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Influence of seed sowing and nutrient management on yield and economics in drilled paddy (*Oryza sativa*)

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Abstract
A field experiment was carried out during kharif 2018-19 at Research Farm of College of Agriculture, Nagpur to study the "Influence of seed sowing and nutrient management in drilled paddy (*Oryza sativa*)". The experiment was laid out in split plot design with four spacing and three treatments of fertilizer doses. The yield attributing character *viz*. number of panicle plant^{-1}, length of panicle, number of grains panicle^{-1} and weight of grains panicle^{-1} recorded maximum in Drilling soaked seed at 30 cm and grain yield, straw yield, biological yield (q ha^{-1}) and harvest index were significantly highest at drilling of soaked seed at 20 cm and application of 125:62.5:62.5 kg NPK ha^{-1}. GMR and NMR (Rs. ha^{-1}) recorded maximum in Drilling soaked seed at 20 cm and application of 125:62.5:62.5 kg NPK ha^{-1}. B:C ratio recorded maximum in Drilling of soaked seed at 20 cm and application of 100:50:50 kg NPK ha^{-1}.

Keywords: Rice, seed drilling, seed soaking, nutrient management

Introduction
Rice (*Oryza sativa* L.) is an important daily diet as a cereal grain of the world's human population belong to family *Poaceae* and rank second highest in cereal grain production. It is a staple food of 90 million Asians. Rice contribute 16% to the gross value added (GVA) of agriculture and 3.5% of gross domestic product (GDP) (Dept. of Agri. and Co-op. GOI. 2016). At the same time, it provides about 11.5 million farmers as a source of income and employment (Upland rice production). Total geographical area under rice in India is 44.10 million ha and annual production of 112.90 million tones with productivity of 2.6 tons ha^{-1} in 2018-2019 (Anonymous, 2018) [1]. Hence a significant portion of the world's agricultural research has been focused on rice.

One of the major reasons of low productivity of rice is low maintenance of optimum plant population and nutrient management in rice production in achieving high production but also providing sustainability in crop production. Improper spacing reduced yield up to 20-30%. The optimum spacing ensures the plant to grow in their both aerial and underground parts through efficient utilization of solar radiation and nutrients (Khan *et al.*, 2005; Mohaddesi *et al*., 2011) [7, 8]. Nutrient management helps to restore and sustain soil fertility and crop productivity. It may also help to check the emerging deficiency of nutrient. It bring economy and efficiency in fertilizer use and favourably affect the physical, chemical and biological environment of soil, also helps to produce grain having high nutritional quality.

Materials and Methods
A field experiment was carried out to study the "Effect of seed sowing and nutrient management in drilled paddy (*Oryza sativa*)" at Agronomy Section Farm, College of Agriculture, Nagpur during *kharif* season of 2018-19. The soil of experimental plot was vertisol, fairly uniform and levelled which is low in available nitrogen, medium in available phosphorus and organic carbon, very high in available potassium and slightly alkaline in reaction. The experiment was laid out in split plot design with 12 treatments with four spacing *viz.* D_1 (drilling dry seed at 20 cm), D_2 (drilling dry seed at 30 cm), D_3 (drilling soaked seed at 20 cm) and D_4 (drilling soaked seed at 30 cm), and three treatments of fertilizer doses *viz.* F_1 (75:37.5:37.5 kg NPK ha^{-1}), F_2 (100:50:50 kg NPK ha^{-1}) and F_3 (125:62.5:62.5 kg NPK ha^{-1}) replicated thrice.

The seed of paddy variety Sye-1 was used for present investigation. Before sowing the seeds were treated with 3% brine solution (300 g salt in the 10 lit of water) for 24 hours. The healthy seeds which sunk at the bottom were dried in shadow for 24 hours and that seeds were treated with Thiram (3g Kg^{-1} seed) used for sowing.

Result and Discussion

Yield attributes and yield

The data given in Table no. 1 revealed that drilling soaked seed at 30 cm recorded maximum number of panicle plant^{-1} (12.78), length of panicle (21.58), number of grains panicle^{-1} (133.89) and weight of grains panicle^{-1} (2.18 g) and were significantly superior over drilling dry or soaked seed at 20 cm, however, it was at par with drilling dry seed at 30 cm. This might be due to lesser competition among the plant for space, nutrient, moisture and air and better availability of space and interception of solar radiation which might have allowed a luxurious growth of the plant. Similar results were also reported by Basavaraja *et al.* (2010) [2] and Jadeyegowda *et al*. (2019) [5].

Application of 125:62.5:62.5 kg NPK ha^{-1} recorded maximum number of panicles plant^{-1} (12.83), length of panicle (20.93), number of grains panicle^{-1} (130.04) and weight of grains panicle^{-1} (2.10 g) and was significantly superior over application of 75:37.5:37.5 kg NPK ha^{-1}, however, it was at par with application of 100:50:50 kg NPK ha^{-1}. This might be attributed due to increased availability of nutrients resulting in improved metabolic activity, increased flowering and seed setting. These results are close in conformity with Shrinivas and Krishnamurthy *et al.* (2017) [13] and Bhat *et al.* (2018) [3].

The grain yield (31.11 q ha^{-1}), straw yield (46.67 q ha^{-1}), biological yield (77.78 q ha^{-1}) and harvest index (40.35) were significantly highest at drilling of soaked seed at 20 cm over drilling dry or soaked seed at 30 cm, but found at par with drilling dry seed at 20 cm. This might be due to more plant population in closer spacing than wider spacing. Similar results were also observed by Saoji *et al*. (2007) [12] and Borkar *et al*. (2008) [4].

Among fertilizer doses application of 125:62.5:62.5 kg NPK ha^{-1} produced highest grain yield (29.72 q ha^{-1}), straw yield (44.58 q ha^{-1}), biological yield (74.31q ha^{-1}) and harvest index (40.52) were significantly superior over application of 75:37.5:37.5 kg NPK ha^{-1}. Increased yield of rice under higher dose of fertilizer is due to significant increase in various yield attributes *viz*. number of panicle plant^{-1}, number of grains panicle^{-1} and weight of grains panicle^{-1}. This is confirmation with the results of Shrinivas and Krishnamurthy *et al*. (2017) [13] and Bhat *et al*. (2018) [3].

Economics

The data given in Table no. 2 revealed that Drilling soaked seed at 20 cm recorded maximum Net monetary return (Rs. 31348 ha^{-1}), Gross monetary return (Rs. 59111 ha^{-1}) and B:C ratio (2.67) were significantly superior over drilling dry or soaked seed 30 cm, however, it was at par with drilling dry seed at 20 cm. Similar results were also reported by Borkar *et al.* (2008) [4].

Among the fertilizer application of 125:62.5:62.5 kg NPK ha^{-1}recorded highest Gross monetary return (Rs. 56,473ha^{-1}) and Net monetary return (Rs. 27437ha^{-1}) were significantly superior over application of 75:37.5:37.5 kg NPK ha^{-1}, however, it was at par with application of 100:50:50 kg NPK ha^{-1}. It is also revealed that maximum B:C ratio was recorded in application of 100:50:50 kg NPK ha^{-1}. Obtained result was also confirmed by matching finding of Chouwdhury *et al.* (2012).

Interaction effect of seed sowing (spacing) and different fertilizer doses on yield and economics was found to be non-significant.

Table 1: Yield attributes and yield and economics of rice as influenced by various treatments

Sr. No.	Treatments	No. of panicles plant^{-1}	Length of panicle	Number of grains panicle^{-1}	Wt. of grains panicle^{-1} g	Grain yield q ha^{-1}	Straw yield q ha^{-1}	Biological yield q ha^{-1}	Harvest index	GMR Rs. q ha^{-1}	NMR Rs. q ha^{-1}	B:C Ratio
A	**Seed sowing (Spacing)**											
	D_1– Drilling dry seed at 20 cm	8.39	19.51	110.11	1.94	28.70	43.05	71.76	40.09	54539	26775	2.46
	D_2 –Drilling dry seed at 30 cm	11.59	21.00	125.17	2.08	24.44	36.67	61.12	39.78	46443	18979	2.13
	D_3– Drilling soaked seed at 20 cm	9.56	20.58	121.22	2.00	31.11	46.67	77.78	40.35	59111	31348	2.67
	D_4 – Drilling soaked seed at 30 cm	12.78	21.58	133.89	2.18	25.55	38.33	63.89	40.04	48556	21092	2.22
	S.E. (m) ±	0.64	0.41	3.00	0.03	0.83	1.10	2.08	-	1583	1583	-
	C.D. at 5%	2.22	NS	10.39	0.11	2.88	3.81	7.20	-	5478	5478	-
B	**Fertilizer doses**											
	F_1– 75:37.5:37.5	8.73	20.57	114.67	1.99	24.03	37.25	60.07	40.23	45654	19472	1.83
	F_2– 100:50:50	10.17	20.50	123.08	2.06	28.58	42.83	71.53	40.32	54359	26736	2.06
	F_3 – 125:62.5:62.5	12.83	20.93	130.04	2.10	29.72	44.58	74.31	40.52	56473	27437	1.96
	S.E. (m) ±	0.93	0.17	2.66	0.01	0.73	1.14	1.83	-	1392	1392	-
	C.D. at	2.79	NS	7.99	0.05	2.19	3.44	5.49	-	4174	4174	-
C	**Interaction**											
	S.E. (m) ±	1.86	0.35	5.33	0.03	1.46	2.29	3.66	-	2785	2785	-
	C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	G. M.	10.57	20.66	122.59	2.47	27.44	41.34	68.64	40.05	52162	24548	2.19

Conclusion

Drilling soaked or dry seed at 30 cm and application of 125:62.5:62.5 kg NPK ha^{-1} recorded significant increase in all yield attributing character *viz*. number of panicle plant^{-1}, length of panicle, number of grains panicle^{-1} and weight of grains panicle^{-1}(g). Significantly higher grain, straw, biological yield (q ha^{-1}) and harvest index was recorded with the application of 125:62.5:62.5 kg NPK ha^{-1}. Drilling soaked seed at 20 cm and application of 125:62.5:62.5 kg NPK ha^{-1} recorded significantly increased in GMR and NMR except B:C ratio was recorded highest in Drilling soaked seed at 20 cm and application of 100:50:50 kg NPK ha^{-1}.

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