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Effect of various quality rice cultivars and crop management practices on growth and yield of rice (*Oryza sativa* L.)

Kulendra Jaiswal, Dr. MC Bhambri and Dr. HL Sonboir

Abstract
An experiment was carried out during *kharif* season of 2018 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The experiment was laid out in split plot design with three replicationsand five main plot treatments consist of quality rice cultivars *viz* V1: Trombay CG Dubraj Mutant-1, V2: Tarunbhog Mutant-1, V3: Safri 17-48-2, V4: Trombay Raipur Rice-106, V5: Zinco Rice and five sub plot treatments of crop management practices (Spacing+nutrient management) *viz* P1: 20x10 cm spacing + 100% RDF through inorganic (standard check), P2: 20x10 cm spacing + 100% RDF through inorganic and organic, P3: 20x10 cm spacing + 150% RDF through inorganic and organic,P4: 15x10 cm spacing + 150% RDF through inorganic and organic, P5: 20x10 cm spacing + 150% RDF inorganic.In case of P2, P3 and P4 top dressing of vermicompost@ 2 q ha^{-1} + DAP@ 25 kg ha^{-1} was done at 25-30 DAT and remaining $N:P_2O_5:K_2O$ was applied through inorganic sources.The result of the experiment indicate that quality rice cultivar Trombay Raipur Rice-106 recorded superior growth characters like number of tillers m^{-2}, dry matter accumulation(g hill^{-1}), CGR but it was at par with Trombay CG Dubraj Mutant-1.As regard to crop management practices, crop planted at 15x10 cm spacing + 150% RDF through inorganic and organic observed better growth characters like number of hills m^{-2}, plant height (cm), number of tillers m^{-2} CGR, RGR. as compared to rest of the treatments.

Keywords: Various quality, cultivars and crop, *Oryza sativa* L.

Introduction
Rice (*Oryza sativa* L.) is a major cereal crop which is used as a main source of food for more than 85% population in the world and 90% in Asia but, lacking imbalanced, inappropriate or excessive use of nutrients in agricultural systems is a major cause for low crop yields in parts of developing countries. During 2017-18 rice was cultivated in an area of 431.94 lakh hectare with a production of 110.41 million tonnes and productivity of 2550 kg ha^{-1} (Annual report, 2017-18) [1] However, considering the present growth rate of population as well as per capita income, the demand for rice has been projected as 156 million tonnes by 2030. High yield potential of short grain aromatic rice can be only exploited under appropriate agronomical management practices. Among various agronomical management practices, the optimum age and planting geometry play significant role in increasing the productivity of rice. Uniform distribution of crop plants over an area with proper age of seedling results in efficient use of nutrients, moisture and suppression of weeds leading to high yield.

Materials and Methods
An experiment was carried out during *kharif* season of 2018 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. Geographically, Raipur is situated at South Eastern part of Chhattisgarh at 21^0 4 N latitude and 81^0 35 E longitude at the height of 290.20 m above mean sea level. Climatologically, Chhattisgarh state is Raipur, which comes under seventh agro climatic zone of India *i.e*. Eastern Plateau and Hills and it is known for sub-humid with hot summer and cold winter climate. The mean annual precipitation of the region is 1326 mm (based on 80 years mean), about 85% of rainfall is received during rainy season *i.e.* middle of June to September with occasional showers in winter and summer months. The weekly maximum temperature raises upto 46˚C during summer and minimum temperature drop down as low as 6˚C during winter season. The relative humidity is high from June to October and wind velocity is high from May to August with its peak in June and July months. The soil of experimental field was '*Vertisols*', The soil was neutral (pH 6.9) in reaction with medium in fertility having 0.51% soil organic carbon,

low in nitrogen (198.25 kg ha^{-1}), medium in phosphorus (11.8 kg ha^{-1}) and medium in potassium (258.15 kg ha^{-1}) contents with normal pH (6.9). The experiment was laid out in split plot design with three replicationsand five main plot treatments consist of quality rice cultivars *viz* V1: Trombay CG Dubraj Mutant-1, V2: Tarunbhog Mutant-1, V3: Safri 17-48-2, V4: Trombay Raipur Rice-106, V5: Zinco Rice and five sub plot treatments of crop management practices (Spacing+nutrient management) *viz.* P1: 20x10 cm spacing + 100% RDF through inorganic (standard check), P2: 20x10 cm spacing + 100% RDF through inorganic and organic, P3: 20x10 cm spacing + 150% RDF through inorganic and organic, P4: 15x10 cm spacing + 150% RDF through inorganic and organic, P5: 20x10 cm spacing + 150% RDF inorganic.

Results and Discussion

Crop stand (Number of hills m^{-2}) and plant height (cm)

Crop stand and plant height of quality rice cultivars was recorded periodically and presented in Table 1. The results on number of hills m^{-2} indicates that quality rice cultivars and crop management practices behave differently to crop geometry. Number of hills m^{-2} ware not influenced significantly due to quality rice cultivars at both the observations. However, in crop management practices the total number of hills m^{-2} ware significantly higher under P4 *i.e.* 15x10 cm spacing +150% RDF through inorganic and organic. Rest of the crop management practices were at par with each other for crop stand. Plant height of different quality cultivars influenced significantly due to varietal differences and with crop management practices. Among the cultivars, the highest plant height was observed in Tarunbhog Mutant-1 at all the stages of observation and it was significantly higher over rest of the cultivars. On the contrary the lowest plant height was recorded in Trombay CG Dubraj Mutant-1. As regards to crop management practices, at initial stages the plant height was higher in 15x10 cm spacing +150% RDF through inorganic and organic treatment and at harvest no significant variation in the plant height was observed in all the crop management practices. The interaction between varieties and crop management practices was non- significant for plant height at all the observations.Similar results have been obtained by Kanungo and Roul. (1994) [3] and Raju *et al.* (1984) [5].

Number of tillers (m^{-2})

Number of tillers (m^{-2}) at different growth period influenced significantly due to quality rice cultivars and crop management practices (Table 2).

Table 1: Crops stand and plant height of rice as influenced by quality rice cultivars and crop management practices.

	Treatment	Crops stand (Number of hills m^{-2})		Plant height (cm)			
		30 DAT	At Harvest	30 DAT	60 DAT	90 DAT	At Harvest
	A. Quality rice cultivars						
V1	Trombay CG Dubraj Mutant-1	53.2	53.2	71.9	84.9	91.9	92.8
V2	Tarunbhog Mutant -1	53.1	53.1	105.6	132.7	151.0	152.8
V3	Safri 17-48-2	53.2	53.2	84.6	98.9	102.2	102.3
V4	Trombay Raipur Rice-106	53.2	53.2	76.5	99.8	108.3	111.7
V5	Zinco Rice	53.2	53.2	75.0	94.8	102.3	102.5
	SEm±	0.06	0.06	1.2	1.1	1.2	1.1
	CD (P=0.05)	0.21	0.21	4.0	3.5	4.1	3.4
	B. Crop management practices						
P1	20x10 cm spacing +100%RDF through inorganic (standard check)	49.9	49.9	80.7	98.5	109.7	110.4
P2	20x10 cm spacing +100%RDF through inorganic and organic	50.0	50.0	82.3	102.7	110.1	112.54
P3	20x10 cm spacing +150%RDF through inorganic and organic	50.0	50.0	83.4	101.6	111.9	112.9
P4	15x10 cm spacing +150% RDF through inorganic and organic	65.9	65.9	85.8	105.7	112.1	113.8
P5	20x10 cm spacing + 150%RDF inorganic	50.0	50.0	81.4	102.6	111.6	112.5
	SEm±	0.05	0.05	1.1	0.8	0.5	0.4
	CD (P=0.05)	0.14	0.14	3.3	2.2	1.6	1.3
	VXP						
	SEm±	0.11	0.11	2.6	1.7	1.2	1.0
	CD (P=0.05)	0.32	0.32	NS	NS	NS	NS

* P2, P3, and P4 Topdressing of vermicompost @ 2 q ha^{-1}+ DAP @ 25 kg ha^{-1} at 25-30 DAT and remaining N: P_2O5:K_2O through inorganic.

Table 2: Number of tillers in rice as influenced by quality rice cultivars and crop management practices.

	Treatment	No. of tillers (m^{-2})			
		30 DAT	60 DAT	90 DAT	At Harvest
	Quality rice cultivars				
V1	Trombay CG Dubraj Mutant-1	390.5	448.8	463.1	472.9
V2	Tarunbhog Mutant -1	336.3	360.0	379.8	395.6
V3	Safri 17-48-2	386.5	395.8	416.6	431.1
V4	Trombay Raipur Rice-106	392.9	528.1	546.5	550.59
V5	Zinco Rice	369.0	377.3	389.4	394.81
	SEm±	4.6	6.6	5.7	7.89
	CD (P=0.05)	15.2	21.5	18.5	25.74
	Crop management practices				
P1	20x10 cm spacing +100%RDF through inorganic (standard check)	351.2	412.5	419.4	428.2
P2	20x10 cm spacing +100%RDF through inorganic and organic	360.8	407.1	420.2	431.2
P3	20x10 cm spacing +150%RDF through inorganic and organic	368.0	417.4	442.0	447.1

P4	15x10 cm spacing +150% RDF through inorganic and organic	432.7	456.5	485.6	501.2
P5	20x10 cm spacing + 150%RDF inorganic	363.0	416.6	427.9	437.3
SEm±		6.4	4.1	5.5	3.7
CD (P=0.05)		18.5	11.9	15.9	10.6
VXP					
SEm±		14.5	9.3	12.5	8.3
CD (P=0.05)		NS	NS	NS	NS

*P2, P3, and P4 Topdressing of vermicompost@ 2 q ha^{-1}+ DAP @ 25 kg ha^{-1} at 25-30 DAT and remaining N: P_2O5:K_2O through inorganic.

Tillering is the one of the most vital character of growth of rice plant. The number of tillers increased with the advancement of crop age and increased up to harvest. Among the different quality rice cultivars the maximum number of tillers m^{-2} were recorded in Trombay Raipur Rice 106 followed by Trombay CG Dubraj Mutant-1. Other rice cultivars produced almost similar number of tillers m^{-2} except Tarunbhog Mutant-1 which produced significantly lower number of tillers m^{-2} over rest of the cultivars at all the stages of observation starting from 30 DAT to at harvest.The influence of crop management practices was significant for number of tillers m^{-2}. The data indicate that significantly higher number of tillers m^{-2} were recorded in 15×10 cm spacing + 150% RDF through inorganic and organic treatment, while lowest number of tillers m^{-2} were observed in 20×10 cm spacing + 100% RDF through inorganic treatment at all the stages of observation (Table 2). Other crop management practices observed similar trend and were comparable with each other for number of tillers m^{-2}. The interaction effect of both the factors was non-significant. Similar result was reported by Patel (2012) [4].

Dry matter accumulation (g hill^{-1})

Dry matter accumulation showed significant variation in all stages (Table 3). The dry matter accumulation was significantly higher under Trombay Raipur Rice-106 at 30, 60, 90 DAT and at harvest which was at par with Trombay CG Dubraj Mutant-1 at 90 DAT and at harvest. The significantly lower dry matter accumulation was noted under Tarunbhog Mutant-1 at all the stages of observation (Table 3)

There was a significant increase in dry matter accumulation due to crop management practices (Table 3). The data showed that 15x10 cm spacing +150% RDF through inorganic and organic recorded higher dry matter accumulation at all the observational stages through out the crop growth period followed by 20x10 cm spacing +150%RDF through inorganic and organic. The lowest dry matter accumulation was seen under 20x10 cm spacing +100% RDF through inorganic (standard check).

The interaction of quality rice cultivars with crop management practices towards dry matter accumulation was not significant at all the stages. Similar result has earlier been reported by other researchers Dhal and Mishra (1994) [2].

Table 3: Dry matter accumulation rice in as influenced by quality rice cultivars and crop management practices.

Treatment		Dry matter accumulation (g hill^{-1})			
		30 DAT	**60 DAT**	**90 DAT**	**At harvest**
A. Quality rice cultivars					
V1	Trombay CG Dubraj Mutant-1	2.4	11.7	37.4	48.0
V2	Tarunbhog Mutant-1	1.9	9.61	33.2	44.3
V3	Safri 17-48-2	2.0	10.9	35.8	45.6
V4	Trombay Raipur Rice-106	3.1	15.6	37.7	48.1
V5	Zinco Rice	2.2	10.2	34.7	44.7
SEm±		**0.0**	**0.2**	**0.2**	**0.4**
CD (P=0.05)		**0.2**	**0.6**	**0.6**	**0.6**
B. Crop management practices					
P1	20x10 cm spacing +100%RDF through inorganic (standard check)	2.2	8.2	33.96	45.0
P2	20x10 cm spacing +100%RDF through inorganic and organic	2.1	9.6	34.6	45.9
P3	20x10 cm spacing +150%RDF through inorganic and organic	2.4	12.47	36.2	45.7
P4	15x10 cm spacing +150% RDF through inorganic and organic	2.6	16.3	38.6	47.8
P5	20x10 cm spacing + 150%RDF inorganic	2.4	11.3	35.5	46.4
SEm±		0.1	0.3	0.4	0.4
CD (P=0.05)		0.2	0.9	1.2	1.2
VXP					
SEm±		0.2	0.7	0.9	0.9
CD (P=0.05)		NS	NS	NS	NS

* P2, P3, and P4 Topdressing of vermicompost @ 2q ha^{-1}+ DAP @ 25 kg ha^{-1} at 25-30 DAT and remaining N: P_2O5:K_2O through inorganic.

Crop growth rate (g day^{-1} hill^{-1})

The data related to crop growth rate are presented in Fig 1 and 2 indicate that quality rice cultivars showed significant variation in crop growth rate throughout the crop growth period. Significantly higher crop growth rate was exhibited in Trombay Raipur Rice-106 at initial stage of 0-30 DAT and 30-60 DAT. However, at later stages variety Trombay CG Dubraj Mutant-1 gave the higher CGR at 60-90 DAT followed by cultivars Safri 17-48-2., whereas from 90 DAT to at harvest Safri 17-48-2 was superior over rest of the cultivars in depicting higher CGR. In case of crop management practices initially upto 60 DAT the crop growth rate was significantly higher in 15x10 cm spacing +150% RDF through inorganic treatment. whereas, during 60-90 DAT the crop growth rate was significantly higher in wider spacing of 20x10 cm +100% RDF through inorganic which was comparable with similar spacing *i.e.* 20x10 cm+100% RDF through inorganic and organic sources (Fig 2)

Relative growth rate (gg^{-1} day^{-1} hill^{-1})

Relative growth rate of rice was influenced significantly due to quality rice cultivars and crop management practices. (Fig.

3 and 4). Among the quality rice cultivars Trombay Raipur Rice-106 was significantly superior over rest of the cultivars in RGR at 30-60 DAT, however during 60-90 DAT same cultivar gave the higher RGR which was comparable with Trombay CG Dubraj Mutant-1 whereas at 90 DAT-at harvest Trombay Raipur Rice-106 and Safri 17-48-2 resulted in higher and comparable relative growth rate of rice. Crop management practices also behaved differently towards relative growth rate of rice (Fig 4). At initial stage of crop 30-60 DAT onwards and upto harvest 15x10 cm spacing +150% RDF through inorganic and organic exhibited significantly higher RGR over other crop management practices at all the growth period. No significant interaction effect was observed between quality rice cultivars and crop management practices.

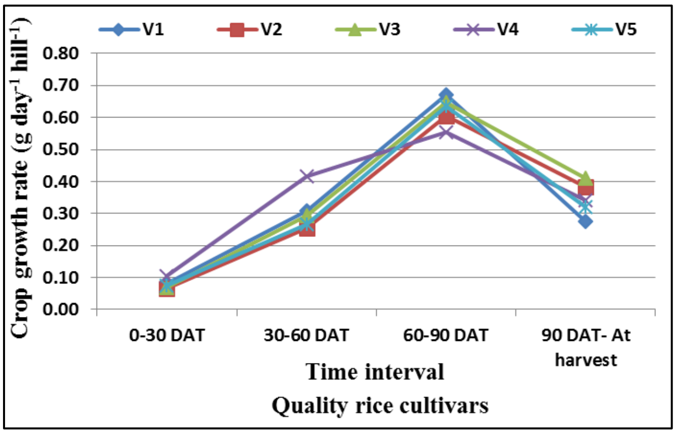

Fig 1: Crop growth rate (g day^{-1} $hill^{-1}$) of rice as influenced by quality rice cultivars at different time interval

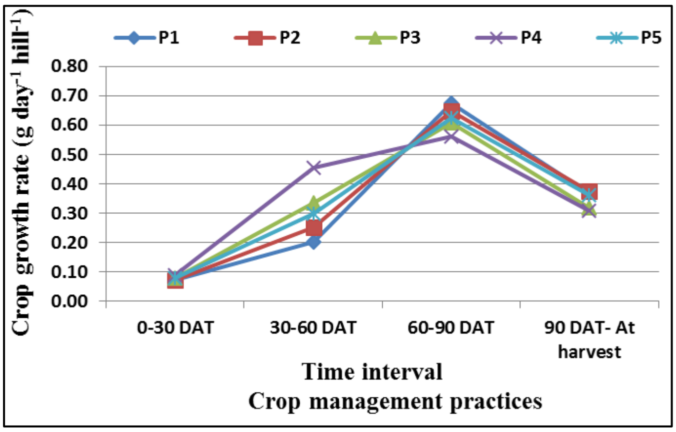

Fig 2: Crop growth rate (g day^{-1} $hill^{-1}$) of rice as influenced by crop management practices at different time interval.

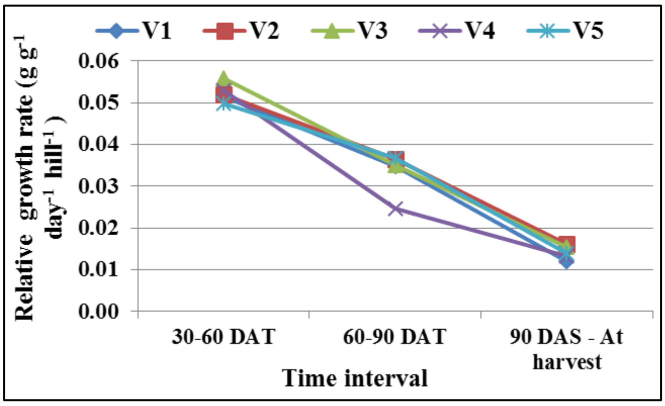

Fig 3: Relative growth rate (g g^{-1} day^{-1} $hill^{-1}$) of rice as influenced by various quality rice cultivars at different time interval

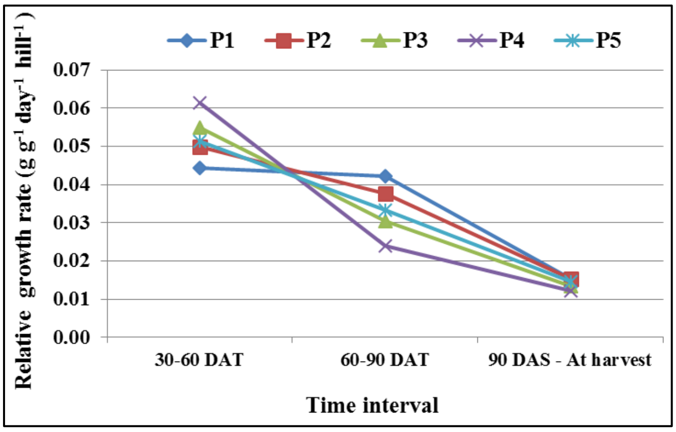

Fig 4: Relative growth rate (g g^{-1} day^{-1} $hill^{-1}$) of rice as influenced by various crop management practices at different time interval.

Conclusion
The finding of studies conducted on "Influence of crop management practices on growth and yield of quality rice cultivars " clearly visualized that Trombay Raipur Rice -106 gave better growth performance under different crop management practices followed by Trombay CG Dubraj mutant-1.

Among the crop management practices for quality rice cultivars, significantly higher growth was obtained under 15x10 cm spacing + 150% RDF through inorganic and organic sources, followed by 20x10 cm spacing + 150% RDF through inorganic and organic sources.

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