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# Impact Assessment of Technological Interventions for Reducing Yield Gaps in Rice ( *Oryza sativa* L.) Under Temperate Hill Ecology

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## ABSTRACT

Rice cultivation extends from the planes having altitude 1600 m above the mean sea level to high altitude hills 2300 m above msl in the temperate Kashmir valley. Productivity of Rice crop is very low compared to the potential yield. To narrow down the yield gaps and achieve maximum yields, demonstrations on improved rice technologies among rice growing farmers of mid belts were conducted by the KVK Kulgam from year 2013 to 2017. The results demonstrations revealed a significant improvement in yield in demonstrations over farmers practice. The yield superiority ranged from 9.2 % to 15.8 %. A yield advantage of 11.9 % over farmers' practice was recorded in demonstrations. An extension gap of 6.32 q/ ha hectare was recorded. Net returns of 96843/= were recorded in demonstrations against 87315/= from the farmers practice. Incremental Benefit Cost Ratio (IBCR) of demonstrations was 2.1.

**Key Words:** Paddy, Frontline Demonstration, Impact, Temperate condition.

## INTRODUCTION

India is the leading rice (*Oryza sativa* L.) producing country in terms of area and the second largest producer next to China (Mouneshwari *et al*, 2017). It is staple food of the people of temperate Kashmir Valley and its cultivation extends from the planes having altitude 1600 m above the mean sea level to high altitude hills 2300 m above msl in the valley. Average productivity of paddy in the Jammu & Kashmir is 2.2 t/ha (Mysir and Tapan, 2015). In a study Singh *et al* (2015) found that maximum number of farmers applied urea in the range of 187.5 to 250 kg/ha to the variety Pusa Punjab Basmati 1509 and harvested an additional yield of about 0.75q/ha as compared to the farmers applying ≤187.5kg/ ha. A decline in productivity was also noticed with higher application rates in this variety while in case of Pusa Basmati 1121 an equal number of farmers applied in the range of ≤187.5 kg/ha and 187.5 to 250 kg/ha and the yields were almost comparable. However, few farmers got much higher yield by applying urea in the range of 250.0 to 312.5 kg/ha. There exists a huge gap between the present level of productivity and the production potential, which can be narrowed down through demonstrations on improved rice technologies among rice farming community. Kumar *et al* (2018) analyzed the constraints experienced by agricultural scientists and extension personnel in rice knowledge management and its delivery. The results showed that agricultural scientists and extension personnel faced technological, social, economical and psychological constraints more severely. Likewise, Kumar and Lal (2018) reported that effective communication from different sources and channels were the essence of extension which provides agricultural information and knowledge to the farmers. They concluded that extension personnel were considered as the most credible source of information followed by radio, television, newspaper and computer. In view of this, frontline demonstrations on rice were conducted by the

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Krishi Vigyan Kendra, Kulgam with an objective to popularize the potential technologies related rice farming.

## MATERIALS AND METHODS

Front line demonstration (FLD) were conducted by the Krishi Vigyan Kendra Kulgam. Paddy variety Jhelum, a high yielding rice cultivar famous for high yield potential and quality , released for the plain zone and successfully tested in the mid altitudes areas in district Kulgam situated at 75$^o$01' east longitude and 33$^o$ 39' north latitude in the lap of Peer Panchal , Himalayan Ranges. The study area falls between an altitude of 1650 and 1850 m amsl. Improved production and protection technologies related to the paddy variety Jhelum were demonstrated at farmers' field in participatory mode during *Kharif* seasons from 2013 to 2017. Each FLD was conducted in an area of 0.4 ha. The data recorded were used for calculating economics and gap analysis. The details of the technologies demonstrated were:

**Seed rate:** 60 kg seed for one hectare against famers' practice of higher seed rate ranging 150-200 kg/ha.

**Seed treatment:** Treatment with Mancozeb@ 2g + Carbendazim @1g per kg of seed

**Seedbed treatment:** Spray of Captan 50 WP 0.15% and Hexaconazole 5 EC 0.15% in cocktail.
**Sowing time:** The sowing of seed was done in the first week of May**.**

### Nursery management:

Seedlings were raised under Modified protected nursery against farmers' practice of raising nursery in the open. In modified protected nursery the medium consisted of a 20-25 cm layer of soil, sand, organic manure and ash in the ratio of 2:2:1:1 laid on polythene sheet .Nursery area had good facilities for drainage. Polythene sheets were used to cover locally available willows sticks to make low tunnels. Nursery was kept covered with polythene during cloudy/rainy days and also during night hours particularly. 22-25d old seedlings from modified protected nursery were transplanted at different locations over the years.

### Balanced dose of fertilizer

Farmers were advised to strictly follow the recommendations with regard to the dose and time of fertilizer application. In some cases farmers were advised to reduce urea fertilizer dose owing to inherent nitrogen fertility/consistent use of organic manures in plenty.

### Plant population

Farmers were instructed to transplant 2-3 healthy rice seedling per hill **w**ith 35-45 Plants/ m

### Water management

Owing to availability of water in plenty famers generally apply running water to the paddy crop throughout the season excluding the pre heading stage. Farmers were therefore, advised to impound water (5cm) for the first 15d after transplanting. Complete draining out of water was advocated at mid- tillering stage (20-22 DAT) for 1$^{st}$ top dose of nitrogen after hand weeding, panicle initiation stage (35-40 DAT) for application of 2$^{nd}$ top dose of nitrogen and pre-heading stage (50-55 DAT) to stimulate heading. From flowering to milk stage, a thin layer of water was advised to be maintained in the field. After Alternate wetting and drying was done from dough stage, (85-90 DAT) to physiological maturity (100DAT). No irrigation was given after physiological maturity.

## RESULTS AND DISCUSSION

### Crop yield

During five years of demonstrations, 278 FLDs were laid over an area of 111.4 ha. The results of demonstrations revealed a substantial increase in yield in improved technology over farmers' practice. Over the years and locations improved practices recorded an average yield of 59.48q/ha compared to 53.16 q/ha obtained under farmers' practice of rice cultivation (Table 1). The yield superiority ranged between 9.2 and 15.8 per cent. An overall

**Table 1. Grain yield and gap analysis of front line demonstrations on paddy (2013-17) at farmers' field.**

| Year | Variety | No. of demonstrations | Area under demonstration (ha) | Average yield in Demonstration (q/ha) | Average yield in Farmers practice (q/ha) | Percentage yield increase | Extension gap (q/ha) |
|---|---|---|---|---|---|---|---|
| 2013 | Jehlum | 75.0 | 30.0 | 60.6 | 52.3 | 15.8 | 8.3 |
| 2014* | Jehlum | 97.5 | 39.0 | 42.6 | 38.3 | 11.2 | 4.3 |
| 2015 | Jehlum | 25.0 | 10.0 | 63.8 | 58.4 | 9.2 | 5.4 |
| 2016 | Jehlum | 21.0 | 8.4 | 66.2 | 59.4 | 11.4 | 6.8 |
| 2017 | Jehlum | 60.0 | 24.0 | 64.2 | 57.4 | 11.8 | 6.8 |
| Total/ Average | | 278.5 | 111.4 | 59.48 | 53.16 | 11.88 | 6.32 |

**Due to incessant rains and floods in 2014 yield declined drastically.*

**Table 2: Economic Analysis of frontline demonstration programme on paddy at farmers' field.**

| Year | Input cost (Rs./ha) | | Additional cost in demonstrations | Net returns (Rs.) | | Additional returns from demonstration (Rs.) | Effective Gain from demonstration ( Rs.) | BCR |
|---|---|---|---|---|---|---|---|---|
| | Farmers' Practice | Demonstration | | Farmers' practice | Demonstration | | | |
| 2013 | 25,690 | 28,700 | 3,010 | 55,165 | 65,096 | 9,931 | 6,921 | 2.3 |
| 2014 | 26,200 | 29,200 | 3000 | 73,430 | 82,539 | 9,109 | 6,109 | 2.0 |
| 2015 | 26,600 | 29,415 | 2,815 | 77,100 | 85,200 | 8,100 | 5,285 | 1.9 |
| 2016 | 27,800 | 30,872 | 3,072 | 1,14,310 | 1,23,816 | 9,506 | 6,434 | 2.1 |
| 2017 | 28,192 | 32,448 | 4,256 | 1,16,574 | 1,27,564 | 10,990 | 6,734 | 1.6 |
| Average | 26,896 | 30,127 | 3,230 | 87,315 | 96,843 | 9,528 | 6,298 | 1.9 |

yield advantage of 11.9 per cent was recorded in technology demonstrated.

**Gap analysis**

An extension gap between 4.3 to 8.3 q/ ha was recorded over the years and location. On an average the extension gap was 6.32q/ha (Table 1). The extension gap was lowest (4.3q/ha) during 2014 and was highest (8.3 q/ha) during 2013. Such gap might be attributed to adoption of improved whole package technologies in demonstrations which resulted in higher grain yield than the traditional farmers practices (Singh *et al,* 2012). The declining trend in extension gap during 2014 might be due to better performance of farmers' practice under abnormal weather condition *i.e.* incessant rains and lower temperature during flowering period.

**Economic impact**

Economic returns as a function of grain yield and sale price varied during different years. Maximum returns of Rs.1,27,564/-ha were achieved from demonstration plots during the year 2017 .Net returns pooled over the years were Rs.96,843/-ha in technology demonstrated against Rs.87,315/-ha from the farmers' practice. The higher additional returns and effective gain (Table 2 ) obtained under demonstrations could be due to improved technology, timely execution of field operations and monitoring of demonstration plots followed by on spot advisories (Mubarak *et al,* 2012). The highest incremental benefit: cost ratio (IBCR) 2.3 was registered during 2013. Overall IBCR recorded during the period was 1.9.

## CONCLUSION

Since rice is the staple food of the people of Kashmir Valley, there is and will always remain demand for rice in the valley. The area is shrinking day by day due to diversification into other sectors especially horticulture and non-agriculture activities. To meet the present and future demand of paddy the average productivity not less than 5t/ha is required. For this it is imperative to demonstrate all the proven technologies developed by the SAU at farmers' field so that the productivity is reasonably high to meet the demand. Suitable varieties with other technological components play an important role as evident from the results of this study.

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