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Effect of different sowing methods under DSR system in midland situation at bastar plateau zone of Chhattisgarh

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Abstract
A field experiment was conducted during the *Kharif* season 2023 under AICRIP, at Research cum Instructional Farm Shaheed Gundadhoor College of Agriculture and Research Station Jagdalpur, Chhattisgarh, to study the "Effect of different sowing methods under DSR system in midland situation at Bastar Plateau Zone of Chhattisgarh" in Randomized Block Design using seven treatments which were replicated in three times. The results obtained under Raised bed sowing (T_3) revealed significantly higher growth parameters *viz.*, number of tillers, leaf area index, dry matter accumulation, crop growth rate, relative growth rate, net assimilation rate and yield attributing characters *viz.*, length of panicles, total number of grains panicle^{-1}. Early flowering and maturity were recorded with treatment T_3. The statistically highest grain and straw yield was recorded under treatment T_5 (Line sowing methods of DSR may be followed weeding through Ambika paddy weeder). In the case of harvest index, treatment T_5 was found higher. Maximum gross return, net return and B: C ratio was obtained treatment T_5.

Keywords: Rice establishment method

Introduction
Rice (*Oryza sativa* L.) is a monocot plant belongs to the family Poaceae (2n=24) and the genus *Oryzae. Oryzae* contains about 24 different species of which only two are cultivated *viz. Oryza sativa* L. (Asian rice) and *Oryza glaberrima* (African rice). Rice is an important staple food of more than 60% of the world population. About 90% of all rice is grown in world is produced and consumed in the Asian region. Food is the basic need of all lives on earth for survival, as well as an instrument of national power for maintaining independence, prestige, and honor of a nation. Food security is not only a key aspect of human development, but also the prime goal of any nations. Food security in the country is very essential for achieving primary goal of stability of a political government, since no any sensible nations would tolerate food insecurity particularly in the face of mounting population pressure which leads to further widening of already existing disparities (Ahmad 2009) [1]. The motto "Rice is life" is maximum suitable for India, as this crop performs a crucial function in our country wide food safety and is a livelihood for thousands and thousands of rural families. Among cereal crops, it serves as the primary source of food for more than half of the area's population as reported by Davla *et al*. (2013) [6]. Rice, as a submerged crop, is a prime target for water conservation because it is the most widely grown of all crops under irrigation. To produce 1 kg of grain, farmers have to supply 2-3 times more water in rice fields than other cereals (Barker *et al*., 2000) [3].
Direct seeding can be done by either broadcasting or line sowing. In Chhattisgarh most of the rice growing area is under direct seeded rice. Direct seeded rice offers the advantage of faster and easier planting, ensure proper plant population, reduce labour and hence less drudgery 10-12 days earlier crop maturity, more efficient water use and higher tolerance to water deficit, and often high profit in areas with assured water supply (Datta, 1986) [7].
Dry direct seeding (DSR) of rice allows early establishment of the succeeding crop and higher profit in areas with assured water supply by utilizing short duration modern varieties and cost efficient herbicides. So, there is need to search for suitable crop establishment methods to increase the productivity and profitability of rice (Farooq *et al*., 2011a) [8].

Observed that vegetative growth of direct sown rice was shortened by 7-10 days and number of leaves on main culms was reduced by 1-1.5 and exhibited more productive tillers than manually transplanted rice (Wang and Sun, 1990) [15].

Under rainfed conditions, ridges and furrows may help with conservation and availability of moisture for a relatively longer time. With high rainfall, the furrows between the ridges may help drained out of excess water from the crop root zone, improved soil temperature, aeration and nutrient availability and also enhanced the depth of crop root zone (Parihar *et al*., 2012) [12].

The ridges and furrows increased root growth activity due to higher soil moisture content and nitrogen availability, which ultimately increased the N uptake by the crops. It reduces the soil compaction, salt accumulation at the root zone and increased the root activity and microbial population in the rhizosphere of sodic soil ecosystem (Nagarajan *et al*., 2018) [11].

The ridges and furrows system may help to increase the income to the farmer besides preventing land degradation due to runoff erosion (Patil and Sheelavantar, 2004) [13].

Dry direct sowing is done, respectively broadcast and row sowing with either a drum seeder under unpuddled fields. Sowing makes it easy to maintain row-to-row spacing, and losing seeds into hills is a powerful way of sowing rice in time, in addition to reducing exertions prices. Dry direct seeding of rice lets in early established order of the succeeding crop and higher income in regions with confident water deliver by using making use of brief duration present day types and cost efficient herbicides. So, there may be want to search for appropriate crop establishment techniques to boom the productivity and profitability of rice (Farooq *et al*., 2011b) [9].

The rice crop establishment methods, treatment drum seeder with normal sowing time and it was comparable with treatment normal sowing time and line sowing establishment methods recorded higher plant height, dry matter accumulation, leaf area index, crop growth rate, yield attributes and yield. The highest gross return, net return and B: C ratio was recorded under treatment drum seeder with normal sowing time which was comparable to normal sowing time and line sowing. The highest N content and uptake was obtained by drum seeder with normal sowing time and it was comparable to normal sowing time and line sowing (Deeksha *et al*., 2021) [5].

Materials and Methods

The experiment was conducted during the month of June 2023. The experiment was consists of three replications with seven treatments that was laid out in Randomized Block Design (RBD). The treatment details are as follows, T_1: Broadcasting of seeds, T_2: Mechanized line sowing (Drum seeder), T_3: Raised bed sowing, T_4: Semi-Dry system (Sowing in dry soil and flooding after one month of sowing), T_5: Line sowing method of DSR followed Ambika paddy weeder, T_6: Improved Beushening method for high yielding dry DSR method, T_7: Line sowing practices of the DSR method. Climate of the region was hot sub-humid eco-region with an average annual rainfall of about 1386.7 mm. The crop encountered 1152.8 mm rainfall throughout its growth period and the maximum temperature was 29.9 °C in the third week of August and the minimum temperature was about 17.9 °C in the first week of October as well as the maximum sunshine hour was 7.6 hours in the second week of October.

The recommended dose of fertilizer (100:60:40 kg NPK ha^{-1}) applied in the experiment. The 50 per cent dose of nitrogen and 100 per cent recommended dose of phosphorus and potassium were applied as basal and enduring nitrogen was applied in two equal split at active tillering and panicle initiation stage of the crop. Pre emergence herbicides pyrazosulfuron ethyl 10% WP @ 200 g ha^{-1} applied before emergence of weed and post emergence herbicides bispyribac sodium 10% W/V SC @ 250 ml ha^{-1} was applied at 25 DAS to control both narrow and broad leaf weed. Roughing was done manually to remove off type of plant and weeds at panicle initiation stage. Insecticide (chlorpyrifos 50% + cypermethrin 5%) 20 EC was sprayed at the rate of 0.5 litre ha^{-1} to control stem borer and leaf folder.

Result and Discussion

Growth parameters

Plant height (cm): The significantly taller plant was observed under treatment T_2 at all the crop growth stages which was found at par with treatment T_5 and T_1 at 60 DAS whereas at 90 DAS treatment T_5, T_1, T_3, T_4, and T_6 were found on par but at harvest, treatment T_3, T_5, T_1, T_4 and T_6 found on par. The smallest plant height was recorded under treatment T_7. It might be due to increasing plant height because more plant population, more availability of solar radiation, space, water, CO_2, and nutrients for that the root surface area was medium and better uptake of nutrients. Chandel *et al.* (2021) [4] also reported same result.

Number of tillers (hill^{-1})

The significantly maximum number of tillers was observed under treatment T_3 at all the growth stages but it had found on par with treatment T_2 and T_4 at 30, 60 and at 90 DAS. The lowest number of tillers was recorded under treatment T_7. It might be due to more number of tillers were recorded in raised bed sowing method because it provides sufficient moisture during crop stress condition and sufficient nutrient for plant growth and its development. Similar result was also reported by Amritpal *et al.* (2018) [2].

Leaf area index (LAI)

The maximum leaf area index was observed under treatment T_3 at all the crop growth stages which was at par with treatment T_2 at 30 DAS and at 90 DAS, treatment T_6, T_4, T_5, T_7 and T_2 was found on par whereas that lowest LAI was observed in treatment T_7 at 30 DAS and 60 DAS, while at 90 DAS treatment T_1 was found lowest value of LAI. It might be due to increasing leaf area index because more number of leaves per plant is an essential component for photosynthesis and also affects the grain yield.it was also corroborated with Mollah *et al.* (2015) [10].

Dry weight (g hill^{-1})

Treatment T_3 was recorded significantly higher dry weight at 90 DAS and at harvest but it was found similar result with treatment T_2, T_4, T_5 and T_6. However at, 30 DAS and 60 DAS dry weight was not found significantly but it had numerically higher value of dry weight in treatment T_3 and lowest dry weight was recorded in treatment T_7 at all the growth stages.

Yield attributes and yield

Panicle Length (cm): The different crop establishment methods was found statistically non-significant effect due to different treatments but numerically higher panicle length was observed under treatment T_3 among the all treatments and shortest panicle length was observed under treatment T_7. It might be due to the raised bed supply sufficient amount of moisture at the critical stages which would have been maintained the continuous supply of nutrient, which ultimately led to the meristematic activity and stimulation of cell elongation in the plants which resulted in higher length of panicle.

Number of seeds (panicle^{-1})

The different crop establishment methods was did not affect significantly due to different treatment but numerically maximum number of seeds per panicle was observed under treatment T_3 among the all treatments and less number of seeds were observed in treatment T_1. It might be due the higher translocation of starch both from the active site of leaves and also straw to grain (sink) and the increased amount of interception of photosynthetically active radiations and greater photosynthesis. It was also reported by Sarangi *et al.* (2019) [14].

Days to 50% flowering and days to maturity

Treatment T_3 required more duration for both days to 50 per cent- flowering and days to maturity whereas, early flowering and maturity was recorded with treatment T_7. It was due to raised bed provide sufficient moisture and nutrients to the plants which increases the time of sowing and days to maturity.

Test weight (g)

The non-significant effect of different rice establishment methods was recorded for test weight of rice during the one year experimenation. Among different methods of rice establishment, treatment T_2 produced the maximum test weight of rice followed by treatment T_4 and the lowest test weight was observed in treatment T_1. It was also reported by Chandel *et al.* (2021) [4].

Yields of rice

Grain yield (q ha^{-1})

The significantly highest grain yield was recorded in treatment T_5. Which was statistically comparable with treatment T_3. It might be due to increases the rate of photosynthesis which increase production higher dry matter photosynthate accumulation and translocation to the economic part of the plant.

Straw yield (q ha^{-1})

Treatment T_5 was recorded significantly superior over other methods of rice establishment and produced straw yield, but it was comparable with treatment T_3 and T_6. The statistically lowest straw yield was observed from treatment T_1. It might be due the better rates of photosynthesis and more dry matter accumulation, resulting in higher straw yield. Amritpal *et al.* (2018) [2] also finding the same result.

Harvest Index (%)

Treatment T_2 was found significantly highest haevest index among all the treatments which was comparable with treatment T_5, T_3 and T_4. The lowest harvest index was recorded under treatment T_1. It was also finding by Chandel *et al.* (2021) [4].

Economics (₹ ha^{-1})

The maximum cost of cultivation was recorded under treatment T_3 and it was followed by treatment T_5 and T_2. The minimum cost of cultivation was noted under treatment T_1. Among different methods of rice establishment methods, maximum gross return, net return and B: C ratio was obtained treatment T_5. The minimum gross return, net return and B: C ratio was obtained treatment T_1.

Conclusion

On the basis of one year study during *Kharif* 2023 at Bastar Plateau zone of Chhattisgarh. The experiment on the "Effect of different sowing methods under DSR system in midland situation at Bastar Plateau Zone of Chhattisgarh" concluded that: The higher growth parameters *viz.*, number of tillers, leaf area index, dry matter accumulation, crop growth rate, relative growth rate, net assimilation rate and yield attributing characters *viz.*, length of panicles, total number of grains panicle^{-1}. Early flowering and maturity were recorded with treatment T_3. The statistically highest grain and straw yield was recorded under treatment T_5 (Line sowing methods of DSR may be followed weeding through Ambika paddy weeder). In case of harvest index, treatment T_5 was found higher. Maximum gross return, net return and B: C ratio was obtained by treatment T_5.

Table 1: Effect of different treatment on growth and yield attributes of DSR

Treatments	Plant height (cm)	No. of tillers hill^{-1}	Dry weight of plant (g)	LAI	Panicle length (cm)	No. of grains Panicle $^{-1}$	Test weight (g)	50% flowering	Days to Maturity
T_1	100.30	3.80	13.84	2.66	25.86	167.33	24.37	75.33	110.67
T_2	106.38	5.48	17.30	2.81	26.22	198.00	25.32	75.67	110.33
T_3	101.60	6.44	17.99	3.16	26.54	201.67	25.10	77.67	113.67
T_4	99.96	5.13	17.04	2.92	26.41	177.67	25.21	76.33	111.67
T_5	101.11	4.40	16.86	2.88	26.54	200.67	24.91	77.33	112.33
T_6	99.41	4.07	16.82	2.93	26.13	186.00	25.08	75.67	111.00
T_7	91.73	3.76	16.38	2.82	25.60	172.33	24.88	75.33	110.00
SEm±	2.93	0.42	0.727	0.148	0.75	10.86	0.27	0.28	0.67
CD at 5%	8.78	1.30	2.265	0.444	NS	NS	NS	0.88	2.08
CV%	5.06	15.24	7.584	8.872	4.96	10.1	1.88	1.80	1.04

Table 2: Effect of different treatment on grain yield, straw yield, harvest index and economics

Treatments	Grains yield (Kg ha^{-1})	Straw yield (Kg ha^{-1})	Harvest Index (%)	Cost of cultivation (Rs ha^{-1})	Gross income (Rs ha^{-1})	Net income (Rs ha^{-1})	Gross income (Rs ha^{-1})	B: C ratio
T_1	23.99	33.08	42.02	45500	49412.17	28858.12	49412.17	1.09
T_2	41.26	51.51	44.46	46300	85000.83	81613.87	85000.83	1.84
T_3	44.21	56.16	44.06	50200	91077.22	86857.96	91077.22	1.81
T_4	36.49	46.47	43.99	45200	75159.59	67904.24	75159.59	1.66
T_5	46.17	58.03	44.32	48350	95105.27	94769.58	95105.27	1.97
T_6	39.31	54.82	41.80	45950	80972.79	75902.26	80972.79	1.76
T_7	32.91	44.30	42.62	42200	67790.11	59814.24	67790.11	1.61
SEm±	1.01	1.58	0.44					
CD at 5%	3.13	4.94	1.38					
CV	4.61	5.58	1.76					

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