132,561
	b) Cash cost basis	82,503
B. Gross and Net return:		
	Gross return (Tk./ha)	
	a) Main product	94,875
	b) By-product	29,939
	Total Gross return (Tk./ha)	124,814
	Net return (Tk./ha)	
	a) Full cost basis	(7,747)
	b) Cash cost basis	42,311
C. Benefit-Cost Ratio		
	a) Full cost basis	(0.94)
	b) Cash cost basis	1.51
D. Yield, cost & price		
	(a) Paddy Yield (Kg/ha)	5,500
	(b) Paddy Production Cost (Tk./kg)	
	a) Full cost basis	24.10
	b) Cash cost basis	15.00
	(c) Paddy Sale Price (Tk/kg)	17.25

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Annex.III: Summary cost and return analysis of BRRI Dhan51 during 2019 T.Aman season at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

SL #	Item	Average Cost-return (Tk/ha)
1	Land Preparation	6,736
2	Labor	47,903
3	Seed	2,446
4	Fertilizer	13,832
5	Crop Protection	11,227
6	Irrigation	-
7	Land rent	44,909
8	Interest on working capital	
	a) Full cost basis	5,708
	b) Cash cost basis	3,553
	Total Cost (A)	
	a) Full cost basis	132,561
	b) Cash cost basis	82,503
B. Gross and Net return:		
	Gross return (Tk./ha)	
	a) Main product	96,025
	b) By-product	29,939
	Total Gross return (Tk./ha)	125,963
	Net return (Tk./ha)	
	a) Full cost basis	(6,598)
	b) Cash cost basis	43,460
C. Benefit-Cost Ratio		
	a) Full cost basis	(0.95)
	b) Cash cost basis	1.53
D. Yield, cost & price		
	(a) Paddy Yield (Kg/ha)	5,750
	(b) Paddy Production Cost (Tk./kg)	
	a) Full cost basis	23.05
	b) Cash cost basis	14.35
	(c) Paddy Sale Price (Tk/kg)	16.70

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Annex.IV: Summary cost and return analysis of Swarna variety during 2019 T.Aman season at 4 villages in Kaharol and Birganj Upazilas of Dinajpur District

SL #	Item	Average Cost-return (Tk/ha)
1	Land Preparation	6,736
2	Labor	50,897
3	Seed	2,246
4	Fertilizer	14,312
5	Crop Protection	14,222
6	Irrigation	-
7	Land rent	44,909
8	Interest on working capital	
	a) Full cost basis	6,000
	b) Cash cost basis	2,699
	Total Cost (A)	
	a) Full cost basis	139,322
	b) Cash cost basis	62,670
B. Gross and Net return:		
	Gross return (Tk./ha)	
	a) Main product	91,640
	b) By-product	29,939
	Total Gross return (Tk./ha)	121,575
	Net return (Tk./ha)	
	a) Full cost basis	(17,747)
	b) Cash cost basis	58,905
C. Benefit-Cost Ratio		
	a) Full cost basis	(0.87)
	b) Cash cost basis	1.97
D. Yield, cost & price		
	(a) Paddy Yield (Kg/ha)	5,800
	(b) Paddy Production Cost (Tk./kg)	
	a) Full cost basis	24.02
	b) Cash cost basis	10.81
	(c) Paddy Sale Price (Tk/kg)	15.80

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix. I: Cost and Return for Rice cultivation

Farmer Name: FGD-1 **Village:** Ramchandrapur **Union:** **Mobile:**

Upazila: Kaharol **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan34

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			1,000	**7,485**
2	**Labor**	15	350	5,250	**39,296**
3	**Seed (kg)**	3	100	300	**2,245**
4	**Fertilizer**				
	a) Urea (kg)	3.5	16	56	**419**
	b) TSP (kg)	33	24	792	**5,928**
	c) MOP (kg)	50	16	800	**5,988**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)				
	Total Chemical Fertilizer Cost			1,648	**12,335**
	f) Organic Fertilizer: Cowdung			660	**4,940**
	Total Fertilizers Cost			**2,308**	**17,275**
5	**Plant health chemicals:**				
	a) Insecticide			500	**3,742**
	b) Fungicide etc			4,500	**33,682**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**5,100**	**38,173**
6	**Irrigation**			-	**-**
7	**Land rent**			5,950	**44,535**
8	**Cost (1-7)**				
	a) Full cost basis			19,908	**149,010**
	b) Cash cost basis			10,673	**79,887**
9	**Interest on working capital**				
	a) Full cost basis			896	**6,706**
	b) Cash cost basis			480	**3,595**
	Total Cost: (1-9)				
	a) Full cost basis			20,804	**155,716**
	b) Cash cost basis			11,153	**83,482**
B Gross and Net return:					
	Gross return				
	a) Main **product (kg)**	470	46	21,633	**161,920**
	b) By-product (Straw)			3,500	**26,197**
	Total Gross return			**25,133**	**188,117**
	Net return				
	a) Full cost basis			8,438	63,159
	b) Cash cost basis			18,089	135,393
C. Benefit-Cost Ratio					
	a) Full cost basis			1.21	1.21
	b) Cash cost basis			2.25	2.25
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			44.24	44.24
	b) Cash cost basis			23.72	23.72

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix. II: Cost and Return for Rice cultivation

Farmer Name: FGD-2 **Village:** Sundail **Union:** **Mobile:**

Upazila: Kaharol **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan34

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			800	**5,988**
2	**Labor**	16	400	6,400	**47,903**
3	**Seed (kg)**	3.5	100	350	**2,620**
4	**Fertilizer**				
	a) Urea (kg)	7	16	112	**838**
	b) TSP (kg)	23	24	552	**4,132**
	c) MOP (kg)	33	16	528	**3,952**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)	1	160	160	**1,198**
	Total Chemical Fertilizer Cost			1,352	**10,120**
	f) Organic Fertilizer: Cowdung			500	**3,742**
	Total Fertilizers Cost			**1,852**	**13,862**
5	**Plant health chemicals:**				
	a) Insecticide			500	**3,742**
	b) Fungicide etc			3,500	**26,197**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**4,100**	**30,688**
6	**Irrigation**			-	**-**
7	**Land rent**			6,600	**49,400**
8	**Cost (1-7)**				
	a) Full cost basis			20,102	**150,461**
	b) Cash cost basis			9,802	**73,368**
9	**Interest on working capital**				
	a) Full cost basis			905	**6,771**
	b) Cash cost basis			441	**3,302**
	Total Cost: (1-9)				
	a) Full cost basis			21,007	**157,232**
	b) Cash cost basis			10,243	**76,670**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	496	46	22,801	**170,660**
	b) By-product (Straw)			3,500	**26,197**
	Total Gross return			**26,301**	**196,857**
	Net return				
	a) Full cost basis			5,294	39,625
	b) Cash cost basis			16,058	120,187
C. Benefit-Cost Ratio					
	a) Full cost basis			1.25	1.25
	b) Cash cost basis			2.57	2.57
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			42.38	42.38
	b) Cash cost basis			20.67	20.67

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix.III: Cost and Return for Rice cultivation

Farmer Name: FGD-3 **Village:** Gandara **Union:** **Mobile:**

Upazila: Birganj **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan34

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			990	**7,140**
2	**Labor**	17	400	6,400	**47,903**
3	**Seed (kg)**	3.5	100	350	**2,620**
4	**Fertilizer**				
	a) Urea (kg)	7	16	112	**838**
	b) TSP (kg)	20	24	480	**3,593**
	c) MOP (kg)	20	16	320	**2,395**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)				
	Total Chemical Fertilizer Cost			912	**6,826**
	f) Organic Fertilizer: Cowdung			990	**7,410**
	Total Fertilizers Cost			**1,902**	**14,236**
5	**Plant health chemicals:**				
	a) Insecticide			330	**2,470**
	b) Fungicide etc			2,000	**14,970**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**2,430**	**18,189**
6	**Irrigation**			-	**-**
7	**Land rent**			6,600	**49,400**
8	**Cost (1-7)**				
	a) Full cost basis			18,672	**139,758**
	b) Cash cost basis			11,082	**82,948**
9	**Interest on working capital**				
	a) Full cost basis			840	**6,289**
	b) Cash cost basis			499	**3,733**
	Total Cost: (1-9)				
	a) Full cost basis			19,512	**146,047**
	b) Cash cost basis			**11,581**	**86,681**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	643	46	29,561	**221,260**
	b) By-product (Straw)			4,000	**29,939**
	Total Gross return			**33,561**	**251,195**
	Net return				
	a) Full cost basis			14,049	105,148
	b) Cash cost basis			21,980	164,514
C. Benefit-Cost Ratio					
	a) Full cost basis			1.72	1.72
	b) Cash cost basis			2.90	2.90
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			30.36	30.36
	b) Cash cost basis			18.02	18.02

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix. IV: Cost and Return for Rice cultivation

Farmer Name: FGD-4 **Village:** Modonpur **Union:** **Mobile:**

Upazila: Birganj **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan34

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			1,050	**7,859**
2	**Labor**	15	400	6,000	**44,909**
3	**Seed (kg)**	3	100	300	**2,246**
4	**Fertilizer**				
	a) Urea (kg)	7	16	112	**838**
	b) TSP (kg)	20	24	480	**3,593**
	c) MOP (kg)	20	16	320	**2,395**
	d) Gypsum (kg)	7	10	70	**524**
	e) Zinc Sulphate (kg)				
	Total Chemical Fertilizer Cost			982	**7,350**
	f) Organic Fertilizer: Cowdung			660	**4,940**
	Total Fertilizers Cost			**1,642**	**12,290**
5	**Plant health chemicals:**				
	a) Insecticide			700	**5,239**
	b) Fungicide etc			2,000	**14,970**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**2,800**	**20,958**
6	**Irrigation**			300	**2,246**
7	**Land rent**			7,920	**59,280**
8	**Cost (1-7)**				
	a) Full cost basis			20,012	**149,788**
	b) Cash cost basis			8,432	**63,114**
9	**Interest on working capital**				
	a) Full cost basis			901	**6,741**
	b) Cash cost basis			379	**2,840**
	Total Cost: (1-9)				
	a) Full cost basis			20,913	**156,529**
	b) Cash cost basis			**8,811**	**65,954**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	643	46	29,561	**221,260**
	b) By-product (Straw)			2,700	**20,209**
	Total Gross return			**32,261**	**241,469**
	Net return				
	a) Full cost basis			11,348	84,940
	b) Cash cost basis			23,450	175,515
C. Benefit-Cost Ratio					
	a) Full cost basis			1.54	1.54
	b) Cash cost basis			3.66	3.66
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			32.54	32.54
	b) Cash cost basis			13.71	13.71

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix. V: Cost and Return for Rice cultivation

Farmer Name: FGD 1-4 **Village:** 4 Villages **Union:** **Mobile:**

Upazila: 2 Upazilas **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan49

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			900	**6,736**
2	**Labor**	16	400	6,400	**47,903**
3	**Seed (kg)**	6	50	300	**2,246**
4	**Fertilizer**				
	a) Urea (kg)	18	16	288	**2,156**
	b) TSP (kg)	25	24	600	**4,491**
	c) MOP (kg)	25	16	400	**2,994**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)	1	160	160	**1,198**
	Total Chemical Fertilizer Cost			1,448	**10,838**
	f) Organic Fertilizer: Cowdung			400	**2,994**
	Total Fertilizers Cost			**1,848**	**13,832**
5	**Plant health chemicals:**				
	a) Insecticide			1,000	**7,485**
	b) Fungicide etc			400	**2,994**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**1,500**	**11,227**
6	**Irrigation**			-	**-**
7	**Land rent**			6,000	**44,909**
8	**Cost (1-7)**				
	a) Full cost basis			16,948	**126,853**
	b) Cash cost basis			10,548	**78,950**
9	**Interest on working capital**				
	a) Full cost basis			763	**5,708**
	b) Cash cost basis			475	**3,553**
	Total Cost: (1-9)				
	a) Full cost basis			17,711	**132,561**
	b) Cash cost basis			11,023	**82,503**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	735	17.25	12,676	**94,875**
	b) By-product (Straw)			4,000	**29,939**
	Total Gross return			16,676	**124,814**
	Net return				
	a) Full cost basis			(1,035)	(7,747)
	b) Cash cost basis			(5,653)	42,311
C. Benefit-Cost Ratio					
	a) Full cost basis			(0.94)	(0.94)
	b) Cash cost basis			1.51	1.51
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			24.10	24.10
	b) Cash cost basis			15.00	15.00

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix.VI: Cost and Return for Rice cultivation

Farmer Name: FGD 1-4 **Village:** 4 Villages **Union:** **Mobile:**

Upazila: 2 Upazilas **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** BRRI Dhan 51

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			900	**6,736**
2	**Labor**	16	400	6,400	**47,903**
3	**Seed (kg)**	6	50	300	**2,246**
4	**Fertilizer**				
	a) Urea (kg)	18	16	288	**2,156**
	b) TSP (kg)	25	24	600	**4,491**
	c) MOP (kg)	25	16	400	**2,994**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)	1	160	160	**1,198**
	Total Chemical Fertilizer Cost			1,448	**10,838**
	f) Organic Fertilizer: Cowdung			400	**2,994**
	Total Fertilizers Cost			**1,848**	**13,832**
5	**Plant health chemicals:**				
	a) Insecticide			1,000	**7,485**
	b) Fungicide etc			400	**2,994**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**1,500**	**11,227**
6	**Irrigation**			-	**-**
7	**Land rent**			6,000	**44,909**
8	**Cost (1-7)**				
	a) Full cost basis			16,948	**126,853**
	b) Cash cost basis			10,548	**78,950**
9	**Interest on working capital**				
	a) Full cost basis			763	**5,708**
	b) Cash cost basis			475	**3,553**
	Total Cost: (1-9)				
	a) Full cost basis			17,711	**132,561**
	b) Cash cost basis			11,023	**82,503**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	768	16.70	12,829	**96,025**
	b) By-product (Straw)			4,000	**29,939**
	Total Gross return			**16,829**	**125,963**
	Net return				
	a) Full cost basis			(882)	(6,598)
	b) Cash cost basis			5,806	43,460
C. Benefit-Cost Ratio					
	a) Full cost basis			(0.95)	(0.95)
	b) Cash cost basis			1.53	1.53
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			23.05	23.05
	b) Cash cost basis			14.35	14.35

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital

Appendix.VII: Cost and Return for Rice cultivation

Farmer Name: FGD 1-4 **Village:** 4 Villages **Union:** **Mobile:**

Upazila: 2 Upazilas **District:** Dinajpur **Year:** 2019 T.Aman season **Variety:** Swarna

SL#	Item	Quantity (Bigha)	Rate (Tk)	Cost-return/ Bigha (Tk)	Cost-return/Ha (Tk/ha)
A. Cost					
1	**Land Preparation**			900	**6,736**
2	**Labor**	17	400	6,800	**50,897**
3	**Seed (kg)**	6	50	300	**2,246**
4	**Fertilizer**				
	a) Urea (kg)	22	16	352	**2,635**
	b) TSP (kg)	25	24	600	**4,491**
	c) MOP (kg)	25	16	400	**2,994**
	d) Gypsum (kg)				
	e) Zinc Sulphate (kg)	1	160	160	**1,198**
	Total Chemical Fertilizer Cost			1,512	**11,318**
	f) Organic Fertilizer: Cowdung			400	**2,994**
	Total Fertilizers Cost			**1,912**	**14,312**
5	**Plant health chemicals:**				
	a) Insecticide			1,000	**7,485**
	b) Fungicide etc			800	**5,988**
	c) Weedicide			100	**749**
	Total Plant health chemicals			**1,900**	**14,222**
6	**Irrigation**			-	**-**
7	**Land rent**			6,000	**44,909**
8	**Cost (1-7)**				
	a) Full cost basis			17,812	**133,322**
	b) Cash cost basis			8,012	**59,971**
9	**Interest on working capital**				
	a) Full cost basis			802	**6,000**
	b) Cash cost basis			361	**2,699**
	Total Cost: (1-9)				
	a) Full cost basis			18,614	**139,322**
	b) Cash cost basis			**8373**	**62,670**
B Gross and Net return:					
	Gross return				
	a) Main product (kg)	775	15.80	12,243	**91,640**
	b) By-product (Straw)			4,000	**29,939**
	Total Gross return			**16,243**	**121,575**
	Net return				
	a) Full cost basis			(2,371)	(17,747)
	b) Cash cost basis			7,870	58,905
C. Benefit-Cost Ratio					
	a) Full cost basis			(0.87)	(0.87)
	b) Cash cost basis			1.94	1.94
D. Paddy cost (Tk/Kg)					
	a) Full cost basis			24.02	24.02
	b) Cash cost basis			10.81	10.81

1 Bigha = 33 Decimals, 1 Hectare = 247 Decimals

A. Cash cost basis: 1. Land Preparation, 2. Labor (50 %), 3. Seed, 4. Chemical fertilizer, 5. Pesticide 6. Irrigation, 7. Interest on working capital

B. Full cost basis: 1. Land Preparation 2. Labor (100 %), 3.Seed, 4. Organic fertilizer, 5. Chemical fertilizer, 6. Pesticide, 7. Irrigation, 8. Land rent, 9. Interest on working capital