

Original Research Article

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Effect of Sowing Dates and Varieties on Economics and Nutrient Status of Direct Seeded Rice (*Oryza sativa* L.) and Soil

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ABSTRACT

Sowing time of rice sometimes get delayed due to lack of assured irrigation or surplus of rainfall. Moreover, no specific varieties have been specifically developed for this purpose. An experiment was conducted to study the effect of sowing dates and varieties on economics and soil properties of direct seeded rice in 2018 at Agricultural Research Station, Dhadesugur in Karnataka. The experimental site was medium black clay soil belonging to the order *vertisol* with soil pH (8.10), EC (0.65 dS m⁻¹), available nitrogen (244.60 kg ha⁻¹), P₂O₅ (37.50 kg ha⁻¹) and K₂O (336.3 kg ha⁻¹). The experiment comprised of five dates of sowing *viz.*, D₁: 2nd Fortnight of June, D₂: 1st Fortnight of July, D₃: 2nd Fortnight of July, D₄: 1st Fortnight of August and D₅: 2nd Fortnight of August and four varieties *viz.*, V₁: GGV- 05- 01, V₂: RNR-15048, V₃: BPT-5204 and V₄: GNV-10-89. These treatments were laid out in split plot design with three replications. The experimental results revealed that, 2nd fortnight of June recorded higher NPK content and uptake (117.8, 39.3 and 124.1 kg ha⁻¹, respectively), whereas higher available NPK was recorded by crop sown on 2nd Fortnight of August (242.4, 46.53, and 305.9 kg ha⁻¹, respectively). Cost of cultivation of each crop was worked out and income of crop yields was calculated on prevailing market prices. Among the different treatment combinations, D₁V₂ recorded significantly higher gross returns (Rs. 1,31,564 ha⁻¹), net returns (Rs. 75,550 ha⁻¹) and BCR (2.35) which was on par with D₂V₂ (Rs. 1,30,502 ha⁻¹, 74,488 ha⁻¹ and 2.33, respectively).

Keywords

Direct seeded rice (DSR), Dates of sowing, Varieties, economics and Uptake

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Introduction

Rice (*Oryza sativa* L.) is the world's third largest crop after maize and wheat. It is the staple food for more than half of the world's population. Rice cultivation is the principal

activity and source of income for about 100 million households and its demand will continue to expand due to population growth and increasing consumption patterns in different regions [FAO, 2004]. In Karnataka, rice is grown in an area of 1.36 million

hectare with a production of 3.99 million tonnes and the productivity of 3.10 tonnes per hectare (Anon., 2018). More than 80 per cent of the developed fresh water resources in Asia are used for irrigation purposes and consumes up to 43 per cent of the world's developed irrigation resources (Bouman *et al.*, 2007).

The common method of rice cultivation in India is transplanting the nursery which is very laborious and time consuming. To address these problems, direct seeded rice is evolved. Direct sowing method is the new development in water saving techniques, where rice is grown like other cereal crop with supplemental irrigation. DSR is considered as water saving technology which can help to overcome the present water scarcity and nutrient loss. Time of sowing is one of the critical aspects of direct seeding of rice and determines the productivity of a crop.

Optimum sowing time for a crop is location specific. Production of direct seeded rice decreases if there is delay in sowing. However, at the same time, no varieties have been specifically developed for this purpose.

Rice varieties vary in their seedling vigor, weed competitiveness, submergence and drought tolerance, maturity duration, lodging resistance, affecting the resource utilization and productivity. Not much information is available on suitable varieties and crop establishment practices for direct seeding in comparison to traditional method. Viewing these facts, a field experiment was conducted to evaluate the effectiveness of sowing dates and varieties on economics and nutrient status of direct seeded rice and in soil.

Materials and Methods

A field experiment was carried out at Agriculture Research Station, Dhadesugur in Karnataka during 2018-19 to study on

Response of direct seeded rice (*Oryza sativa* L.) to dates of sowing and varieties. The centre is located in agro-climatic zone III (Northern Dry zone) of Karnataka. The station is situated at latitude of 15° 69' N and 76° 89' E longitude with an altitude of 358 m above mean sea level.

The experimental site was medium black clay soil belonging to the order *vertisol* with soil pH (8.10), EC (0.65 dS m⁻¹), available nitrogen (244.60 kg ha⁻¹), P₂O₅ (37.50 kg ha⁻¹) and K₂O (336.3 kg ha⁻¹).

The experiment comprised of five dates of sowing *viz.*, D₁: 2nd Fortnight of June, D₂: 1st Fortnight of July, D₃: 2nd Fortnight of July, D₄: 1st Fortnight of August and D₅: 2nd Fortnight of August and four varieties *viz.*, V₁: GGV- 05- 01, V₂: RNR-15048, V₃: BPT-5204 and V₄: GNV-10-89. Crop was sown with the spacing of 20 cm between the rows in 6 x 4 m plot. As split-split plot design with three replications was used, dates of sowing were allocated to the main plots while rice varieties in the sub plots. These treatments were laid out in split plot design with three replications.

The recommended dose of fertilizer to each crop was applied at the rate of 150:75:75 kg N, P₂O₅, K₂O ha⁻¹ in the form of urea, diammonium phosphate and muriate of potash, respectively. Entire quantity of phosphorus, potassium and 50 per cent of nitrogen were applied at the time of sowing. Remaining 50 per cent of nitrogen was applied as two splits, one at tillering stage and other at panicle initiation (PI) stage. Farmyard manure at 5 tonnes per hectare was applied one week before sowing and incorporated into the soil before passing the cultivator.

Data were collected on nitrogen, phosphorous and potassium content, NPK uptake, available nitrogen, phosphorous and potassium in soil,

cost of cultivation, gross returns, net returns and benefit-cost ratio. NPK analysis was done by using micro-kjeldhal's method, vanadomolybodo phosphoric acid yellow color method and flame photometer method, respectively. With the help of NPK content and biomass yield NPK uptake was calculated. The statistical analysis for various characters under investigation was done.

Results and Discussion

Nutrient status of direct seeded rice and soil after harvest

Nutrient status and economics of direct seeded rice differed significantly as influenced by different varieties under varied dates of sowing. The results revealed that the crop sown on 2nd Fortnight of June recorded higher nitrogen, phosphorous and potassium content (2.11, 0.74 and 2.94 %, respectively) and also its uptake (117.8, 39.3 and 124.1 kg ha⁻¹ of NPK, respectively) and is presented in the table 1 and 2, respectively. Whereas, crop sown on 2nd fortnight of August recorded lower nitrogen, phosphorous and potassium content (1.91, 0.56 and 2.59 %, respectively) and also its uptake (77.5, 22.0 and 77.5 kg ha⁻¹ of NPK, respectively).

Higher dry matter accumulation and availability of nutrients might be the reason for higher NPK content of the variety GGV-05-01 and crop sown on 2nd fortnight of June. Similar results were obtained by Chamely *et al.*, 2014.

Among different varieties, GGV-05-01 recorded higher NPK content (2.20, 0.79 and 3.09 %, respectively) and uptake (119.4, 40.5 and 127.3 kg ha⁻¹, respectively), whereas BPT-5204 recorded lower NPK content (1.83, 0.52 and 2.48 %, respectively) and uptake (85.4, 23.5 and 85.7 kg ha⁻¹, respectively). It is clear that nutrient uptake also depends on

the varieties. As there was higher biomass and NPK content, higher uptake was observed. Higher available NPK in soil was observed, where crop was sown on 2nd fortnight of August (242.4, 46.53, and 305.9 kg ha⁻¹, respectively), while lower available NPK in soil was observed, where crop was sown on 2nd fortnight of June (210.5, 35.3, and 282.4 kg ha⁻¹, respectively).

As there was better uptake of the nutrients in early sown direct seeded rice, available nutrients in soil at harvest decreased. In the same way, when varieties are considered available NPK in soil was lower in the treatment of GGV-05-01 (207.5, 35.3 and 282 kg NPK ha⁻¹, respectively), while available NPK in the treatment of variety BPT-5204 (241.6, 45.5 and 302.2 kg NPK ha⁻¹, respectively). Thus, crop variety GGV-05-01 sown on 2nd fortnight of June is considered to be the best treatment with respect to nutrient availability.

Economics of direct seeded rice

Labour saving of Direct Seeded Rice reduces 11.2 per cent of total production cost as well as Direct Seeded Rice methods have several advantages over transplanting (Singh *et al.*, 2005; Naresh *et al.*, 2010). Economics is the main parameter which finally decides the adoption levels at farming situations of any newly introduced technology by the farmers. A new technology should be technically and economically viable.

Therefore, the economic analysis of the results is very important. In addition to higher economic returns, Direct Seeded Rice crops are faster and easier to plant and less labor intensive (Jhangir *et al.*, 2005). In this experiment, the cost of cultivation was similar for all treatments (Rs. 56014 ha⁻¹) except for the treatments where BPT-5204 (Rs. 61,014 ha⁻¹) was grown as it was attacked by BPH.

Table.1 NPK content of direct seeded rice as influenced by different varieties under varied dates of sowing

(D) / (V)	Nitrogen (%)					Mean	Phosphorous (%)					Mean	Potassium (%)					Mean		
	D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅			
V ₁	2.29	2.24	2.21	2.17	2.09	2.20	0.879	0.828	0.790	0.736	0.700	0.79	3.22	3.15	3.13	3.00	2.94	3.09		
V ₂	2.06	2.02	2.00	1.96	1.87	1.98	0.700	0.654	0.621	0.544	0.521	0.61	2.85	2.79	2.71	2.58	2.49	2.69		
V ₃	1.93	1.89	1.85	1.80	1.70	1.83	0.608	0.565	0.531	0.464	0.424	0.52	2.65	2.58	2.52	2.37	2.26	2.48		
V ₄	2.18	2.13	2.11	2.06	1.97	2.09	0.780	0.732	0.693	0.630	0.592	0.69	3.02	2.96	2.90	2.76	2.68	2.87		
Mean	2.11	2.07	2.04	2.00	1.91		0.74	0.69	0.66	0.59	0.56		2.94	2.87	2.82	2.68	2.59			
	SEm_±					C.D (p=0.05)					SEm_±					C.D (p=0.05)				
D	0.01					0.04					0.02					0.04				
V	0.01					0.04					0.01					0.04				
D X V	0.02					NS					0.02					NS				

Note:

D: Dates of sowing

D₁: 2nd Fortnight of June

D₂: 1st Fortnight of July

D₃: 2nd Fortnight of July

D₄: 1st Fortnight of August

V: Varieties

V₁: GGV-05-01

V₂: RNR -15048

V₃: BPT -5204

V₄:GNV-10-89

D₅: 2nd Fortnight of August

Table.2 Uptake of nutrients after harvest of direct seeded rice as influenced by different varieties under varied dates of sowing

(D) / (V)	Nitrogen (kg ha ⁻¹)					Mean	Phosphorous (kg ha ⁻¹)					Mean	Potassium (kg ha ⁻¹)					Mean		
	D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅			
V ₁	132.6	129.6	124.5	119.5	90.6	119.4	47.8	45.1	42.1	38.4	28.9	40.5	143.4	138.8	133.9	124.6	95.7	127.3		
V ₂	113.2	110.5	107.9	102.3	75.8	101.9	36.7	34.4	32.3	27.7	20.6	30.3	118.3	112.9	110.5	101.1	72.2	103.0		
V ₃	101.0	91.2	88.9	82.5	63.3	85.4	30.5	26.1	24.6	20.7	15.4	23.5	103.7	92.2	90.7	80.7	61.1	85.7		
V ₄	124.5	120.9	117.6	108.2	80.1	110.3	42.1	39.7	36.7	31.8	23.3	34.7	131.1	127.1	120.7	107.9	80.9	113.6		
Mean	117.8	113.1	109.7	103.1	77.5		39.3	36.3	33.9	29.7	22.0		124.1	117.7	113.9	103.6	77.5			
	SEm_±					C.D (p=0.05)					SEm_±					C.D (p=0.05)				
D	1.34					3.88					0.95					2.76				
V	0.90					2.60					0.74					2.14				
D X V	1.16					NS					0.96					NS				

Note:

D: Dates of sowing

D₁: 2nd Fortnight of June

D₂: 1st Fortnight of July

D₃: 2nd Fortnight of July

D₄: 1st Fortnight of August

D₅: 2nd Fortnight of August

V: Varieties

V₁: GGV-05-01

V₂: RNR -15048

V₃: BPT -5204

V₄:GNV-10-89

Table.3 Soil available nutrients after harvest of direct seeded rice as influenced by different varieties under varied dates of sowing

(D) / (V)	Nitrogen (kg ha ⁻¹)					Mean	Phosphorous (kg ha ⁻¹)					Mean	Potassium (kg ha ⁻¹)					Mean
	D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅		D ₁	D ₂	D ₃	D ₄	D ₅	
V ₁	195.1	199.9	205.6	213.9	223.2	207.5	31.3	32.7	34.0	37.1	41.5	35.3	272.8	277.3	280.5	284.9	295.2	282.1
V ₂	214.3	221.1	227.7	235.1	246.7	228.9	36.2	38.1	40.2	43.3	47.6	41.1	285.9	290.0	293.7	298.0	307.3	295.0
V ₃	225.9	233.3	239.6	247.7	261.6	241.6	40.3	42.4	45.5	47.2	51.9	45.5	291.6	295.9	299.8	305.6	317.9	302.2
V ₄	206.7	213.1	220.5	227.9	238.0	221.3	33.6	35.1	36.8	39.3	45.1	37.9	279.1	284.2	287.3	292.2	303.2	289.2
Mean	210.5	216.9	223.7	231.2	242.4		35.3	37.1	39.1	41.7	46.53		282.4	286.9	290.3	295.2	305.9	
	SEm_±					C.D (p=0.05)	SEm_±					C.D (p=0.05)	SEm_±					C.D (p=0.05)
D	3.45					9.95	0.98					2.84	1.75					5.05
V	1.78					5.15	0.81					2.35	1.53					4.41
D X V	2.30					NS	1.05					NS	1.97					NS

Note:

D: Dates of sowing

D₁: 2nd Fortnight of June

D₂: 1st Fortnight of July

D₃: 2nd Fortnight of July

D₄: 1st Fortnight of August

D₅: 2nd Fortnight of August

V: Varieties

V₁: GGV-05-01

V₂: RNR -15048

V₃: BPT -5204

V₄:GNV-10-89

Table.4 Economics of direct seeded rice as influenced by different varieties under varied dates of sowing

DV	Cost of cultivation (Rs. ha ⁻¹)	Gross returns (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	BCR
D ₁ V ₁	56,000	1,25,711	69,711	2.24
D ₁ V ₂	56,000	1,31,564	75,564	2.35
D ₁ V ₃	61,000	1,24,744	63,744	2.04
D ₁ V ₄	56,000	1,23,839	67,839	2.21
D ₂ V ₁	56,000	1,24,965	68,965	2.23
D ₂ V ₂	56,000	1,30,502	74,502	2.33
D ₂ V ₃	61,000	1,15,057	54,057	1.89
D ₂ V ₄	56,000	1,22,546	66,546	2.19
D ₃ V ₁	56,000	1,21,588	65,588	2.17
D ₃ V ₂	56,000	1,28,309	72,309	2.29
D ₃ V ₃	61,000	1,13,466	52,466	1.86
D ₃ V ₄	56,000	1,20,211	64,211	2.15
D ₄ V ₁	56,000	1,18,887	62,887	2.12
D ₄ V ₂	56,000	1,23,862	67,862	2.21
D ₄ V ₃	61,000	1,08,078	47,078	1.77
D ₄ V ₄	56,000	1,13,344	57,344	2.02
D ₅ V ₁	56,000	92,478	36,478	1.65
D ₅ V ₂	56,000	95,758	39,758	1.71
D ₅ V ₃	61,000	87,026	26,026	1.43
D ₅ V ₄	56,000	86,951	30,951	1.55
SEm±	-	404.2	404.2	0.05
C.D (p=0.05)	-	1213	1213	0.16

Note:

D: Dates of sowing

D₁: 2nd Fortnight of June

D₂: 1st Fortnight of July

D₃: 2nd Fortnight of July

D₄: 1st Fortnight of August

D₅: 2nd Fortnight of August

V: Varieties

V₁: GGV-05-01

V₂: RNR -15048

V₃: BPT -5204

V₄: GNV-10-89

The results also revealed that the interaction effect of RNR-15042 sown on 2nd fortnight of June recorded higher gross returns, net returns and also BCR (Rs. 1,31,564 ha⁻¹, Rs. 75,550 ha⁻¹ and 2.35, respectively) which was found on par with RNR-15048 sown on 1st fortnight of July (Rs. 1,30,502 ha⁻¹, 74,488 ha⁻¹ and 2.33, respectively). Whereas lower gross returns, net returns and also BCR was recorded by BPT-5204 sown on 2nd fortnight

of August (Rs. 86,951 ha⁻¹, Rs. 26,013 ha⁻¹ and 1.43, respectively). Comparatively, there was good growth and yield parameters, thus better grain and straw yield observed in early sown crop which led to higher gross returns, net returns and benefit cost ratio. Even the market price for RNR-15048 was high thus economic returns is high. These results are in conformity with the findings of Dawadi and Choudhary, 2013 and Satapathy *et al.*, (2016).

In conclusion from the experiment we can conclude that, among different treatments, GGV-05-01 sown on 2nd fortnight of June recorded higher NPK content and uptake, as there was higher biomass. But economic returns is of great importance to the farmers. The results showed that RNR-15048 sown on 2nd fortnight of June is best sowing date as it recorded higher gross returns, net returns and also BCR.

References

- Anonymous, 2018, *Directorate of Economics and Statistics*.<http://www.indiastat.com>
- Bouman, B. A. M., Humphreys, E., Tuong, T. P. and Barker, R., 2007, Rice and water. *Adv. Agron.*, 92: 187–237.
- Chamely, S. G., Islam, N., Hoshain, S., Rabbani, M. G., Kader, M. A. and Salam, M. A., 2014, Effect of variety and nitrogen rate on the yield performance of *boro* rice. *Progressive Agric.*, 26(1): 6-14.
- Dawadi, K. P. and Chaudhary, N. K., 2013, Effect of sowing dates and varieties on yield and yield attributes of direct seeded rice in chitwan condition. *Int. J. Agric. Sci. Res.*, 2(4): 095-102.
- FAO, 2004. Rice and Us. Food and Agricultural organization of the united nations, Rome, Italy.
- Jehangir, W. A., Masih, I., Ahmed, S., Gill,

- M. A., Ahmad, M., Mann, R. A., Chaudhary, M. R., and Turrall, H., 2005, Sustaining crop water productivity in rice-wheat systems of South Asia: a case study from Punjab Pakistan. In: Draft Working Paper. Inter. Water Manag. Ins., Lahore, Pakistan.
- Naresh, R. K., Gupta Raj, K., Singh, B., Kumar Ashok, Shahi, U. P., Pal Gajendra, Singh, Adesh, Yadav, A. K. and Tomar, S. S., 2010, Assessment of no-tillage and direct seeding technologies in rice-wheat rotation for saving of water and labor in Western IGP. *Progr. Agri. Int. J.*, 10(2): 205-218.
- Satapathy, B. S., Pun, K. B., Singh, T. and Rautaray, S. K., 2016. Influence of dates of sowing on growth and yield of direct wet sown early Ahu rice (*Oryza sativa* L.) varieties under flood prone lowland ecosystem of Assam. *Ann. Agric. Res. New Series.*, 37 (1) : 30-35.
- Singh Samar, Sharma, R. K., Govindra Singh, Singh, S. S., Singh, U. P., Gill, M. A., Jat, M. L., Sharma, S. K, Malik, R. K., Josan, A. S. and Gupta, R. K., 2005, Direct seeded rice: A promising resource conserving technology. Rice-Wheat consortium for the Indo-Gangetic Plains, New Delhi.

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