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# Impact assessment of front line demonstrations (FLDs) on rice (*Oryza sativa* L.) variety Shraboni in Lakhimpur district of Assam

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## Abstract
Rice is normally grown as an important crop of Assam during *kharif* throughout the state. During 2015-16 to 2019-20, Front Line Demonstration (FLD) on medium duration *Sali* rice variety *Shraboni* was conducted by Krishi Vigyan Kendra, Lakhimpur covering 74 numbers farmers in Lakhimpur district of Assam under North Bank Plain Zone by the involvement of farmers participated in the demonstration with the aim to popularized the newly developed improved *Sali* rice variety among the farming community. It was observed in the demonstration that rice productivity could be increased by replacing the old traditional variety with recommended package of practices. For comparison with demonstrated variety of *Shraboni*, existing farmers' variety *Mahsuri* was considered as check variety. The results of the demonstration showed that the yield of variety *Shraboni* was ranging from 49.8 to 52.6 q/ha with the average yield of 50.9 q/ha, against the farmers practice of 41.3 to 49.5 q/ha with the average yield of 43.02 q/ha. During 2015-16 to 2019-20, the per cent increase in the yield of improved variety over the farmers' practice was 6.26% to 23.61% respectively. The demonstration also showed 3.1 to 9.8 q/ha extension gap and 7.4 to 10.2 q/ha technology gap during the period with the technology index of 12.33 to 17.0 per cent which indicated the requirement to upgrade the knowledge farmers and lower the technology index indicated the suitability of improved demonstrated technology at specific location of the farmers' field. In the demonstrated technology, the average net return (Rs 20,564/ha), economic efficiency (Rs. 151.58/ha/day), benefit cost ratio (1.57) and production efficiency (37.52 kg/ha/day) were also recorded higher against the existing variety of the farmer.

**Keywords:** *Sali* rice, front line demonstration, extension gap, technology gap, technology index, production efficiency, economic efficiency

## Introduction
World's almost of half of the population consumed rice as staple food. For about 34 countries in Asia, Pacific, North and South America and Africa, rice is considered as the predominant dietary energy source. It is also considered that 20% of the world's dietary energy is contributed by rice. In developing countries of the world, people taken rice as important food crops and more than 60% of the Indian population consumed rice as staple food (Anomymous, 2012) [1]. In India rice is the most important food crops in terms of area, production and preferred food item in the entire country. During 2011-12, India produced more than 100 million MT rice accounting 22.81% of global production and hold the second position in production and consumption of rice in the world. It is estimated that due to increased population of more than one and a half billion by 2030, India has to increase the rice production to120 million MT to feed the entire country (Anonymous, 2013) [2]. Rice is the predominant food crop of Assam occupying an area of 25.03 lakh ha, where four types of rice *viz*., *ahu, sali, boro* and *bao* are grown. Out of the total area under rice, *sali* (kharif) rice covered the highest area of 18.81 lakh ha with an average productivity of 20.02 q/ha. Long duration photosensitive local varieties of *sali* rice are mostly grown in Assam and only 10-15 percent area is devoted to high yielding varieties (HYV), as a result the productivity becomes low.

Cultivation of long duration local varieties of rice creates problems to sow the rabi crops in time. If the farmers are able to harvest the kharif rice at least 15-20 days earlier than usual harvesting time then the next rabi crops could be sown in optimum time. Medium duration HYV of rice maturing about 130-135 days are important to fit in the existing cropping system followed in the state. Keeping in view the unavailability of medium duration improved *Sali* rice variety with high yield potential, the present assessment was undertaken to evaluate the impact of demonstration on *Sali* rice in various blocks of Lakhimpur district of Assam.

## Materials and Methods

A total of seventy-four (74) NOS. of Front Line Demonstrations (FLDs) on rice were conducted in Lakhimpur district of Assam covering five blocks *viz.*, Lakhimpur, Ghilamora, Telahi, Karunabari and Narayanpur during the period of 2015-16 to 2019-20. Before conducting demonstrations, survey was done as suggested by Choudhary (1999) [3] for selecting the farmers for the demonstration. The necessary critical inputs were provided to the farmers and regular monitoring of the demonstration by the KVK scientists helped proper guidance to the farmers. Awareness camp, capacity building trainings programme, field days and group discussions were also conducted to disseminate the demonstrated technology to the neighbouring farmers. The sowing was done during mid-June and transplanting was done in mid-July under rainfed medium land situation and harvested during the month of October-November. The recommended medium duration *Sali* rice variety "Shraboni" was demonstrated with the seed rate of 40 kg/ha. Seed was treated with fungicide Carbendazim@ 2.5g/kg seed. Compost @ 5 t/ha along with 60-20-40 NPK kg/ha were also applied in demonstration and transplanted with the spacing of 20 cm x 15 cm. In the contrary, the farmers existing variety "Mahsuri" was transplanted using seed rate of 45-50 kg/ha without maintaining any line and spacing. Seed treatment was also not done for the existing farmers variety. An equal area was selected and various data on yield and yield attributes were collected from that area both for demonstrated Improved Technology (IT) and farmers' practice (FP). The objective of the demonstration was to study the gaps between the potential yield and demonstration yield, extension gap, technology index, production efficiency and economic efficiency. During the period of assessment study, the various data related to output of rice cultivation were collected from demonstrated area, besides that information on different local practices adopted generally by the rice farmers of the district were also collected. The formulae for estimation of technology gap, extension gap and technology index (Samui *et al.*, 2000) [4] are as:

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield - Farmers yield

$$\text{Technology index} = \frac{\text{Potential yield - Demonstration yield}}{\text{Potential yield}} \times 100$$

Additional return = Demonstration return - Farmers practice return

$$\text{Incremental B: C ratio} = \frac{\text{Additional return}}{\text{Additional cost}}$$

For calculating different economic aspect such as net return per ha and benefit cost ratio, the cost of cultivation for treatments was taken into account by considering all the expenses incurred during cultivation. The gross return was calculated as total income obtained from the produce of grain and straw yield based on the prevailing market price. Net return and benefit cost ratio was calculated as follows:

Net return (Rs/ha) = Gross return (Rs/ha) - cost of cultivation (Rs/ha).

For calculation of Production efficiency and economic efficiency (Kumar *et al.*, 2017) [5] the formulae was used as below:

$$\text{Production efficiency (kg/ha/day)} = \frac{\text{Grain yield (kg/ha)}}{\text{Total duration of the crop (in days)}} \times 100$$

$$\text{Economic efficiency (Rs/ha/day)} = \frac{\text{Net return (Rs/ha)}}{\text{Total duration of the crop (in days)}} \times 100$$

### Details of Technology demonstrated

The high yielding *Sali* rice variety "Shraboni (TTB-404)" suitable for medium land situation was released from Assam Agricultural University, Assam. The duration of the variety is 130-135 days with the average yield of 50-55 q/ha. It is suitable for double cropped area of the district where after harvesting of this variety any rabi crops can be grown in same piece of land which may increase the cropping of the district.

## Results and Discussion

The district Lakhimpur is surrounded by Dhemaji district in the East and Siang and Papumpare districts of Arunachal Pradesh in the North. The Subansiri and Ranganadi are the two main rivers which controls the main drainage system of the district. The district receives an annual average rainfall of 2949 mm with 125 rainy days experiencing a warm humid climate (Sarmah *et al.*, 2013) [6]. The south west monsoon started from the month of April and continues up to September. Substantial amount of pre-monsoon rainfall also receives during the month of March to May which sometimes leads to occurrence of flood in the district (Table 1).

**Table 1:** Rainfall pattern during *kharif* in Lakhimpur district of Assam

| Rainfall trend (mm) | Normal Rainfall (mm) | Rainfall (mm) | | | | |
|---|---|---|---|---|---|---|
| | | 2015 | 2016 | 2017 | 2018 | 2019 |
| Annual rainfall | 2999.2 | 3222.5 | 3355.5 | 3782.2 | 2689.9 | 832.1 |
| June | 618.0 | 904.8 | 577.2 | 737.0 | 443.2 | 18.3 |
| July | 548.0 | 384.0 | 781.1 | 685.0 | 687.5 | 151.1 |
| August | 469.0 | 650.1 | 189.1 | 538.30 | 497.9 | 104.7 |
| September | 444.0 | 225.2 | 639.1 | 428.3 | 326.8 | 49.2 |
| Total rainfall (*kharif*) (mm) | 2079.0 | 2191.1 | 2186.5 | 2388.6 | 1955.4 | 323.3 |
| No. of rainy days (*kharif*) | 80 | 67 | 71 | 73 | 65 | 32 |

**Table 2:** Yield attributes under demonstrations and existing farmers' practice (Mean of five years data)

| Yield parameters | Rice variety Shraboni | Farmer's variety Mahsuri |
|---|---|---|
| Plant height (cm) | 116.2 | 115.6 |
| Panicle/hill (NOS) | 16 | 14 |
| Panicle length (cm) | 21.6 | 20.3 |
| Grain/panicle (NOS) | 203 | 157 |
| Average Grain yield (q/ha) | 50.90 | 43.02 |

It was revealed from the study that, the average height of plant (cm), number of tillers per hill, length of panicle (cm), number of grains per panicle and grains yield (q/ha) of rice variety Shraboni was 116.2 cm, 16 NOS, 21.6 cm, 203 no and 50.90 q/ha respectively during the period from 2015-16 to 2019-20, whereas, average height of plant (cm), number of tillers per hill, length of panicle (cm), number of grains per panicle and grains yield (q/ha) of farmer's variety (Var. Mahsuri) were 115.6 cm, 14 NOS, 20.3 cm, 157 NOS and 43.02 q/ha respectively during the period from 2015-16 to 2019-20. Therefore, data presented in the Table-2 clearly indicated that in all the yield and yield attributes rice variety Shraboni showed better performance than farmer's existing variety Mahsuri.

**Table 3:** Yield performances of rice variety Shraboni and Farmer's variety (Mahsuri) during 2015-16 to 2019-20 in Lakhimpur district of Assam

| Year | Farmers (No) | Area (ha) | Demo yield (q/ha) | Farmer's Practice (q/ha) | % Yield increase |
|---|---|---|---|---|---|
| 2015-16 | 04 | 0.52 | 52.6 | 49.5 | 6.26 |
| 2016-17 | 04 | 1.0 | 50.6 | 41.3 | 22.52 |
| 2017-18 | 23 | 3.0 | 50.1 | 41.5 | 20.72 |
| 2018-19 | 21 | 3.0 | 49.8 | 41.3 | 20.58 |
| 2019-20 | 22 | 3.0 | 51.3 | 41.5 | 23.61 |
| Mean | - | - | 50.9 | 43.02 | 18.74 |
| Total | 74 | 10.52 | - | - | - |

## Yield gaps

The data showed in Table-3 revealed that the average grain yield of improved medium duration *Sali* rice variety Shraboni under demonstration was 50.9 q/ha as against 43.02 q/ha in farmers existing traditional variety Mahsuri. It indicated that 18.74% higher production of rice could be obtained using improved variety along with recommended package of practices than farmers' traditional variety. The highest rice yield was recorded during 2015-16 (52.6 q/ha) followed by during 2019-20 (51.3 q/ha). The lowest yield of rice 49.8 q/ha was recorded during the year 2018-19.

**Table 4:** Technology gap, extension gap and technological index of *Sali* rice variety Shraboni under impact assessment study

| Year | Technology gap (q/ha) | Extension gap (q/ha) | Technology Index (%) | Production efficiency (kg/ha/day) | |
|---|---|---|---|---|---|
| | | | | Recommended practice | Farmer's practice |
| 2015-16 | 7.4 | 3.1 | 12.33 | 38.96 | 35.36 |
| 2016-17 | 9.4 | 9.3 | 15.67 | 37.21 | 29.71 |
| 2017-18 | 9.9 | 8.6 | 16.50 | 37.11 | 29.43 |
| 2018-19 | 10.2 | 8.5 | 17.00 | 37.16 | 29.50 |
| 2019-20 | 8.7 | 9.8 | 14.50 | 37.17 | 29.23 |
| Total | 45.6 | 39.3 | 76.00 | 187.61 | 153.23 |
| Mean | 9.12 | 7.86 | 15.20 | 37.52 | 30.65 |

## Technology gap, Extension gap and Technology index

The lowest technology gap of 7.4 q/ha during 2015-16 and highest technology gap of 10.2 q/ha during 2018-19 was recorded under study. The above technology gap was observed due to difference in soil fertility status, topography of the land, sowing time of crops and weather conditions prevails at different demonstrated areas in the district during the period under report. Therefore, various recommendation specific to the local condition may be required to bridge the gap between the yields of rice. During 2019-20, the highest extension gap was recorded followed by during the year 2016-17, which indicated that there is need to educate and aware the farmers for adoption of new improved technologies to change the trend of extension gap in reverse direction. Subsequently bringing more areas under high yielding varieties may change the trend of extension gap (Sarma *et al.*, 2014) [7]. The satisfactory performance of new varieties at farmers field during demonstration will definitely encourage the farmers to replace their existing old varieties. The technology index indicated the feasibility of new improved technology at the farmer's fields. Lower value of technology index means higher the feasibility of the technology. As such the reduction of technology index varying from location to location exhibited the feasibility of technology demonstrated. The technology index recorded was 12.33, 15.67, 16.50, 17.00, 14.50 percent during the year 2015-16, 2016-17, 2017-18, 2018-19 and 2019-20, respectively. Mean technology index of five years was recorded 15.20 percent. The fluctuation in technology index in some locations during the study period might be attributed to the difference in soil fertility status of the fields, weather conditions prevail, non-availability of irrigation facilities and infestation of insect-pest in the crop. Mitra and Samajdar (2010) [8] observed the more feasibility of the technology demonstrated with the lower value technology index. Same finding was also reported by Kumar *et al.*, (2020) [9]. Feasibility of the improved technology in the field can be measured by technology index. Chauhan, (2011) [10] opined that if technology index value is low which indicates the more feasibility of the technology demonstrated.

**Table 5:** Economic of demonstrated plots and farmers' practice under demonstration

| Year | Net return (Rs./ ha) | | B:C ratio | | Economic efficiency (Rs/ha/day) | |
|---|---|---|---|---|---|---|
| | Demonstrated plot | Farmers practice | Demonstrated plot | Farmers practice | Demonstrated plot | Farmers practice |
| 2015-16 | 21220 | 16020 | 1.60 | 1.52 | 157.18 | 114.43 |
| 2016-17 | 20010 | 14810 | 1.54 | 1.48 | 147.13 | 106.55 |
| 2017-18 | 19460 | 15030 | 1.55 | 1.49 | 144.15 | 106.60 |
| 2018-19 | 19130 | 14810 | 1.54 | 1.48 | 142.76 | 105.79 |
| 2019-20 | 23000 | 11240 | 1.60 | 1.29 | 166.67 | 79.16 |
| Mean | 20564 | 14382 | 1.57 | 1.45 | 151.58 | 102.50 |

## Economics
The various economic parameter such as cost of cultivation, gross return, net return, benefit cost ratio was calculated based on the input and output prices of commodities prevailing during the five years of demonstration (Table-5). The economic indicator clearly revealed that net return from the improved technology was higher than the farmers' practice during the demonstration period. Results showed that the net return recorded was Rs. 21220.00, 20010.00, 19460.00, 19130.00 and 23000.00 per ha in demonstration plot and 16020.00, 14810.00, 15030.00, 14810.00 and 11240.00 per ha in farmers' practice during the year 2015-16, 2016-17, 2017-18, 2018-19 and 2019-20, respectively. Higher mean net return of five years recorded was Rs. 23000.00 per ha in the demonstrated plot as compared to farmers' practice during 2019-20. Higher benefit cost ratio was also recorded demonstrated plot (1.57) than the farmers' practice (1.45). This is due to more yield obtained under improved variety as compared to farmers' variety. Similar findings were also reported by Kumar *et al.*, (2020) [11]. Higher mean production efficiency of 37.52 kg/ha/day and economic efficiency of 151.58 Rs/ha/day during five years were recorded in improved technology demonstrated than the farmer's practice. Therefore, emphasis should be given on increasing awareness among the farmers through the demonstration to get the potential performance of improved technologies.

## Conclusion
To obtain the maximum yield, net return and additional income from rice cultivation, the improved technologies had been demonstrated under Front Line Demonstrations which leads to economic viability of the farming among the farmers of the district. The various biophysical, socio-economic, management, institutional and policy factors may affect the yield and profit gaps between technology demonstrated and farmer's practice. The highest extension gap indicates the need of various extension mechanism to upgrade the knowledge of farmers for adoption of improved technologies to change the trend of wide extension gap in reverse direction.

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