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Short Research Article

# Promotion of Rice Variety NDR 8002 in Rainfed Lowland Condition of Eastern Uttar Pradesh

**Saurabh Verma*, D. P. Singh, N. K. Singh and V. K. Singh**

Krishi Vigyan Kendra Mau, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh (224 229), India

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**Correspondence to**

**E-mail*: saurabh011012@gmail.com

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**Abstract**

Rice is a main crop in the lowland condition of eastern Uttar Pradesh where it grows extensively under rainfed condition during monsoon months. The participatory approaches revealed the problem associated with rice cultivation and it has been found that there is need of a short to medium duration high yielding rice variety in lieu of the traditional medium long duration varieties to catch the *rabi* season in time. Considering the factual need of the farming community, the on farm trials and front line demonstrations has been planned by the KVK and conducted in an area of 30.0 ha involving 100 farmers in five adopted villages in five different blocks of Mau district. The results show that the yield of newly introduced rice variety NDR 8002 increased successively over the years in demonstration plots and with little increase in cost of cultivation under demonstration a higher return was achieved. Improved technology increased yield (35.08 q ha$^{-1}$) over farmers' practices by the margins of 49.02% in rice crop under rainfed conditions. Net profit of ₹ 17,905 ha$^{-1}$ and B:C ratio of 1.95 was found with demonstrations and was much higher when compared with farmers' practices (₹ 8,900 ha$^{-1}$ and 1.56, respectively) in the crop under studied. The extension gaps for improved technologies were more than technology gaps and also the technology index was low, highlighted the need to educate the farmers in rapid adoption of improved technologies in rice crops.

## 1. Introduction

Rice is the most important and extensively grown food crop for more than two third of the Indian population. India is second largest paddy producer in the world followed by China. Rice is the major crop in Uttar Pradesh and is grown in about 5.90 m ha which comprises of 13.5% of total rice in India. The state ranks 3rd in the country in production of rice. Annual rice production is around 12 m mt in the state. The average productivity of the state is 2.0 t ha$^{-1}$ (Singh et al., 2009; Singh et al., 2013). However, natural hazards including submergence or drought or both adversely affect the productivity. As such, no recent information on district wise rice ecosystems of the Uttar Pradesh is available. However, Huke and Huke (1997) estimated the area under different ecosystem in the state (Table 1). The major area under lowland and flood prone is located in eastern part of Uttar Pradesh covering 15 districts which constitutes about 30% area of total rice cultivated in the state. Rainfed areas are vulnerable to the vagaries of rain and therefore, the fluctuations in their output. The average rice productivity from rainfed ecology is low and fluctuates between 0.5 to 1.6 t ha$^{-1}$ (Adhya et al., 2008).

The irregularites in south-west monsoons do result in moderate to severe droughts in rainfed rice growing areas especially in eastern Uttar Pradesh. Unlike many other places of the state, rainfed region is also extensively occupied by rice crop during monsoon months. Mostly the farmers of this region cultivated medium duration (120–140 days) rice varieties as rainfed crop (Singh, 2011). Sarjoo 52, NDR 359, BPT-5204, Mehsuri, etc are the popular rice varieties mostly grown in this region; but among these Sarjoo 52 is the predominant variety which covers more than 50% of the rice growing area. The cropping systems followed here are rice-based, the crops grown during *rabi* season after rice face the problem of late sowing; due to which the productivity of *rabi* field crops remain low. There is hardly any scope to replace the rice crop in the rainfed low lands considering the high moisture contents remains throughout the growing periods during the monsoon season. Rainfed lowlands which contributes more than 50% area under rice in eastern Uttar Pradesh, multiple cropping system using short to medium duration rice varieties and intensive

 

Table 1: Area under different rice ecosystem in the region

| Sl. No. | Ecosystems | Area (mha) | | |
|---|---|---|---|---|
| | | Eastern UP | UP | India |
| 1. | Upland | 0.24 (08.0%) | 0.55 (09.2%) | 05.87 (13.0%) |
| 2. | Irrigated | 0.82 (28.0%) | 2.57 (43.1%) | 24.34 (53.9%) |
| 3. | Deep water (>100 cm) | 0.35 (12.0%) | 0.42 (07.1%) | 02.71 (06.0%) |
| 4. | Rainfed shallow lowland | 1.49 (51.0%) | 2.42 (40.6%) | 12.24 (27.1%) |
| Total | | 2.9 | 5.96 | 45.16 |

input management may enhance the land use efficiency and increase the production level if sowing of *rabi* crops was done in time (Khanda et al., 2005). Hence, there remains a scope to introduce a short to medium duration high yielding rice variety in the existing rice-based cropping system in rainfed lowlands of Eastern Uttar Pradesh.

The participatory approaches were followed here to identify the real problem associated with the rice cultivation during monsoon season. If the farmers are able to harvest their rice crop 25–30 days earlier than usual harvesting time of the traditional varieties then they could be able to sow their next crop in time during *rabi* season. Keeping in view the constraint, Krishi Vigyan Kendra, Mau conducted front line demonstrations on paddy variety NDR 8002 with crop management practices under rainfed condition.

## 2. Materials and Methods

Front line demonstrations (FLDs) on paddy variety NDR 8002 was conducted by Krishi Vigya Kendra Mau, Uttar Pradesh (India) during the period from 2013–14 to 2015–16 in five villages viz. Dighera, Parashupur, Thalaipur, Semri Jamalpur and Khukhundwa. Front line demonstrations were conducted to demonstrate the production potential of newly released variety in farmers' field under real farming situation. The study was conducted during *kharif* season in five adopted villages across the different blocks (Madhuban, Ratanpura, Ghosi, Kopaganj) of Mau district for wider dissemination and popularization. Before demonstration, group meetings were conducted in each and every village where the problems associated were discussed and the advantages of growing short duration variety were addressed. A probable list of interested farmers had been prepared from the meeting. Further, KVK scientists visited the land of the selected farmers in presence of the villagers. Before implementing the programme, the skill training programmes were organized involving the selected farmers. Field days and other extension programmes were also organized inviting the farmers of the sand and nearby villages. The fertilizer doses were fixed on the soil test values. The fertility status of the demonstration plots was medium in nitrogen, low in phosphorus and medium in potassium.

The component demonstration of front line technology in paddy was comprised of improved variety NDR 8002, proper tillage, proper seed rate and direct seeding through drum seeder, balance dose of fertilizer (120 kg N, 60 kg $P_2O_5$ and 40 kg $K_2O$ $ha^{-1}$), seed treatment with streptocycline and carbendazim, weed management and protection measure (Table 2). An area of 30.0 ha was covered in three consecutive years. In the demonstration, one control plot was also kept where farmers practices was carried out. The demonstrations were conducted on block concept with an area varying from 0.2–0.4 ha involving 5–10 farmers $block^{-1}$.

The FLDs was conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and the technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap, extension gap and technological index (Samui et al., 2000) were calculated by using following equations as given below:

Technology gap (q $ha^{-1}$)=Potential yield (q $ha^{-1}$)-Demonstration yield (q $ha^{-1}$)

Extension gap (q $ha^{-1}$)=Demonstration yield (q $ha^{-1}$)-Farmer's yield (q $ha^{-1}$)

Technology index (%)=(Potential yield-Demonstration yield) Potential $^{-1}$ yield×100

## 3. Results and Discussion

The gap between the existing and recommended technologies of rice on selected farmers in district Mau is presented in Table 2. Full gap was observed in case of use of HYVs, seed treatment, sowing method and weed management, while partial gap was observed in fertilizer dose and plant protection measure, causes the reason for lower yield under rainfed conditions. Farmers were not aware about the recommended technologies. Farmers in general used local or old-age long duration varieties instead of the recommended high yielding short duration varieties. Unavailability of seed in time and lack of awareness were the main reasons. Farmers followed nursery method of sowing and transplanted old age nursery (25–30 days) seedlings of rice and closer spacing (15×15 $cm^2$) against the recommended direct seeding either wet seeded or dry seeded and proper spacing (20–25 cm row to row spacing).

Table 2: Package of practices adopted for demonstration and existing practice in rainfed lowland conditions

| Particulars | Improved practices demonstrated | Existing practices | Gap analyzed |
|---|---|---|---|
| Farming situation | Rainfed low land | Rainfed low land | - |
| Variety | NDR 8002 | Sarjoo 52 | Full gap |
| Land preparation | Three ploughing | Three ploughing | Nil |
| Planting method | Direct seeded rice under wet condition | Transplanting rice under puddle condition | Full gap |
| Seed rate | 40−50 kg ha$^{-1}$ | 25−30 kg ha$^{-1}$ | Higher seed rate |
| Seed treatment | Streptocycline @ 8.0 g 50 kg$^{-1}$ seed for BLB and carbendazim @ 100 g 50 kg$^{-1}$ seed for ShB and blast | No seed treatment | Full gap |
| Time of sowing transplanting$^{-1}$ | 25−30 June | 10−20 July | Early sowing |
| Seedling age at transplanting | - | 28−38 days | Full gap |
| Fertilizer application | 100:40:40 (NPK); Zn ($ZnSO_4$ @ 25 kg ha$^{-1}$) during final land preparation | 150:60:0 ( NPK); no application of micronutrients | Partial gap |
| Weed management | Integrated weed management | No weeding or delayed manual weeding | Full gap |
| Plant protection | Need based plant protection measures with special attention on bacterial leaf blight and sheath blight | Indiscriminate use of pesticides as prescribed by local pesticide retailers | Partial gap |
| Harvesting | 100−110 days | 125−145 days | Early harvesting |

### *3.1. Yield analysis*

Results of 75 front line demonstrations (Table 3) conducted during 2013–14 to 2015–16 in 30 ha area on farmers' fields of five villages of Mau district under rainfed lowland conditions indicated that average paddy yield was recorded 33.53 q ha$^{-1}$ under demonstrated plots as compared to existing farmers practice of 23.33 q ha$^{-1}$. These results clearly indicated higher average grain yield in demonstration plots compared to local check was due to knowledge and adoption of full package of practices. The yield of newly introduced rice variety NDR 8002 was increased successively over the years in demonstrated plots. The maximum demonstration yield (35.4 q ha$^{-1}$) was achieved during 2015–16, which was 48.12% higher than the existing farmers' practice yield of 23.9 q ha$^{-1}$. The above results are in similarity with the findings of Singh (2002); Singh et al. (2015).

Table 3: Yield performances of short duration var. NDR 8002 under demonstration

| Year | Number of demonstrations | Area (ha) | Potential yield (q ha$^{-1}$) | Demo yield (q ha$^{-1}$) | Local check (q ha$^{-1}$) | Yield increment (%) |
|---|---|---|---|---|---|---|
| 2013−14 | 25 | 10.0 | 37.5 | 31.4 | 22.6 | 38.94 |
| 2014−15 | 25 | 10.0 | 37.5 | 33.8 | 23.5 | 43.83 |
| 2015−16 | 25 | 10.0 | 37.5 | 35.4 | 23.9 | 48.12 |
| Mean | 75 | 30.0 | 37.5 | 33.53 | 23.33 | 43.71 |

Three consecutive years (2013−14 to 2015−16) of front line demonstrations with the rice variety NDR 8002 revealed that increase in yield over existing farmers' practice was 38.94 to 48.12% with the mean of 43.71% towards the enhancement of rice yield with its positive effects on yield attributing characters. The total number of matured panicles m$^{-2}$ as well as number of filled grains panicle$^{-1}$ is the two major yield attributing characters showed an increase under demonstration as compared to the control plots (Table 4). The variation in

Table 4: Comparison of yield attributes of rice between demonstration and control plots (average of three years)

| Yield attributes | Demonstration | Farmers' practice (control) |
|---|---|---|
| Number of matured panicles m$^{-2}$ | 247−259 | 205−225 |
| Number of filled grains panicle$^{-1}$ | 111−1120 | 94−109 |
| Test weight (g) | 20.5−21.5 | 19.8−21.4 |

yield in the successive years could be attributed to variation in climatic condition prevailing during the crop growth period. Depending upon the farming situation specific interventions may have greater implication in enhancing system productivity (Mukherjee, 2003; Mitra et al., 2014).

### 3.2. Technology gap analysis

The data depicted in Table 5 revealed that the short duration rice variety NDR 8002 found technology gap of 4.0 q $ha^{-1}$ between the demonstrations yield and potential yield. However, demonstrations were conducted under close supervision of scientists but the technology gap was still found there. It might be due to varied agro-ecosystems, soil fertility status and weather conditions of the area. Though technology gap decreases from 6.1 q $ha^{-1}$ to 2.1 q $ha^{-1}$ in due course of demonstrations conducted.

Table 5: Technology gap, extension gap and technology index in rice (var. NDR 8002) under FLDs

| Year | Technology gap (q $ha^{-1}$) | Extension gap (q $ha^{-1}$) | Technology index (%) |
|---|---|---|---|
| 2013−14 | 6.1 | 8.8 | 16.27 |
| 2014−15 | 3.7 | 10.3 | 09.87 |
| 2015−16 | 2.1 | 11.5 | 05.60 |
| Mean | 4.0 | 10.2 | 10.58 |

The extension gap ranged from 8.8 to 11.5 q $ha^{-1}$ during the period indicates that there is a gap existed between the yield of demonstrations and local check (farmers' practice). The farmers were failed to adopt recommended package of practices under conventional system and lead to extension gap (Table 5). The extension gap in the yield indicates that there is big scope to increase the yield of rice under rainfed lowland conditions at farmers' fields by adopting the recommended package of practices. Therefore, to bridge the extension gap, there is a need to give due emphasis on transfer of improved technologies and management practices of rice through strengthening of extension network. The extension gap for crop was higher as compared to the technology gap, which also indicates that there is a need to train and educate to the farmers about improved technologies. More and more use of latest production technologies during further years with high yielding varieties will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old existing practices and to adopt new technology.

The technology index shows the feasibility of the evolved technology at the farmers' field (Table 5). The lower the value of technology index more is the feasibility of the technology. Technology index was minimum (5.60%) during the later year of demonstrations (2015–16) compared to early demonstration programme of 2013–14 (16.27%). Technology index shows the feasibility of the demonstrated scientific technological interventions at the farmers' field. Similar findings were also observed by Mitra et al. (2014); Singh et al. (2015).

### 3.3. Economics analysis

The use of improved techniques required more cost for crop production than farmers practice in the crop under studied (Table 6). Increase in expenditure due to improved techniques over conventional system was lowest of ₹ 24,500 $ha^{-1}$ during the year 2013–14 and gradually increased during the subsequent years due to rise in prices of inputs. The use of improved techniques increased net economic gain of crop under demonstrations considerably. Maximum increase of ₹ 23,164 $ha^{-1}$ in net profit was observed in the crop during the year 2015–16. On an average, net profit of ₹ 20,172 $ha^{-1}$ and B:C ratio of 1.79 was found with demonstrations and was much higher when compared with farmers' practices (₹ 7,488 $ha^{-1}$ and 1.31, respectively) in the crop under studied. It might be attributed to quantity wise highest increased in yield with improved techniques over conventional system of rice. Benefit cost ratio on improved techniques was worked out highest of 1.87 during the year 2015–16. These results showed that investment on improved cultivation techniques is more profitable on rice under rainfed lowland in eastern plain zone of Uttar Pradesh. This finding is in corroboration with the findings of Singh et al. (2015). The crops, which gave higher profitability, proved economically beneficial.

Table 6: Comparative economics of rice cultivation between demonstration and farmers' practice

| Year | Demonstration | | | | Farmers' practice (control) | | | |
|---|---|---|---|---|---|---|---|---|
| | Cost of cultivation (₹ $ha^{-1}$) | Gross return (₹ $ha^{-1}$) | Net return (₹ $ha^{-1}$) | B:C | Cost of cultivation (₹ $ha^{-1}$) | Gross return (₹ $ha^{-1}$) | Net return (₹ $ha^{-1}$) | B:C |
| 2013−14 | 24500 | 41134 | 16634 | 1.68 | 22250 | 29606 | 7356 | 1.33 |
| 2014−15 | 25250 | 45968 | 20718 | 1.82 | 24750 | 31960 | 7210 | 1.29 |
| 2015−16 | 26750 | 49914 | 23164 | 1.87 | 25800 | 33699 | 7899 | 1.31 |
| Mean | 25500 | 45672 | 20172 | 1.79 | 24267 | 31755 | 7488 | 1.31 |

## 4. Conclusion

The productivity gain under FLD over existing practices of rice cultivation created greater awareness and motivated the other farmers to adopt suitable production technology of rice under rainfed lowland condition in the district. There is technology gap, which need to be bridged by promoting the scientific production and protection technologies in varied condition. Therefore, specific technology modules should be given for enhancing the productivity of rice under rainfed lowland condition of eastern plain zone of Uttar Pradesh.

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