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Effect of Various Sowing Methods of Direct Seeded Rice on Yield of Different Cultivars in Relation to Weather Parameters

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Abstract

The field experiment on effect of weather parameters on different rice cultivars with various sowing methods of direct seeded rice was carried out during *kharif*, 2017 at Agricultural Research Station Farm, Vadgaon Maval, Tal. Maval, Dist. Pune. It was laid out in split plot design with three replications. There were sixteen treatment combinations comprising of four sowing methods and four varieties. Among the four different varieties of paddy, VDN-99-29 (*Phule Samruddhi*) recorded significantly higher increased yield when sown on raised bed (15-25 x 15-25 cm). It would be, therefore, suggested to adopt direct sowing of paddy variety *Phule Samruddhi*,on raised bed (15-25 x 15-25 cm) to obtain higher yield.

Key words : Rice, Direct Sowing Methods, cultivars, grain and straw yield.

Rice (*Oryza sativa* L.) is most important food crop of the developing world and the staple food for more than 60 per cent of the Indian population, who are also highly vulnerable to inflationary pressure due to high rice price. The production of conventional puddle transplanted rice faces severe constraints because of water and labour scarcity and climatic changes (Pathak *et al*., 2011). Imminent water crisis, water-demanding nature of traditionally cultivated rice and climbing labour costs ramble the search for alternative management methods to increase water productivity, system sustainability and profitability. Direct seeded rice (DSR) technique is becoming popular nowadays because of its low-input demanding nature. It offers a very exciting opportunity to improve water and environmental sustainability.

It is a feasible alternative to conventional puddled transplanted rice with good potential for saving water, mitigating greenhouse gas emissions and adapting to climatic risks; and the yield can be comparable with that of transplanted rice if the crop is properly managed (Kumar and Ladha, 2011). It involves sowing pre-germinated seeds into a puddle soil surface (wet seeding), standing water (water seeding) or dry seeding into a prepared seedbed (dry seeding). Recently there is trend towards direct seeded rice because of labour and water scarcity (Mallikarjun *et al*., 2014). Although the development of suitable varieties and agronomic packages for promoting direct-seeded rice is under way, so far no variety has been developed that possess traits specifically needed to high yield under dry direct-seeded conditions, particularly for rainfed systems that may be prone to drought and low fertility. (Pathak *et al*., 2011). The present investigation was carried out to study the effect of various methods of direct seeded rice on yield of different cultivars in relation to weather parameters.

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Materials and Methods

Experimental details : The experiment was laid out in split plot with sixteen treatment combinations and three replications. There are four sowing methods *viz*., M_1 : Drill sowing at

22.5 cm, M_2 : Drill sowing at 30 cm, M_3 : Dibbing at 30 x 10 cm and M4: Sowing on raised bed (15-25 x 15-25 cm) as a main plot treatments and four paddy varieties *viz.* V_1 : VDN-3-51-18 (*Indrayani*), V_2 : VDN-99-29 (*Phule Samruddhi*), V_3 : IET-13549 (*Bhogawati*) and V_4 : RDN-99-1 (*Phule Radha*) as sub plot treatment. The gross plot size was 3.60 m x 3.60 m and net plot size was different as per treatments. A recommended dose of fertilizer (100:50:50 kg N, P_2O_5 and K_2O ha^{-1}) was applied uniformly to all the treatments.

Results and Discussion

Grain yield : Data in respect of mean grain and straw yield of paddy as influenced by different treatments are presented in Table 1. The mean grain yield of paddy was 51.64 q ha^{-1} while the mean straw yield was 57.00 q ha^{-1}.

Effect of sowing methods : The grain yield of paddy was influenced significantly due to different sowing methods. The grain (57.52 q ha^{-1}) and straw yield (63.48 q ha^{-1}) was superior in the treatment of sowing on raised bed (15-25 x 15-25 cm) than rest of the sowing methods. The lowest grain (47.21 q ha^{-1}) and straw yield (51.58 q ha^{-1}) were produced by the Drill sowing at 22.5 cm. Similar results were reported by Gunri *et al*. (2004) and Christian (2017).

Effect of varieties : The grain yield (q ha^{-1}) of paddy was influenced significantly due to varieties. The grain (58.37 q ha^{-1}) and straw yield (64.43 q ha^{-1}) were significantly the highest in variety *Phule Samruddhi* over rest of the paddy varieties. The variety Phule Radha recorded significantly lowest grain (45.20 q ha^{-1}) and straw yield (49.91 q ha^{-1}). The differences in grain yield in paddy varieties might be due to inherent genetical potential of paddy varieties.

Table 1. Mean grain (q ha^{-1}) as influenced by different treatments

Treatment	Grain yield q ha^{-1}	Straw yield q ha^{-1}
Main plot : Sowing methods (M)		
M_1 : Drill sowing at 22.5 cm	47.21	51.58
M_2 : Drill sowing at 30 cm	49.30	54.42
M_3 : Dibbling (30 cm x 10 cm)	52.51	58.52
M_4 : Sowing on raised bed (15-25 x 15-25 cm)	57.25	63.48
S.E.±	0.37	0.48
C.D. at 5%	1.32	1.68
Sub plot : Varieties (V)		
V_1 : VDN-3-51-18 (Indrayani)	52.19	57.60
V_2 : VDN-99-29 (Phule Samruddhi)	58.37	64.43
V_3 : IET-13549 (Bhogawati)	50.78	56.06
V_4 : RDN-99-1 (Phule Radha)	45.20	49.91
S.E.±	1.08	1.19
C.D. at 5%	3.17	3.57
Interaction between levels of 'M' at same levels of 'V'		
S.E.±	0.75	0.95
C.D .at 5%	2.25	2.85
Interaction between levels of 'V' at same levels of 'M'		
S.E.±	1.91	2.12
C.D. at 5%	5.47	6.05
General mean	51.64	57.00

Effect of interaction : The grain yield (q ha^{-1}) of paddy as influenced by interaction effects between different sowing methods and varieties are reported in Table 2. When paddy varietyPhule Samruddhi sown on raised bed (15-25 x 15-25 cm) recorded higher grain (63.87q ha^{-1}) and straw yield (70.49 q ha^{-1}) which were at par with variety Indrayani sown on raised bed (15-25 x 15-25 cm) having grain (58.83 q ha^{-1}) and straw yield (64.91 q ha^{-1}). The lowest grain (40.53 q ha^{-1}) and straw yields (44.28 q ha^{-1}) were observed in variety Phule Radha sown by Drill sowing at 22.5 cm. A variety *Phule Samruddhi* recorded maximum grain and straw yield due to varietal characters and weather conditions during that period

Table 2. Grain yield (q ha-1) as influenced by interaction between Sowing methods and varieties at harvest

Varieties/ Sowing methods	At harvest				
	V_1	V_2	V_3	V_4	Mean
M_1 : Drill sowing at 22.5 cm	49.03	55.28	43.99	40.53	47.21
M_2 : Drill sowing at 30 cm	47.83	56.37	49.45	43.57	49.30
M_3 : Dibbling (30 cm x 10 cm)	53.09	57.96	52.87	46.11	52.51
M_4 : Sowing on raised bed (15-25 x 15-25 cm)	58.83	63.87	56.81	50.58	57.52
Mean	52.19	58.37	50.78	45.20	
S.E.± M at same level of V	0.75				
C.D. at 5%	2.25				
S.E.± V at same level of M	1.91				
C.D. at 5%	5.47				
General mean	51.64				

Table 3. Straw yield (q ha-1) of paddy as influenced by interaction between sowing methods and varieties at harvest

Varieties/ Sowing methods	At harvest				
	V_1	V_2	V_3	V_4	Mean
M_1 : Drill sowing at 22.5 cm	53.57	60.41	48.05	44.28	51.58
M_2 : Drill sowing at 30 cm	52.75	62.22	54.59	48.10	54.42
M_3 : Dibbling (30 cm x 10 cm)	59.17	64.59	58.92	51.41	58.52
M_4 : Sowing on raised bed (15-25 x 15-25 cm)	64.91	70.49	62.67	55.83	63.48
Mean	57.60	64.43	56.06	49.91	
S.E.± M at same level of V	0.95				
C.D. at 5%	2.85				
S.E.± V at same level of M	2.12				
C.D. at 5%	6.05				
General mean	57.00				

The correlation between weather parameters and grain yield presented in Table 4, showed significant positive correlation in case of T min (r = 0.969**), RH-I (r= 0.663*) and RH-II (r= 0.678*). The significant negative correlation found with Tmax (r= -0.521*), canopy temperature (r=-0.754**), BSS(r= -0.345) and GDD (r= 0.989**). While the correlation between weather parameters and straw yield presented in Table 4, revealed significant negative correlation in case of Tmax (r = -0.382), BSS (r = -0.448) and canopy temperature (r= -0.424) and GDD (r = -0.770**) Significant positive correlation found with T min (r = 0.709**), RH-I (r=0.406) and RH-II (r = 0.706**).

Table 4. Correlation between weather parameters and yield of paddy

Weather parameter	Grain yield (qha^{-1})	Straw yield ($q\ ha^{-1}$)
T max	-0.521*	-0.382
T min	0.969**	0.709**
R-I	0.663*	0.406
R-II	0.678*	0.709**
Canopy temp.	-0.754**	-0.424
BSS	-0.345	-0.448
GDD	-0.989**	-0.770**

Conclusions

From the studies it is observed that, among the four different varieties of paddy, VDN-99-29 (*Phule Samruddhi*) recorded significantly higher increased yield as compared to VDN-3-51-18 (*Indrayani*), IET-13549 (Bhogawati) and RDN-99-1 (*Phule Radha*). It would be, therefore, suggested to adopt VDN-99-29 (*Phule Samruddhi*) variety for *kharif* direct seeded paddy cultivation under sub mountaine zone conditions. Sowing on raised bed (15-25 x 15-25 cm) favorably influenced yield components. It would be, therefore, suggested to adopt sowing on raised bed (15-25 x 15-25 cm) to *kharif* direct seeded paddy variety Phule Samruddhi.

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