Technology Adoption and Profitability of BINA Released Lentil Variety Binamasur-5 in Bangladesh

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ABSTRACT

The study was conducted in five major Binamasur-5 growing areas of Bangladesh, namely Magura, Pabna, Jashore, Kushtia and Faridpur districts. It is important to know the profitability and the existing level of technology in terms of agronomic practices, time of operation and input use. At Magura (85%), Pabna (85%) and Faridpur (75%) farmers, sowed seed in optimum level but 5% in Jashore and 8% in Kushtia farmers followed it. The adoption index of sowing level of adoption Binamasur-5 was higher use. The average net return was Tk. 52405.29 per hectare. The average Benefit cost ratio was 1.86. The highest BCR was found in Magura district (1.96) which was followed by Jashore (1.91), Faridpur (1.88), Pabna (1.84) and Kushtia (1.73) districts, respectively. The first ranked constraint was unavailability of Binamasur-5 seeds (93%) in all areas. It is followed by lack of technical know-how (71%), lack of training (65%), attack of root rot diseases (50%). Nonetheless, lentil farmers should also be provided hand-on training on package technology of lentil cultivation.

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1. INTRODUCTION

Pulse crops are important for the people of Bangladesh. It plays a vital role in the Bangladesh diet as a cheap source of protein. Eight kinds of pulses, such as lentil, mungbean, blackgram, grasspea, chickpea, cowpea, filed pea and pigeon pea are grown in Bangladesh. Among the pulses, lentil commonly known as “masur” is a popular pulse crop in Bangladesh. It contains more protein than any other agricultural produce, and is nearer to animal flesh in food value for which it is often called poor man’s meat [1]. Bangladesh is a densely populated country where per capita cultivable land availability is not more than 0.066 ha. Farmer is not likely to come forward with a risky crop because harvest risky. The country is facing acute shortage of pulses due to accelerated increase of requirements with its rapid growth of population. Side by side the fallow period between two major crops to be utilized for production of pulse crops. Pulses area decreased from 7.35 lakh hectares in 1988-89 to 3.57 lakh hectares in 2016-17 [2]. Production also decreased from 5.12 lakh tonnes to 3.79 lakh tonnes during the same period. The average yield of pulse was 1.25 mt/ha. The area and production were decreased due to increase of requirements with overuse; (70-100) as high; (50-69) as medium and <50 as low [4]. Population of Bangladesh is increasing rapidly due to accelerated increase of population side by side the fallow period between two major crops to be utilized for production of pulse crops. Pulses area decreased from 7.35 lakh hectares in 1988-89 to 3.57 lakh hectares in 2016-17 [2]. Production also decreased from 5.12 lakh tonnes to 3.79 lakh tonnes during the same period. The average yield of pulse was 1.25 mt/ha. The area and production were decreased due to increase of requirements with overuse; (70-100) as high; (50-69) as medium and <50 as low [4].

2. MATERIALS AND METHODS

Sampling design: A multi-stages sampling procedure was followed to select study areas and sample households. At first, we selected five major Binamasur-5 growing areas of Bangladesh, namely Magura, Pabna, Jashore, Kushtia and Faridpur district and then two Upazilas in each Jashore district were purposively selected for the study. Secondly, two villages were purposively selected from each upazila for household survey. Finally, a list of lentil growers was constructed for each village and then a total of 200 samples taking 40 samples from each district were randomly selected for data collection.

Data collection procedure: Data for the present study were collected by interviewing sample lentil growers using a pre-tested interview schedule during the period from March to May 2016. Secondary data were also collected from Directorate of Agricultural Extension to supplement the study. Analytical techniques: The collected data were analyzed by tabular and statistical methods. The profitability of lentil cultivation was examined on the basis of gross margin, net return, and rate of return over cost. A higher index indicates a higher level of adoption, while a lower index indicates a lower level of adoption of a technology. Technology adoption level was categorized for mean index > 100 as over use; (70-100) as high; (50-69) as medium and <50 as low [4].

Adoption index = \( \frac{\text{Farmers/practice}}{\text{Recommendation}} \times 100 \)

The equation has been applied for each of the selected farmers:

\[ \pi = Y_m \times P_m + Y_b \times P_b - \Sigma (X_i \times P_x) - \text{TFC} \]

Where,

\( \pi \) = Net return;
\( Y_m \) = Total quantity of main product;
\( P_m \) = Price of main product per units;
\( Y_b \) = Quantity of by-product;
\( P_b \) = Price of by-product per unit;
\( X_i \) = Quantity of the ith input used for Binamasur-5 production;
\( P_x \) = Price of ith input per unit used for Binamasur-5 production;
\( \text{TFC} \) = Total fixed cost

\( i = 1, 2, 3, \ldots \ldots \ldots \ldots \) (number of input)
The estimation of interest on operating capital (IOC) was as follows:

\[ \text{Interest on OC} = AI \times I \times t \]

Where,

- \( AI = \frac{\text{Total investment}}{2} \);
- \( I = \text{Rate of interest per annum (\%)} \); and
- \( T = \text{Period of lentil production (in month)} \).

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.

3. RESULTS AND DISCUSSION

3.1 Technology Used and Their Level of Adoption

Appropriate inputs use and time of operations are essential for achieving higher yield and economic benefit. Therefore, it is important to
know the existing level of technology in terms of agronomic practices, time of operation, and input use [5]. The existing level of technology employed in the production of Binamasur-5 and their level of adoption have been presented in Table 1. Farmers in the study areas ploughed their lands with the help of power tiller. The number of ploughing and laddering varied from farm to farm and location to location. On an average, 71% farmers ploughed their land 3-4 times, which is the recommended for lentil cultivation. Based on the mean index, land preparation secured the overuse level of adoption. About 87% farmers applied laddering 2-3 times, which was lower than recommendation. Therefore, the level of adoption of laddering was secured lower use. About 52% farmer’s sowed seeds during last week of October to first week of November which is optimum time for seed sowing, whereas 37% farmers sowed during second week of November to 1st week of December. At Magura (85%), Pabna (85%) and Faridpur (75%) farmers, sowed seed in optimum level but 5% in Jashore and 8% in Kushtia farmers followed it. The adoption index of sowing level of adoption Binamasur-5 was higher use. The recommended seed rate of Binamasur-5 ranged 35-40 kg/ha [6]. All respondent farmers used higher amount of seed (40% higher) than its recommendation. Therefore, the adoption level seed rate was found to be over used.

Weeding was done by human labour. Forty percent of the total farmers performed weeding once between 20 and 30 days. At Magura and Kushtia, all farmers weeded their land one time, while Pabna, Jashore and Faridpur farmers did not remove weed. The lower level of adoption was occurred in providing weeding to Binamasur-5. The study found that farmers often do not follow recommendations for applying fertilizers and tended to excess use of fertilizers. All the sample farmers applied urea, TSP, MoP and Gypsum in higher quantity compared to their recommended doses. Therefore, according to adoption index, the level of adoption for applying fertilizer was over use.

## 3.2 Profitability of Binamasur-5 Cultivation

Human labour was measured in terms of man-days which usually consisted of 8 hours. It was employed for sowing seed, fertilizing, weeding, pesticiding, harvesting, threshing and drying. The cost of cultivation was calculated on the basis of total variable cost and total cost.

From Table 2, it can be showed that the average total variable cost of Binamasur-5 production was estimated in Magura (Tk. 58358.06), Jashore (Tk. 56234.82), Faridpur (Tk. 55664.68), Pabna (Tk. 55615.25) and Kushtia (Tk. 55592.57) ha⁻¹, respectively. The major shares of total cost were human labour (35.53%), fertilizer (15.16%), power tiller (12.07%), irrigation (6.79%) and seed (6.80%). The highest total cost in farm level of Binamasur-5 was in Magura (Tk. 62816.65 ha⁻¹) followed by Jashore (Tk. 60160.69), Faridpur (Tk. 60086.56), Pabna (Tk. 60003.70) and Kushtia (Tk. 59714.45) ha⁻¹, respectively. The average total cost of production in field level of Binamasur-5 was Tk. 60556.41.

From Table 3, it can be showed that the grain yield was higher at Magura (1879.67 kg/ha) compared to Kushtia (1709.90 kg/ha). The gross return of Binamasur-5 cultivation was found higher in Magura (Tk. 123084.32 ha⁻¹) followed by Jashore (Tk. 115164.72), Faridpur (Tk. 112783.28), Pabna (Tk. 110338.95) and Kushtia (Tk. 103437.26) per hectare among the study areas. The net returns per hectare were Magura (Tk. 60267.66), Faridpur (Tk. 53652.75), Jashore (Tk. 53404.03), Pabna (Tk. 50335.25) and Kushtia (Tk. 46860.81), respectively. The average net return was Tk. 52405.29 per hectare. The average Benefit cost ratio was 1.86; which indicates that cultivation of this variety is profitable to the farmer’s level when all sorts of cost were taken into consideration. The highest BCR was found in Magura district (1.96) which was followed by Jashore (1.91), Faridpur (1.88), Pabna (1.84) and Kushtia (1.73) districts, respectively.

## 3.3 Constraints to Binamasur-5 Cultivation at Farm Level

The farmers in the study areas encountered some constraints to Binamasur-5 cultivation. The first ranked constraint was unavailability of Binamasur-5 seeds (93%) in all areas. It is followed by lack of technical know-how (71%), lack of training (65%), attack of root rot diseases (50%). Therefore, necessary steps should be taken to make disease resistant Binamasur-5 seed available to the farmers. Nonetheless, lentil farmers should also be provided hand-on training on package technology of lentil cultivation.
Table 1. Adoption of crop management technologies for Binamasur-5 production at farm level

| Name of Technology | Recommendation | Magura | Pabna | Jashore | Kushtia | Faridpur | Average | Adoption level |
|--------------------|----------------|--------|-------|---------|---------|----------|---------|----------------|
| 1. No. of Ploughing (% of respondents) | | | | | | | | Over use |
| 3-4                | Optimum        | 75     | 69    | 72      | 68      | 70       | 71      |                |
| 5-6                | Optimum        | 25     | 31    | 28      | 32      | 30       | 29      |                |
| Adoption index     |                | 113    | 116   | 114     | 116     | 115      | 115     |                |
| 2. Laddering (% of respondents) | | | | | | | | Lower use |
| 2-3                | Optimum        | 87     | 80    | 92      | 85      | 90       | 87      |                |
| 4-5                | Optimum        | 13     | 20    | 8       | 15      | 10       | 13      |                |
| Adoption index     |                | 48     | 52    | 45      | 49      | 46       | 48      |                |
| 3. Sowing time (% of respondents) | | | | | | | | Higher use |
| Third week of October |                | 10     | 15    | 30      |         | 11       |         |                |
| Last week of Oct. –First week of Nov. | Optimum        | 85     | 85    | 5       | 8       | 75       | 52      |                |
| 2nd week of Nov.– 1st week of Dec. | Optimum        | 5      | 65    | 92      | 25      | 37       |         |                |
| Adoption index     |                | 93     | 93    | 53      | 54      | 88       | 76      |                |
| 4. Seed rate (kg/ha) | | | | | | | | Over use |
| Adoption index     |                | 35-40  | 55    | 48      | 50      | 44       | 52      | 50             |
| 5. No. of weeding (% of respondent) | | | | | | | | Lower use |
| One time (20-30 days after germination) | Optimum        | 100    | 0     | 0       | 100     | 0        | 40      |                |
| Adoption index     |                | 100    | 0     | 0       | 100     | 0        | 40      |                |
| 6. Fertilizer dose (kg/ha) | | | | | | | | Over use |
| Urea               |                | 30-35  | 55    | 48      | 52      | 40       | 50      | 49             |
| Adoption index     |                | 157    | 137   | 149     | 114     | 143      | 140     |                |
| TSP                |                | 80-90  | 132   | 127     | 112     | 135      | 121     | 125            |
| Adoption index     |                | 147    | 141   | 124     | 150     | 134      | 139     |                |
| MoP                |                | 30-35  | 48    | 35      | 25      | 69       | 51      | 46             |
| Adoption index     |                | 80    | 100   | 71      | 197     | 146      | 130     |                |
| Gypsum             |                | 25-30  | 40    | 38      | 41      | 22       | 40      | 36             |
| Adoption index     |                | 133    | 127   | 137     | 73      | 133      | 121     |                |

Note: Adoption level was categorized for mean index > 100 as Over use; (70-100) as Higher use; (50–69) as medium and <50 as lower use
Source: Field Survey, 2016
### Table 2. Input wise cost of Binamasur-5 production at farm level

| Cost Component          | Magura  | Pabna  | Jashore | Kushtia | Faridpur | Average (%) |
|-------------------------|---------|--------|---------|---------|----------|-------------|
| Labor (man-days)        | 21740.37| 21738.93| 21462.02| 20827.20| 21825.05| 21518.71 (35.53) |
| Family                  | 6371.60 | 5725.97 | 5920.06 | 5534.22 | 5823.2   | 5875.01     |
| Hired                   | 15368.77| 16012.96| 15541.96| 15292.98| 16001.85| 15643.70    |
| Power tiler             | 7590.44 | 6802.37 | 6931.70 | 7010.19 | 8212.92  | 7309.53 (12.07) |
| Owned                   | 2530.15 | 2267.46 | 2310.57 | 2336.73 | 2737.64  | 2436.51     |
| Hired                   | 5060.29 | 4534.91 | 4621.14 | 4673.46 | 5475.28  | 4873.02     |
| Seed                    | 4073.16 | 4120.91 | 4023.56 | 4411.93 | 4351.75  | 4196.26 (6.80) |
| Owned                   | 1357.72 | 1373.64 | 1341.19 | 1470.64 | 1450.58  | 1398.75     |
| Purchased               | 2715.44 | 2747.28 | 2682.38 | 2941.29 | 2901.17  | 2797.51     |
| Fertilizer              | 9588.49 | 8413.54 | 9007.54 | 9041.99 | 9848.71  | 9180.05 (15.16) |
| Organic manure          | 1952.95 | 1834.35 | 1817.87 | 1826.70 | 1901.92  | 1866.76 (3.78) |
| Pesticide               | 962.32  | 1306.97 | 904.16  | 866.56  | 1050.44  | 1018.09 (1.68) |
| Insecticide             | 727.15  | 704.44  | 811.66  | 864.75  | 995.85   | 820.77 (1.36) |
| Irrigation              | 4087.65 | 4114.54 | 4086.63 | 3927.96 | 4327.21  | 4108.80 (6.79) |
| Owned                   | 1362.55 | 1371.51 | 1362.21 | 1309.32 | 1442.40  | 1369.60     |
| Hired                   | 2725.10 | 2743.03 | 2724.42 | 2618.64 | 2884.81  | 2739.20     |
| Interest on operating capital | 3043.35 | 2942.16 | 2942.71 | 2902.64 | 3150.831 | 2996.34 (4.95) |
| Total variable cost     | 58358.06| 55615.25| 56234.82| 55592.57| 55664.68| 56293.08 (92.96) |
| Total Fixed cost        | 4458.59 | 4388.45 | 3925.87 | 4521.88 | 4421.88  | 4343.33 (7.04) |
| Total cash cost         | 49241.69| 47430.78| 47408.79| 47370.17| 46730.81| 47636.45 (78.66) |
| Total Cost              | 62816.65| 60003.70| 60160.69| 59714.45| 60086.56| 60556.41 (100)  |

Source: Field Survey, 2016

### Table 3. Productivity and profitability of Binamasur-5 production at farm level

| Type                      | Cost and Return in Taka | Average (%) |
|---------------------------|-------------------------|-------------|
| Yield (kg/ha)             | 1879.67                 | 1737.53     |
| Yield (Tk./ha)            | 12205.94                | 10891.38    |
| By product (Tk./ha)       | 1025.08                 | 1425.47     |
| Gross return              | 123084.32               | 110338.95   |
| Total variable cost       | 58358.06                | 55615.25    |
| Total Cost                | 62816.65                | 60003.70    |
| Gross Margin              | 64726.25                | 54723.70    |
| Net Return (Tk./ha)       | 60267.66                | 50335.25    |
| Benefit Cost Ratio (BCR)  |                         |             |
| Full cost basis           | 1.96                    | 1.84        |
| Cash cost basis           | 2.50                    | 2.33        |

Source: Field Survey, 2016

### Table 4. Constraint to Binamasur-5 cultivation at farm level

| Constraints               | Percent farmers’ responded | Rank |
|---------------------------|----------------------------|------|
| Unavailability of Binamasur-5 seed | Magura 90 | Pabna 97 | Jashore 78 | Kushtia 100 | Faridpur 98 | All 93 | 1 |
| Lack of technical know-how | Magura 66 | Pabna 63 | Jashore 75 | Kushtia 77 | Faridpur 75 | All 71 | 2 |
| Lack of training          | Magura 55 | Pabna 69 | Jashore 61 | Kushtia 70 | Faridpur 69 | All 65 | 3 |
| Attack of root rot disease | Magura 44 | Pabna 48 | Jashore 57 | Kushtia 48 | Faridpur 55 | All 50 | 4 |

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Fig. 1. Major shares of cost of production

Fig. 2. Cost and return of Binamasur-5 production

Fig. 3. Profitability of Binamasur-5 production
4. CONCLUSION

Binamasur-5 production in the study areas is profitable. Lentil farmers received high return on its investment. The gross margin and net return of Binamasur-5 cultivation were positive and encouraging to the farmers. Although Binamasur-5 is a profitable crop, majority of the farmers did not get desired yield for ignoring the recommended use of inputs. Also Binamasur-5 farmers could not receive higher benefit from lentil cultivation due to various constraints. Government should ensure timely adequate supply of quality or adulteration free inputs (seed, fertilizer, pesticides, etc.). Frequent interaction was needed among farmers, extension personnel and Binamasur-5 growers. Hand-on training on improved lentil cultivation and crop management practices for the groundnut growing farmers is also an important and government should take care of it.

CONSENT

As per international standard or university standard, participant’s written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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