**Economic Analysis of Dry Direct Seeded and Transplanted Rice in the Eastern Part of Uttar Pradesh, India**

**ABSTRACT**

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| **Aims:** The study was aimed at comparing dry direct seeding and transplanted systems of rice cultivation with the participation of farmers concerning rice growth, yield, water productivity, and economic returns.  **Place and Duration of Study:** The study was carried out by Krishi Vigyan Kendra, Malhana, Deoria, Uttar Pradesh, under the administrative control of Indian Council of Agriculture Research-Indian Institute of Vegetable Research (ICAR-IIVR) Varanasi, Uttar Pradesh, India during Kharif 2023 and 2024  **Methodology:** A total of 30 and 33 FLDs were conducted among the farming community of Deoria District as well as the KVK farm under dry direct seeding conditions with the Pusa Sambha 1850 paddy variety in the year of 2023 to 2024. The approved agronomical practices were used for the present study with respect to FLDs, and farmers practices are given in Table 1. The crop was seeded in the midweek of June and harvested in the first to midweek of November.  **Results:** The rice grain yields of 10.65 and 11.59 percent were higher under DDSR during both the demonstration periods. Results of this study indicated that higher grain yield with dry direct seeding rice can be achieved by using rice cultivars that can produce more productive tillers and longer panicles. The 20.87 and 19.80 percent cost of cultivation was saved under the dry direct seeding of rice than the transplanted system of rice during study period. The net return 34.92, 36.77 and benefit cost ration 39.56 and 43. 37 percent higher compared with the transplanted system of rice in the demonstrated years.  **Conclusion:** The dry-direct seeded of rice is more suitable, more the water saving, labor saving as well as the saving of the environment and more economical for paddy cultivation in eastern part of India. Furthermore, we require more demonstrations at various locations in this region. |

**Keywords:** Front Line Demonstration, Dry Direct Seeding, Transplanting, Cost of Cultivation, Gross return, Benefit Cost ratio.

**1. Introduction**

One of the world's staple crops, rice (*Oryza sativa* L.), is grown widely throughout all continents, but primarily in Asia. The world's population is expected to double by 2050, which means that the targeted 70% increase in rations until 2050 will require an average annual increase in food production of 44 million metric tons, which should be maintained for the next 40 years (FAO, 2009). However, 35 % of rice-producing regions are currently experiencing yield stagnation (Ray *et al.*, 2012), which could have a significant impact on global food security if rice production does not improve. Additionally, the possibility of alternative systems for developing and implementing better rice production using limited resources with minimal environmental impact is becoming necessary due to increased competition for land, energy, and water, as well as the growing negative environmental impact of current food production (*Tilman et al*. 2001). Rice, the most important cereal crop of India, plays a very important role in the country’s food security and is the vertebrae of the livelihood for millions of rural households. India produced 137.83 million tons of rice on 47.82 million hectares of land with a productivity of 2882 kg/ha in 2023-24 (Agricultural Statistics at a Glance, 2023), ranking second in production in the world only to China. Uttar Pradesh produced 16.14 million tons of rice on 5.90 million hectares of land with a productivity of 2737 kg/ha in 2023-24 (Agricultural Statistics at a Glance, 2023). Uttar Pradesh is a large producer of rice across the country in 2023-24. To provide for the continually growing population of the nation, the rice production has to come from higher yield because cultivated area under the rice is declining. Hence, the main problems are faced by the rice growers for the sustainability of rice ecosystems and the potential to increase production in line with population expansion while using less labor and water. Most of the rice is produced in the temperate regions in irrigated and rainfed lowland conditions. Irrigated rice systems account for 78 percent of all rice production. In India, direct seeded rice (DSR) can boost farmers' incomes by lowering expenses and raising yields. The other common technique for producing paddy, transplanting rice, may not always be as beneficial as DSR.

Fig. 1: Rice productivity in India, Uttar Pradesh, and FLD during 2023-24.

**2. Material and Method**

The evaluation of the differences between dry direct seeded (DDS) and transplanted rice systems (TPR) took place during FLDs at farmers' fields during Kharif 2023 and 2024. The study was carried out by Krishi Vigyan Kendra, Malhana, Deoria, Uttar Pradesh, under the administrative control of Indian Council of Agriculture Research-Indian Institute of Vegetable Research (ICAR-IIVR) Varanasi, Uttar Pradesh, India. A total of 30 and 33 FLDs were conducted among the farming community of Deoria District as well as the KVK farm under dry direct seeding conditions with the Pusa Sambha 1850 paddy variety in the year of Kharif, 2023 to 2024. The approved agronomical practices were used for the present study with respect to FLDs, and farmers practices are given in Table 1. The crop was seeded in the midweek of June and harvested in the first to midweek of November. The paddy variety Pusa Sambha 1850 seeded by a seed cum ferti-drill machine was compared with the traditional transplanting method of rice used among the farming community in the eastern part of Uttar Pradesh, India. The study location soils are very deep loam to loam in texture, and moderately to well-drained systems with groundwater irrigation facilities. The soils are medium in fertility rank. The climate of the eastern part of Uttar Pradesh is characterized by a dry summer and a cool winter with high rainfall during the rainy season. The front-line demonstrations were conducted to find out the economical yield of demonstrations. The gross cost, gross return, net return, and benefit-cost ratio of demonstrations were calculated as per the standard method. The yield and economic analysis were recorded for comparisons of the dry direct seeding condition with the traditional transplanting method used by the farming community. The critical inputs in the form of quality seed of Pusa Sambha 1850 were provided for FLDs by KVK to the farmers. Other facilities were provided to the farmers by subject matter specialists of KVK in the performing field operations like seeding, nutrient management, weed management, water management, plant protection measures, harvesting, and threshing, etc. During the study period of the demonstration course of training, field visits and field days were done by SMSs. The demonstrated technologies in the FLDs are presented in Table 1 and compared with traditional methods.

**Table 1: Agronomical practices used under front line demonstration and farmers practices**

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| **Growing Practice** | **Front Line Demonstration** | **Farmer Practice** |
| Farming Situation | : Irrigated sandy loam soils | Irrigated sandy loam soils |
| Varieties | : Pusa sambha 1850 | Pusa sambha 1850 |
| Date of DSR/Nursery Sowing | : Mid week of June | Mid week of June |
| Method of Sowing | : Dry Direct Seeding | Transplanting |
| Seed Rate (kg/ha) | : 35 kg/ha | 50 kg/ha |
| Seed Treatment | : Fungicide | Fungicide |
| Fertilizers (kg/ha) | : 120 N, 60 P, 50 K and 20 ZnSO4 | 120 N, 60 P, 50 K and 20 ZnSO4 |
| Herbicides | : Yes | Yes |
| Irrigation (No.) | : 2-3 | 2-3 |
| Date of harvesting | : First week of November | First week to mid week of November |

The biological yield, harvesting index, extension gap and technological gap were calculated by using the following formulas as given below

Biological yield = Grain yield + Straw Yield……….(i)

Harvest Index = Economical yield/Biological Yield X 100……….(ii)

**Economic study of front line demonstration**

A number of aspects, such as the cost of cultivation, gross returns, net returns, and the B:C ratio, were assessed in order to calculate the economic study of different systems.

Cost of Cultivation = All input X prevailing market price…………………….(iii)

Gross Returns = Main and by product of crops X Prevailing market price…(iv)

Net Returns = Gross Returns ̶ Cost of cultivation……………………… (v)

Benefit: Cost ratio (B: C) = Gross Returns ̸ Cost of cultivation…………………………(vi)

**3. Result and Discussion**

**3.1 Interpretation of Grain Yield (t/ha)**

The data shown in Figure 2, revealed that the maximum grain yield (4.78 t/ha) was noted under the dry direct seeding of rice than the transplanted rice, which was 10.65 percent higher than the transplanted system of rice during the demonstration period of Kharif 2023. However, the higher grain yield (4.67 t/ha) was recorded under the dry direct seeding of rice than the transplanted rice in the study period of Kharif 2024, which was 11.59 percent higher than the transplanted rice.

Fig. 2: Comparison of yield (t/ha) under DDSR and TPR during both years of 2023-24.

The disparity in rice yield between flooded and non-flooded conditions is related to the general fertility of the soil and the availability of plant nutrients; the latter results in an unfavorable nutritional regime for a number of plant nutrients (Sahrawat 2012).

**3.2 Interpretation of Economic Analysis**

**3.2.1 Gross Cost (Rs)**

The data presented in Figure 3, minimum gross cost (30340 Rs), was found under the dry direct-seeded of rice than the transplanted rice, which was 20.87 percent less than the transplanted rice during the study period of the Kharif 2023. However, the same trend was noted under the dry direct seeded of rice than the transplanted rice, which was 19.80 percent less than the transplanted system of rice during the demonstration year of the Kharif 2024. The 20.87 and 19.80 percent cost of cultivation was saved under the dry direct seeded of rice than the transplanted system of rice during both years of demonstration. These types of data were reported by Awanth *et al*. (2007). Short- to medium-term on-station studies reported 34-46% savings with machine labor used in zero tillage-dry-direct seeded rice (ZT-Dry-DSR) compared to puddled transplanted rice.

Fig.3: Analysis of Gross cost (Rs/ha) under DDSR and TPR during both the year

**3.2.2 Gross Return (Rs)**

The maximum gross return (97512 Rs) was found under the dry direct-seeded of rice than the transplanted method, which was 10.64 percent higher than the transplanted method during the study period of Kharif 2023. Therefore, the maximum gross return (107410 Rs) was found under the dry direct seeded of rice than the transplanted rice, which was 12.80 percent more than the transplanted method during the demonstration year of the Kharif 2024. The 10.64 and 12.80 percent more gross return was found under dry direct seeded rice than transplanted rice, respectively, in 2023 and 2024 (Fig. 4).

Fig.4: Analysis of gross and net return (Rs/ha) under DDSR and TPR during both the year

**3.2.3 Net Return (Rs)**

The highest net return (67172 Rs) was found under the dry direct-seeded of rice than the transplanted method, which was 34.92 percent higher than the transplanted method during the demonstration year of Kharif 2023.The similar finding in Pigeonpea have been reported by Meena *et.al*.,2022 However the more net return (75060 Rs) was found under the direct seeded of rice than the transplanted method, which was 36.77 percent more than the transplanting method during the demonstration year of the Kharif 2024 (Fig.4). These types of results were reported by Kamboj *et. al*., (2012); the grain production of DDSR was either equal to or better than that of puddle-transplanted rice,

**3.2.4 Benefit Cost Ratio (B: C)**

The figures presented in Figure 5, show that the maximum benefit-cost ratio (3.2:1) was found under the dry direct seeded of rice rather than the transplanted rice, which was 39.56 percent greater than the transplanted method during the study period of Kharif 2023. Therefore, the more beneficial cost ratio (3.3:1) was found under the dry direct seeded of rice than the transplanted method, which was 43.37 percent greater than the transplanted method during the study period of Kharif 2024. All figures are presented in the present study. The demonstration of paddy variety Pusa sambha 1850 is better performed under the dry direct-seeded system than the transplanted technique.

Fig.:5: Analysis of B:C ratio (Rs/ha) under DDSR and TPR during both the year.

**4. Conclusion**

The dry-direct seeded of rice is more suitable, more the water saving, labor saving as well as the saving of the environment and more economical for paddy cultivation in eastern part of India. Furthermore, we require more demonstrations at various locations in this region.

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