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Effect of different sowing methods on yield attributing characters in Direct Seeded Rice

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ABSTRACT:

A field experiment was conducted during the *Kharif* season of 2024 at College of Agriculture, Rewa to study the impact of different sowing methods on the performance of direct seeded rice (DSR). Seven sowing methods were tested under randomized block design using variety 'Hansraj'. The mechanized line sowing method significantly outperformed others in terms of weed suppression, growth attributes, yield and profitability. It recorded the highest plant height (100.64 cm), tiller density (279.25/m²), LAI (7.24), and grain yield (30.47q/ha). It also showed lowest weed index (0.5%) and weed biomass (3.20 g/m²), establishing its superiority in both agronomic and economic aspects. The maximum B:C ratio (1.77) was obtained from mechanized line sowing. Thus, it can be concluded that mechanized line sowing is the most suitable and profitable method for direct seeded rice cultivation in clay loam soils of Rewa region.

KEYWORDS: Direct Seeded Rice, Sowing Methods, Weed Index, Growth Parameters, Yield, Economics.

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INTRODUCTION:

Rice (Oryza sativa L.) is a staple food crop for over half of the global population and plays a crucial role in ensuring food and livelihood security in India. Traditionally, rice is cultivated through puddled transplanting, which is labor- and water-intensive, requiring about 1500–2000 mm of water and 250–300 man-hours per hectare for transplanting and related operations (Kumar and Ladha, 2011). However, the growing scarcity of water, rising labor costs, and climate uncertainties have challenged the sustainability of this conventional system (Rao *et al*., 2007; Farooq *et al*., 2011).In this context, Direct Seeded Rice (DSR) has emerged as a promising alternative, offering advantages such as 30–50% reduction in labor, 15–30%

water saving, early crop maturity, and reduced methane emissions (Chauhan *et al*., 2012; Mahajan and Chauhan, 2011). In DSR, pre-germinated or dry rice seeds are sown directly in the field, bypassing the nursery and transplanting stages, which significantly lowers input costs and turnaround time (Pandey and Velasco, 2002).However, a major constraint in DSR is weed infestation, particularly in the absence of standing water, which otherwise suppresses weed emergence in puddled systems. Uncontrolled weeds in DSR can reduce yields by 30–100% depending on species and management (Rao *et al*., 2007; Mahajan *et al*., 2009). Therefore, sowing method becomes a critical factor in DSR not only for crop establishment but also for weed suppression.Different sowing methods like broadcasting, line sowing, raised bed planting, semi-dry system, and mechanized drilling significantly affect seed placement, germination environment, plant population, weed dynamics, and ultimately yield (Singh *et al*., 2020; Ganie *et al*., 2013). For example, mechanized line sowing ensures uniform seed depth and spacing, facilitating better crop stand and enabling mechanical weeding, while broadcasting often leads to non-uniform seed distribution and higher weed pressure (Choudhary *et al*., 2021).

Therefore, the choice of an appropriate sowing method is crucial for maximizing resource-use efficiency, improving crop performance, and enhancing economic returns in DSR cultivation. The present investigation was undertaken to assess the impact of different sowing methods on growth and yield attributes, and economic profitability under direct seeded rice in the agro-climatic conditions of Rewa region, Madhya Pradesh.

MATERIALS AND METHODS:

A field experiment was conducted during the *Kharif* season of 2024 at the Instructional Farm, College of Agriculture, Rewa (Madhya Pradesh), under the jurisdiction of Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur. The experimental site is located in the Kymore Plateau and Satpura Hills agro-climatic zone, characterized by sub-humid climate, with average annual rainfall of about 1100 mm, mostly received from July to September.The soil of the experimental field was clay loam in texture, with neutral pH (7.2), low available nitrogen, medium phosphorus, and medium potassium content. The field was well-drained and leveled, suitable for direct seeding of rice.The experiment was laid out in a Randomized Block Design (RBD) with three replications. The treatment consisted of seven different sowing methods :T_1– Broadcasting, T_2– Mechanized Line Sowing,T_3– Raised Bed Planting, T_4– Semi-dry System, T_5 – Line Sowing, T_6 – Lehi Method, T_7 – Line Sowing with 25% Higher Seed Rate.The gross plot size was 5 m × 4 m for each treatment. The variety 'Hansraj', a medium duration, high yielding local variety suitable for DSR conditions. The seed rate was 100 kg/ha, except for T_7 where it was increased by 25%. Recommended fertilizer dose of 100:60:40 kg N:P_2O_5:K_2O/ha was applied.Nitrogen was applied in three equal splits (basal, tillering, and panicle initiation), while full doses of phosphorus and potassium were applied as basal.Weed control was done manually or with local tools depending on sowing pattern.Need-based plant protection measures were undertaken.

RESULTS AND DISCUSSION:

1.Growth Parameters

Significant variation in growth parameters was observed due to sowing methods. Mechanized line sowing (T_2) produced tallest plants (100.64 cm) and maximum number of tillers (279.25/m²) followed by line sowing with higher seed rate (T_7). Maximum leaf area index (LAI) of 7.24 was also recorded under T_2, indicating efficient light interception and better photosynthetic activity.The improvement in growth attributes under T_2 might be due to uniform seed depth and spacing, resulting in better nutrient availability and aeration. Similar enhancement in growth parameters under line sowing was also reported by Kumar and Ladha (2011) and Mahajan *et al*. (2011) in their DSR studies.

2.Yield Attributes and Grain Yield

Yield components such as panicle length, panicle density, grains per panicle, and test weight were significantly influenced by sowing methods. Mechanized line sowing (T_2) produced the highest number of panicles/m², longer panicles, and greater grain count, contributing to a grain yield of (30.47q/ha), which was 42.98% higher than Semi – dry system T_4 (21.31q/ha), the lowest-yielding treatment.The improved yield in T_2 may be attributed to optimum plant population, better tillering, and efficient weed management. These findings are supported by Singh *et al*. (2020) and Rao *et al*. (2007), who concluded that mechanized and line sowing improves yield performance in DSR due to enhanced growth and reduced weed-crop competition.

3.Economics

Economic analysisrevealed that T_7(Line sowing with 25% higher seed rate) achieved the highest net return of ₹32687/ha due to higher seed rate while benefit-cost (B:C) ratio highest T_2 (Mechanized line sowing) of 1.77. The lowest net return (₹25,610/ha) and B:C ratio (1.30) were recorded in T_4(semi-dry system). The higher profitability under T_2 is due to higher productivity and better resource-use efficiency. These findings align with those of Mahapatra and Behera (1999) and Maurya *et al*. (2024) who also reported improved economic returns under efficient sowing methods in small-scale IFS and DSR systems.

CONCLUSION :

The findings of the present study clearly indicate that sowing methods play a pivotal role in the success of direct seeded rice (DSR) cultivation. Among all the treatments evaluated, mechanized line sowing consistently performed best across all parameters including weed suppression, growth and yield attributes, and economic returns.In contrast, the semi-dry sowing method resulted in the poorest crop performance, highest weed infestation, and lowest yield and profitability.Thus, it can be concluded that mechanized line sowing is the most effective, resource-efficient, and profitable technique for direct seeded rice in the clay loam soils of Rewa region, particularly under labor and water-scarce conditions. Adoption of this method can significantly contribute to sustainable rice cultivation, improved farm income, and reduced weed competition, making it a climate-smart and farmer-friendly option.

Future research may explore the integration of mechanized sowing with herbicide-based weed management, nutrient precision tools, and climate-resilient varieties to further enhance the sustainability of the DSR system.

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Table 1: Effect of different sowing methods on yield attributing characters

Treatment	Sowing method	Plant height 90DAS	Tiller number 90DAS	Grain yield(q/ha)	Leaf area index at 60 DAS	Straw yield (q/ha)	Harvest index(%)	Gross monetary returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net monetary returns (Rs/ha)
T_1	Broadcasting method	96.91	252.37	25.71	5.77	51.00	33.52	61704	43255	18449
T_2	Mechanized line sowing	100.64	279.25	30.47	7.24	60.06	33.69	73128	41125	32003
T_3	Raised bed	97.27	276.28	25.68	5.70	57.28	30.94	61632	40129	21503
T_4	Semi – dry system	93.33	240.08	21.31	5.12	49.38	30.07	51144	39220	11924
T_5	Line sowing	101.54	260.26	28.11	6.40	59.82	31.95	67464	40634	26830
T_6	Lehi	96.08	253.30	26.22	6.13	53.63	32.87	62928	40241	22687
T_7	Line sowing with 25% higher seed rate	94.67	260.22	29.96	7.02	59.03	33.68	71904	39603	32687
	SEm±	0.95	0.57	1.15	0.28	2.11	0.87			
	CD (P=0.05)	2.80	1.69	3.41	0.81	6.24	2.56			

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