

A Comparative Study of Mutant Aman Rice Binadhan-7 with Non-Mutant Variety in Some Selected Areas of Bangladesh

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Abstract:- The study was conducted in seven agricultural regions of Bangladesh to compare the profitability of BINA developed mutant rice variety Binadhan-7 growers and non-growers by location. The objectives were: i) to determine the profitability of mutant rice growers and non growers; ii) to assess the impact of Binadhan-7 production on livelihood pattern of the growers and iii) to identify the preferences and constraints of the variety cultivation. A total of 280 farmers were randomly selected to fulfill the objectives. A pre-designed interview schedule was used to collect the necessary data. Descriptive statistics, profit function and livelihood assets were used to analyzed the collected data. The study revealed that total variable cost of rice cultivation was BDT. 46408.22 & BDT. 48382.22 for mutant & non mutant, respectively, per hectare which was 76% of total cost of production (Table 1.). On an average, the total cost of production was BDT. 63772.5 per hectare, where 24% was fixed costs and 76% was variable cost. For Binadhan-7 cultivation per hectare average net return were found in the highest in Dinajpur BDT. 70918.66 and the lowest in Jashore BDT. 33703.45. BCR on total cost basis was found 1.87 which was the highest in Sylhet 2.56 and the lowest in 1.51 in Jashore for Binadhan-7 production. In case of non growers BCR on total cost basis was found 1.40 which was lower than Binadhan-7 production in the study areas indicating Binadhan-7 growers earn much than the non growers. The asset pentagon approach showed that there is a noteworthy improvement based on different capitals (namely, human capital, social capital, natural capital, physical capital and financial capital) of farm households adopting mutant rice variety in comparison to non-mutant variety. Increases in capitals of sampled farm households were the highest for financial capital that was 10.60 % and the lowest was for natural capital i. e 2.79%. Among the preferences and constraints of the variety cultivation the highest preferences was 96.43% for short duration and it was ranked I, the lowest was high yielding i.e 84.29% which was ranked as V. Among the constraints, the highest constraint reported by the farmer was labour crisis as well as high price of labour (75.71%) and it was ranked I and the lowest ranked V was marketing problem including low price of paddy, high transportation cost, market distance i.e. 53.57 % in Binadhan-7 cultivation.

Keywords:- Profitability, Impact, Livelihood, Mutant & Non mutant, Aman rice, Binadhan-7, Preferences & Constraints.

I. INTRODUCTION

Rice is the staple food of about 150 million people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intakes of an average person in the country [1]. Agriculture is a pillar of Bangladesh's economy, using more than 70% of land area [2] and accounting for nearly 20% of gross domestic product and 65% of the labor force, employed primarily on small-holder farms [3]. All over the world, farming is a means of food security but in Bangladesh it is a livelihood for a huge population as well as a means of reducing poverty (accounting for 90% of reduction in poverty between 2005 and 2010 [4] and fostering sustainable economic development. Despite frequent natural disasters and population growth, Bangladesh has made admirable progress over the past 40 years in achieving food self sufficiency, (food grain production, for example, tripled between 1972 and 2014, from 9.8 to 34.4 million tons). With one of the fastest rates of productivity growth in the world since 1995 (averaging 2.7 percent per year, second only to China), Bangladesh's agricultural sector has benefited from a sound and consistent policy framework backed up by substantial public investments in technology, rural infrastructure and human capital [5].

To combat with future challenge of food security Bangladesh Institute of Nuclear Agriculture & International Atomic Energy Agency developed a mutant rice variety Binadhan-7. It is a short duration and high yielding transplanted aman variety with good quality of rice released in 2007. Crop duration is 110-120 days from seed to seed. As the variety of early maturing, facilitate rabi crop cultivation like potato, mustard, wheat etc. after harvesting the variety in aman season. It is more tolerant to sheath blight, leaf blight and stem rot. This variety is also more tolerant to major insect-pests specially to Brown Plant Hopper (BPH) and hispa.. It produce grain yield is 5~5.5 t/ha. Paddy as well as the rice is long and fine. Rice is tasty and grains are bright color having higher market price. It can be transplanted little bit late as it is a short duration variety. It can also be cultivated in boro and aus seasons [6]. From table 1 we can see that after introducing short duration high

yielding variety, production area of Aman rice become more

stable ranging 56.10-56.82 lac hectare (Fig 1).

SL. No.	Year	Aman rice area (in lac hac.)	SI No.	Year	Aman rice area (in lac hac.)
1.	1994-95	55.59	13.	2006-07	54.16
2.	1995-96	57.72	14.	2007-08	50.48
3.	1996-97	58.03	15.	2008-09	54.98
4.	1997-98	54.82	16.	2009-10	56.63
5.	1998-99	48.65	17.	2010-11	56.46
6.	1999-00	57.05	18.	2011-12	55.80
7.	2000-01	57.1	19.	2012-13	56.10
8.	2001-02	56.47	20.	2013-14	55.30
9.	2002-03	56.82	21.	2014-15	55.30
10.	2003-04	56.78	22.	2015-16	56.61
11.	2004-05	52.8	23.	2016-17	55.86
12.	2005-06	54.29	24.	2017-18	56.82

Table:1 Aman rice area in different years in Bangladesh
Source: [7]

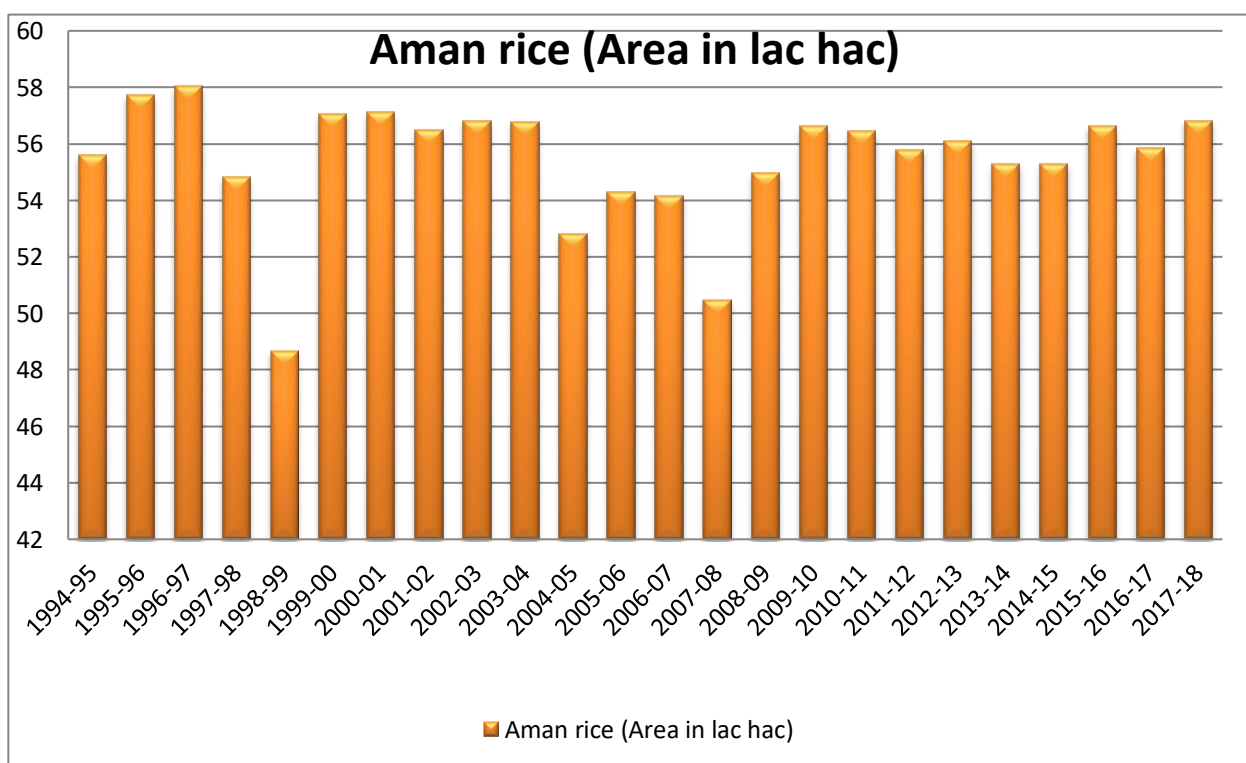


Fig 1: Aman area of Bangladesh in different years.

II. METHODOLOGY

The study was conducted in seven agricultural regions of Bangladesh namely Mymensingh, Jashore, Cumilla, Bogra, Rajshahi, Sylhet and Dinajpur. A total of 280 farmers were randomly selected to fulfill the objectives where 140 farmers were mutant growers and 140 were non-mutant growers. A pre-designed interview schedule was used to collect the necessary data. Descriptive statistics, Profit function and livelihood assets was used to analyzed the collected data.

Profitability study of mutant rice variety Binadhan-7 growers and non growers

For profitability analysis, the following equation was used [8]

The equation applied for each of the selected farmers:

$$\pi = P_m * Y_m + P_b * Y_b - \sum(P_{xi} * X_i) - TFC$$

Where, π = Net return

P_m = Price of main product per units

Y_m = Total quantity of main product

P_b = Price of by-product per unit
 Y_b = Quantity of by-product
 P_{X_i} = Price of i th input per unit used for rice production
 X_i = Quantity of the i th input used for rice production
 TFC = Total fixed cost
 $i = 1, 2, 3, \dots, n$ (number of input)

The estimation of Interest on operating capital (IOC) was as follows:

$$\text{Interest on OC} = AI \times i \times t$$

Where,

$$AI = (\text{Total investment})/2;$$

I = Rate of interest per annum (%); and

T = Period of rice production (in month).

The benefit cost ratio (BCR) is a relative measure which is used to compare benefit per unit of cost. Benefit-cost ratio is the ratio of present net worth of benefit and present net worth of cost. It indicates that the benefit of per unit cost at present worth.

Benefit-Cost Ratio = Present net worth of benefits/ Present net worth of cost

Land preparation: Land preparation included, ploughing, laddering, pit preparation and other activities needed to make the soil suitable for plantation of seedling. In the study areas, all the farmers ploughed their land with the help of power tiller and tractor and the number of ploughing varied from farm to farm.

Human labour: Human labour is one of the most important components for crop cultivation. Machine power could not replace human labour fully for cultivation till now in our country. Farmers used both family supplied and hired labour. Family labour includes the operator himself and other working member of the family, while the hired labour includes permanent hired labour, labour employed on monthly contract basis, casual labour and labour employed on the other contract basis.

Seed: Most of the farmers collect seeds from their own storage. Besides, In research office and DAE office it is also available. Only few farmers purchase seed from the local market or other organization. The farmer of the study areas mainly used Binadhan-7, Pajama, Balaam, BRRI-11, Sawrna, etc.

Fertilizer: Proper use of fertilizer can enhance agricultural production largely and help to retain or improve soil fertility. The sample farmers used four kinds of chemical

fertilizers namely; Urea, TSP, MoP and Sulphur in the survey area.

Pesticide: Pesticide mainly insecticide and fungicide was used by most of the sample farmers and applied to survey plot with different rates. The cost of pesticide was computed based on the price that the farmers have actually paid.

Irrigation: Farmers in the study areas used irrigation water in their plot from shallow tube well (STW). Very few farmers followed deep irrigation method for irrigation purpose.

Land rent: Land rent is one of the biggest fixed cost items for the production process. Rental value of land was estimated for the cropping period at the rate prevailing in the study area. In this analysis, cropping period was considered as 4 months that varied from crop to crop.

III. RESULTS AND DISCUSSION

Total cost of production

Variable cost: The cost of production included all kinds of variable costs such as hired labour, land preparation, seed, fertilizers, irrigation, pesticides, etc. which was used for the production of rice. Both cash expenses and imputed value of family supplied inputs were included in the variable cost. The study revealed that total variable cost of rice cultivation was BDT. 46408.22 & BDT. 48382.22 for mutant & non mutant, respectively, per hectare which was 76% of total cost of production (Table 2.). The highest cost item was human labour which accounted for about 34% for mutant rice & 32 % in case of non mutant of the total cost. Cost of land preparation accounted for about 12% of for mutant & 11 % for non mutant rice cultivation of total cost and ranked second cost item.

Fixed cost: Family labour and rental value of land was considered as fixed cost of production. There are 24 % fixed cost for both category of rice production. The family labour cost were BDT. 14212.23 and BDT. 15390.28 per hectare about 20% of total cost and land use cost were accounted for BDT. 2076.64 (3.43%) and BDT. 2116.89 (3.32%) for mutant & non mutant rice production, respectively (Table 2).

Total cost: Total cost of production included variable costs and fixed costs incurred for Binadhan-7 & non mutant variety cultivation. On an average, the total cost of production was BDT. 63772.5 per hectare, where 24% was fixed costs and 76% was variable cost (Table 2).

Type	Study areas															
	Mymensingh		Jashore		Cumilla		Rajshahi		Bogura		Sylhet		Dinajpur		All (%)	
	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant
(A) Variable Cost	46092.22	44833.54	48615.04	47839.44	50874.72	56825.35	47430.17	55070.71	47962.96	46396.16	34426.16	48498.90	35638.27	39211.46	46408.22 (75.82)	48382.22 (75.87)
Hired labour (Man days)	28035.71	27176.92	24384.45	23175.54	24927.81	25863.37	21261.74	22914.11	23514.81	17541.06	12968.48	18654.44	16523.53	9541.10	21659.51 (34.60)	20695.22 (32.45)
Power tiller (BDT./ha)	6274.09	3805.26	6840.00	7073.43	7276.17	7598.52	7875.17	8814.97	7585.37	8033.42	7937.25	8401.80	6564.55	7449.05	7193.23 (11.96)	7310.92 (11.46)
Seed (BDT./ha)	1391.45	1944.62	1787.25	1650.85	1470.21	1180.89	1791.28	2383.44	2500.95	1723.26	1825.67	2216.22	1516.38	1894.31	1754.74 (2.95)	1856.23 (2.91)
Fertilizers (BDT./ha)	4187.50	5554.77	5367.65	8604.23	9792.55	10537.29	8120.94	9352.35	9220.87	8252.41	7834.75	8486.49	6245.47	9184.36	7252.82 (12.92)	8567.41 (13.43)
Pesticides (BDT./ha)	1634.87	1512.31	3103.92	2822.03	2272.34	4322.82	2553.02	2758.69	2207.32	2439.84	1979.56	3000.00	1190.75	2582.94	2134.54 (4.01)	2776.95 (4.35)
Manure (BDT./ha)	802.63	861.54	2588.24	987.00	740.43	998.14	954.36	1007.16	1355.01	825.13	298.13	602.70	783.04	1744.08	1039.11 (1.70)	1003.68 (1.57)
Irrigation charge (BDT./ha)	3322.37	3504.62	3952.94	2964.41	3876.60	5725.42	4398.39	7296.11	1095.94	7118.32	255.54	6647.75	1341.04	6369.67	2606.12 (4.55)	5660.90 (9.02)
Int. on operating capital (BDT./ha)	443.61	473.51	590.59	561.95	518.62	598.90	475.27	543.92	482.70	462.72	326.78	489.51	473.51	445.96	473.01 (0.80)	510.92 (0.80)
(B) Fixed Cost (BDT./ha)	16873.36	18318.56	17184.50	14321.07	15784.95	16144.61	13982.55	15010.22	14873.27	12041.82	9351.22	12659.07	11435.74	19236.63	14212.23 (24.18)	15390.28 (24.13)
Family labour (BDT./ha)	14626.41	15653.85	15213.59	12875.30	13848.78	14368.54	11812.08	12730.06	13063.78	9745.03	7204.71	10363.58	9179.74	17177.39	12135.59 (20.76)	13273.39 (20.13)
Land use cost (BDT./ha)	2246.95	2664.71	1970.91	1445.77	1936.17	1776.07	2170.47	2280.16	1809.49	2296.79	2146.51	2295.50	2256.00	2059.24	2076.64 (3.43)	2116.89 (3.32)
Total Cost	62965.58	63152.09	65799.54	62160.51	66659.67	72969.96	61412.72	70080.93	62836.23	58437.99	43777.38	61157.97	47074.01	58448.09	61209.48 (100)	63772.51 (100)

Table 02. Per hectare cost of mutant rice variety Binadhan-7 and non mutant rice production

➤ Financial Profitability of Binadhan-7 growers & non growers in the study areas

Financial profitability (FP) is based on calculation of market prices of inputs and outputs that farmers actually pay or receive for producing a crop, along with the quantities used of each. Farmers allocate land and other resources in the production of different crops on the basis of relative financial profitability.

Type	Study areas															
	Mymensingh		Jashore		Cumilla		Rajshahi		Bogura		Sylhet		Dinajpur		All	
	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant	Mutant	Nonmutant
Yield (BDT./kg)	4893.42	4018.46	4023.39	3008.00	4756.17	3998.14	5203.36	4323.72	5021.55	4081.95	4991.37	4190.27	5275.14	4781.51	4880.63	4057.44
Price (BDT./kg)	21.00	19.00	21.00	19.00	21.00	20.00	21.00	20.00	20.00	19.00	20.00	20.00	19.00	18.00	20.43	19.29
Return from paddy (BDT./ha.)	102761.82	76350.74	84491.19	57152.00	99879.57	79962.80	109270.47	86474.44	10043.90	77557.09	99827.48	8380.54	10022.75	86067.18	99555.60	78195.66
Return from straw (BDT./ha.)	10559.21	6030.77	15011.81	13060.18	15276.60	12115.03	15469.80	12098.16	15799.46	12834.22	12421.92	1003.60	17764.93	11658.77	14614.82	11119.02
Total return (BDT./ha.)	113321.03	82381.51	99503.00	70212.18	115156.17	92077.83	124740.27	98572.60	11623.36	90391.31	11224.94	9384.14	11799.26	97725.95	11417.04	89314.69
Total variable cost (BDT./ha.)	46092.22	44833.54	48615.04	47839.44	50874.72	56825.35	47430.17	55070.71	47962.96	46396.16	34426.16	48498.90	35638.27	39211.46	46408.22	48382.22
Total Cost (BDT./ha.)	62965.58	63152.09	65799.54	62160.51	66659.67	72969.96	61412.72	70080.93	62836.23	58437.99	43777.38	61157.97	47074.01	58448.09	61209.48	63772.51
Gross margin (BDT./ha.)	67228.81	37547.97	50887.95	22372.74	64281.45	35252.48	77310.10	43501.89	68267.40	43995.15	77823.25	4534.38	82354.41	58514.49	69736.19	40932.47
Net return (BDT./ha.)	50355.45	19229.41	33703.45	8051.67	48496.50	19107.87	63327.55	28491.66	53394.13	31953.32	68472.03	3268.34	70918.66	39277.86	55523.97	25542.18
BCR																
BCR on full cost	1.80	1.30	1.51	1.13	1.73	1.26	2.03	1.41	1.85	1.55	2.56	1.53	2.51	1.67	1.87	1.40

Table 03. Per hectare return of mutant rice variety Binadhan-7 and non mutant rice production

Source: Field Survey, 2020

From figure 2 it was found that the highest yield was Dinajpur and the lowest in Jashore district for both mutant and non mutant rice varieties.

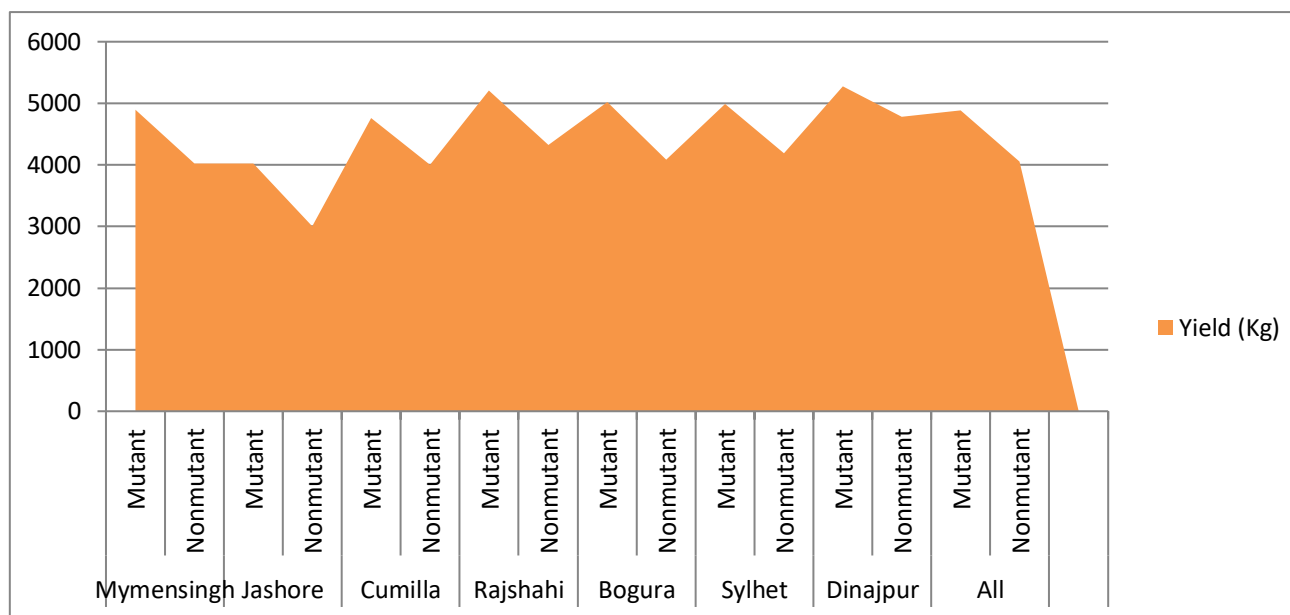


Fig 2: Yield of Mutant & non mutant Aman rice in different areas

➤ *Returns and financial profitability of Binadhan-7 production*

From Table 3, per hectare average yield of rice was 4.88 & 4.05 ton and per kg average price was about BDT. 20 & BDT.19 for Binadhan-7 & non mutant rice variety. The average gross margin and net return of Binadhan-7 production were found BDT. 69736.19 per hectare and BDT. 55523.97 per hectare respectively, which were 41 % & 54% higher than the non-mutant variety in the study areas. For Binadhan-7 cultivation per hectare average net return were found in the highest in Dinajpur BDT. 70918.66 and the lowest in Jashore BDT. 33703.45. BCR on total cost basis was found 1.87 which was the highest in Sylhet 2.56 and the lowest in 1.51 in Jashore for Binadhan-7 production. In case of non growers BCR on total cost basis was found 1.40 which was lower than Binadhan-7 production in the study areas indicating Binadhan-7 growers earn much than the non growers.

➤ *Livelihood changes for mutant rice variety Binadhan-7 cultivation*

Demographic characteristics of the mutant rice variety Binadhan-7 growers and non-growers:

The demographic characteristics of the rice farmers were presented and discussed according to their age, sex, education, household size, years of farming experience and farm size. The distribution of the farmers by age showed that the mean age for Binadhan-7 cultivated farmers was 46 years. Among the farmer 92% was educated which was categories as illiterate, primary, secondary, higher secondary and above. In the study areas, average experience of farmers was 22.28 years and income was BDT. 2,74,485.70 per year (Table 4).

Sl no.	Variables	Mean values
1.	Age (years)	46
2.	Gender (%)	96
3.	Educational qualification (%)	92
4.	Family size (no.)	6
	• Male	3
	• Female	3
5.	Income (BDT/year)	274485.70
6.	Educated person (no.)	3
7.	Earning Person (no.)	2
8.	Land size (hectare)	0.65
9.	Land under Binadhan-7 cultivation (hectare)	0.22
10.	Farming experience (years)	22.28

Table 4. Socio-demographic profile of the Binadhan-7 growers and non-growers.

Source: Field Survey, 2020.

➤ *Livelihoods*

A livelihood is the set of capabilities, assets and activities that furnish the means for people to meet their basic needs and support their well being. The building of livelihoods reflects and seeks to fulfill both material and experiential needs. Livelihoods are not simply a localized phenomenon, but connected by environmental, economic, political and cultural process to wider national, regional and global arenas [9]

In these guidelines, “livelihood” does not just mean the activities that people carry out to earn a living. It means all the different elements that contribute to or affect their ability to ensure a living for themselves and their household. This includes:

- the assets that the household owns or is able to gain access to-human, natural, social, financial and physical capital;
- the activities that allow the household to use those assets to satisfy basic needs;
- the different factors that the household itself may not be able to control directly, like the seasons, natural disasters or economic trends, that affect its vulnerability;
- Policies, institutions and processes that may help them or make it more difficult for them, to achieve an adequate livelihood.

➤ *Impact on livelihood pattern of the mutant farmer*

The members of a household combine their capabilities, skills and knowledge with the different resources at their disposal to create activities that will enable them to achieve the best possible livelihood for themselves and the household as a whole: Everything that goes towards creating that livelihood can be thought of as a livelihood asset [10]. The livelihood framework identifies five core assets or capital upon which livelihoods are built. Increasing access which can take the form of ownership or the right to use to these assets is a primary concern for Department for International Development in its support of livelihoods and poverty elimination. These assets can be divided into five different “types” shown in Figure3.

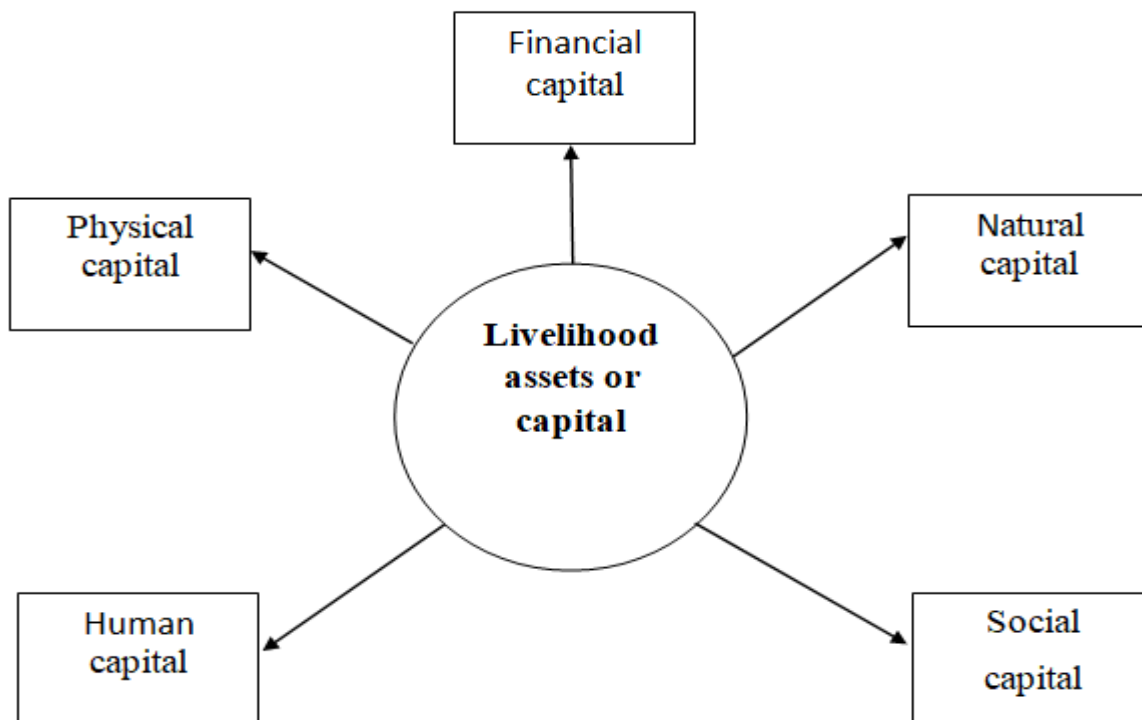


Fig.3 Different types of assets

This asset can provide a useful starting point for household livelihood analysis, as it encourages investigators to take into account all the different kinds of assets and resources that are likely to play a role in household livelihood. In the past, development workers often tended to focus very much on the physical capital, the financial capital and the human capital. But very often people’s access to natural capital and the key role of the social capital of households has not been properly taken into account. Using this pentagon as guide can help investigators to get a more complete picture of the household and its livelihood assets.

The asset pentagon approach showed that there is a noteworthy improvement based on different capitals (namely, human capital, social capital, natural capital, physical capital and financial capital) of farm households adopting mutant rice variety in comparison to non-mutant variety. Table 5 represents the changing nature of different capitals which reveals that the farmers cultivating had a positive impact on farm households’ livelihood patterns in comparison to farmers with non-mutant growers. Increases in capitals of sampled farm households were the highest for financial capital that was 10.60 % and the lowest was for natural capital i. e 2.79%.

Items	Mutant (%)	Non-mutant (%)	Differences (%)
Human capital	24.33	15.10	9.23
Social capital	21.70	18.00	3.70
Financial capital	26.70	16.10	10.60
Natural capital	10.12	7.33	2.79
Physical capital	17.14	14.20	2.94

Table 5: Increases in capitals of sampled farm households in the study areas.

Source: Field Survey, 2020.

From table 6, it was observed that livelihood of Binadhan-7 growers was changed from 12 years before, because Binadhan-7 was developed in 2007. In case of home type, the highest differences were seen in Tin shade building that was 37.86 % and the lowest was mud build 18.57%. Both the livestock & poultry rearing and drinking water through tube well were increased by 10.72 %. Per households number of trees increased by 38% from that of 12 years before. The study revealed that road condition also changed in the study areas. It was the highest for brick road i.e 44.29% than 12 years ago. In case of sanitation, the highest percentage change was seen in half building 77.85% and the lowest was in Tin shed 0.71%. Food security & health condition was increase by 62.86% and 47.85 % respectively, in the study areas. Electricity connection, Social communication (Mobile/Internet), Recreation (TV/Radio), Agricultural industrialization was increased by 42.15%, 70.72%, 46.43% and 93.56% respectively. In case of women empowerment it was increased by 54.28 % and women and child death rate was decreased by 9.28 %.

Item	Present (%)	12 Years Ago (%)	Differences
Home type			
• Mud build	2 (1.43)	28 (20.00)	26 (18.57)
• Tin shade	25 (17.86)	78 (55.72)	53 (37.86)
• Half building	66 (47.14)	29 (20.71)	37 (26.43)
• Building	47 (33.57)	5 (3.57)	42 (30)
No of livestock & poultry increases	25 (17.86)	10 (7.14)	15 (10.72)
Tubewell	137 (97.86)	122 (87.14)	15 (10.72)
Number of tree increases	134 (95.14)	80 (57.14)	54 (38.00)
Source of drinking water			
Sanitation			
• Mud build	0 (0.00)	12 (1.43)	12 (1.43)
• Tinshade	10 (7.14)	60 (6.43)	50 (0.71)
• Half building	117 (83.57)	65 (5.71)	52 (77.85)
• Building	13 (9.28)	3 (0.71)	10 (8.57)
Food security increases	126 (90.00)	38 (27.14)	88 (62.86)
Health condition increases	136 (97.14)	69 (49.29)	67 (47.85)
Road			
• Paved road	2 (1.43)	60 (42.86)	58 (41.43)
• Raw road	40 (28.57)	44 (31.43)	4 (2.86)
• Brick	98 (70.00)	36 (25.71)	62 (44.29)
Electricity connection	139 (99.29)	80 (57.14)	59 (42.15)
Social communication (Mobile/Internet)	139 (99.29)	40 (28.57)	99 (70.72)
Recreation(TV/Radio)	135 (96.43)	70 (50.00)	65 (46.43)
Agricultural industrialization	135 (96.43)	4(2.86)	131 (93.56)
Women empowerment increases	136 (97.14)	60 (42.86)	76 (54.28)
Women and child death rate decreases	44 (31.42)	31 (22.14)	13 (9.28)

Table 6:- Livelihood changes for cultivation of Mutant rice variety Binadhan-7 in study areas.

Source: Field Survey, 2020.

➤ *Preferences and major constraints to mutant rice variety Binadhan-7 Cultivation*

Farmers prefer this variety for various reasons. They can include robi crops like mustard, potato, wheat, different vegetables in their cropping pattern that leads to increase income as well as employment and reduce poverty. Major of these preferences are shown in the Table 7. Among the list the highest preferences was 96.43% for short duration and it was ranked I, the lowest was high yielding i.e. 84.29% which was ranked as V.

Among the constraints, the highest constraint reported by the farmer was labour crisis as well as high price of labour (75.71%) and it was ranked I and the lowest ranked V was marketing problem including low price of paddy, high transportation cost, market distance i.e. 53.57 % in Binadhan-7 cultivation.

Type	Study areas							%	Rank
	Mymensingh	Jashore	Cumilla	Rajshahi	Bogura	Sylhet	Dinajpur		
Preferences									
Short duration	20	20	19	17	19	20	20	96.43	I
High yielding	17	15	16	14	16	20	20	84.29	V
Income increases	19	19	20	17	20	19	19	95.00	II
Create employment Opportunity	19	19	20	17	20	18	18	93.57	III
Reduce Poverty	20	19	20	16	20	17	14	90.00	IV
Constraints									
Lack of quality Seed	7	14	7	13	12	10	7	50.00	IV
Labour crisis & high price of labour	10	14	17	16	18	16	15	75.71	I
Marketing Problem	10	17	9	7	9	13	10	53.57	V
Lack of Godown	05	10	17	10	16	11	14	59.28	III
Destroy by bird	12	16	19	17	8	16	13	72.14	II

Table 7. Distribution of respondents according to Preferences and constraints to Binadhan-7 Cultivation
Source: Field Survey, 2020.

From the table 8, we found that 82.14% respondents got information about this variety cultivation from research office and DAE. There were 68.57% growers who received training, 79.29 % got suggestions from different Agricultural officers, and 43.57% receive seed support in different years. Farmer harvested paddy within 110-115 days and 39.29% of that were used for family consumption and the rest were sold by them. The study found that, 60.71 % paddy was sold by the growers in the market, 72.14% growers noticed about good taste to eat the rice, 62.14% cultivated other BINA developed variety rather than Binadhan-7 in aforesaid locations.

Type	Study areas							
	Mymensingh	Jashore	Cumilla	Rajshahi	Bogura	Sylhet	Dinajpur	%
Technical/ Other Information								
Get information about this variety from DAE & Research station	18	17	17	16	16	17	14	82.14
Type of information/Support								
• Training	17	10	16	14	12	14	13	68.57
• Suggestions	19	14	17	15	15	16	15	79.29
• Seed support	10	8	12	7	9	8	7	43.57
• Amount of rice used for family purpose	10	6	8	9	7	6	9	39.29
Taste good to eat Binadhan-7	11	12	14	17	20	14	13	72.14
Selling paddy at market	14	15	11	14	10	9	12	60.71
Cultivate other BINA's variety rather than Binadhan-7	12	11	16	14	13	10	11	62.14

Table 8 . Major technical Information to Binadhan-7 Cultivation

IV. CONCLUSION

Cultivation of mutant rice variety Binadhan-7 is highly profitable among the study areas and that increasing day by day. Farmers are happy to cultivate Binadhan-7 for the special characteristics of this variety such as-short duration, HYV, early cutting and increasing the number of crop in their pattern i.e. Binasarisha (mustard), potato, Binarashun (garlic), Binamorich (Chili), Binatomato etc. Now in a year, they can cultivate 4 crops so that they can earn more money which stabilizes their income and secured food. Their livelihood also changes within 12 years. The asset pentagon approach showed that there is a noteworthy improvement based on different capitals (namely, human capital, social capital, natural capital, physical capital and financial capital) of farm households adopting mutant rice variety in comparison to non-mutant variety. On the other hand, the non-mutant growers are not growing mutant varieties like Binadhan-7 because of non availability of quality seed, extension weakness, lack of training, reluctant to adopt new variety and farmers willingness to the traditional variety cultivation for their own consumption. Some of the farmers are also cultivating other mutant varieties such as Binasail, Binadhan-9, Binadhan-13, Binadhan-19 and Binadhan-22. So Government can invest more for more expansion of the variety as well as to achieve sustainable development goals.

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