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Periodic Research

Effects of Constraints of Various Input Resources on Growth and Yield of Kharif Rice Under Conditions of Konkan Region

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Abstract

A field experiment was conducted during the *Kharif* season of 2013 to study the effect of constraints of various input resources on growth and yield of rice at Agronomy Farm, College of Agriculture, *Dapoli*, Dist. *Ratnagiri* (M.S.). The soil of the experimental field was sandy clay loam in texture and acidic in reaction, low in available nitrogen, medium in available phosphorus, available potassium and organic carbon. The experiment was laid out in randomized block design consisting eight treatments *viz*., T_1: Full recommended package (FRP), T_2: FRP – Fertilizer (Fert.), T_3: FRP – Plant protection (PP), T_4: FRP – Weed management (WM), T_5: FRP – (Fert. + PP), T_6: FRP – (Fert. + WM), T_7: FRP – (PP + WM), T_8: FRP – (Fert. + PP + WM) and replicated three times. Results revealed that the full recommended package (T_1) was found to be better in terms of growth character, yield attributes and yield over all other treatments. Among various input resource constraints full recommended package (T_1) recorded significantly highest grain (45.18 q ha^{-1}) and straw (55.26 q ha^{-1}) yield over all other treatments, except treatment T_4.Among the three major inputs, skipping plant protection measures from full recommend package had caused maximum reduction in grain yield (26.56%), followed by excluding manures and fertilizer (17.55%) from full recommended package.

Keywords: Rice fertilizers, plant protection, weed management, growth characters, yield attributes and yield.

Introduction

Rice (*Oryza sativa* L.) is important staple food grain crop of more than 60 per cent of the world's population. It is also a staple food grain crop of more than 65 per cent of the Indian population. It contributes about 52 per cent of total food grain production and 55 per cent of total cereal production. In the world, rice is cultivated on about 159.4 million hectares of area with total production of 696.3 million tonnes and productivity is 3.7 tonnes ha^{-1}. (Anonymous, 2012).India is the world's second largest rice producer and consumer next to China. In India, rice occupies an area of 42.56 million hectares with production of 95.33 million tonnes and productivity is 2.2 tonnes ha^{-1}(Anonymous, 2011).

Among various Agronomic inputs, manures and fertilizers, weed management at right time and plant protection measures are the most important factors, which play major role in rice production. Judicious use of manures and fertilizers is one of the important strategies for increasing production of rice per unit area. The use of fertilizers is one of the most potent factor in increasing yield of rice. Weed is another important factor responsible for reduction in crop yield. The weeds compete with crops for one or more plant growth factors such as mineral nutrients, water, solar energy and space as well as they limits the crop cultivation operations. Incidence of serious insects pests and diseases is another important factor responsible for the low yield of rice. In *Konkan* region of Maharashtra state, rice is commonly grown by transplanting method. Rice cultivation has major constraints related to higher cost of inputs in relation to total cost and net returns and timely availability of these inputs. In general due to poor economic condition of the rice farmers, they are unable to purchase these costly inputs. It is therefore not possible for the farmers to apply all these inputs at right time and in optimum quantity. Therefore, it is necessary to study the comparative effects of these inputs on rice production and to identify the most critical inputs, which play major role in increasing rice

production. Once the most critical inputs are identified, the farmers having poor economic condition can be suggested to give more attention towards the management of these critical inputs.

Materials and Methods

The present investigation "Effects of constraints of various input resources on performance of *kharif* rice under conditions of *Konkan* region" was conducted at Agronomy farm, College of Agriculture, *Dapoli*, Dist. *Ratnagiri* (M.S.) during *Kharif* season of 2013. The soil of the experimental plot was sandy clay loam in texture, acidic in pH (5.5) and medium in organic carbon (0.81%) content. It was low in available nitrogen (235.98 kg/ha), medium in available phosphorus (14.02 kg/ha) and available potassium (166.89 kg/ha). The experiment was laid out in randomized block design consisting eight treatments *viz*., T_1: Full recommended package (FRP), T_2: FRP – Fertilizer (Fert.), T_3: FRP – Plant protection (PP), T_4: FRP – Weed management (WM), T_5: FRP – (Fert. + PP), T_6: FRP – (Fert. + WM), T_7: FRP – (PP + WM), T_8: FRP – (Fert. + PP + WM) and replicated three times.

The experimental plot was ploughed twice with the help of tractor drawn plough and clod crushing was done by tractor drawn rotavator. It was thoroughly puddled by tractor drawn puddler and made ready for transplanting. Manures and fertilizers were applied as per treatments. Then 23 days old seedlings were transplanted. Gap filling was done eight days after transplanting to maintain uniform plant population. Herbicide i.e. *Oxadiargyl*, 6 % EC, was sprayed as pre-emergence herbicide @ 0.120 kg a. i. ha^{-1} followed by two hand weeding at 30 and 60 DAT were given as per treatment. Severe infestation of blue beetle was observed on experimental crop. Total two sprays of insecticides as per treatment were taken to control the attack of blue beetle. First spray of *profenophos* 50 EC at the rate of 22.5 ml per 10 liter of water and second spray of *cypermethrine* 25 EC at the rate of 3 ml per 10 liter of water was undertaken at 30 and 45 DAT respectively. No any disease infestation was observed. The experimental crop was harvested when 90 per cent of the grains in panicles were ripened and straw turned yellow.

For recording biometric observations, five hills from each net plot were randomly selected. Height of plant measured from the ground level to base of panicle and average height $hill^{-1}$was worked out. The total number of tillers $hill^{-1}$, total number of functional leaves produced $hill^{-1}$was recorded from five hills and average of five hills was recorded. A single hill was randomly sampled from each plot for dry matter production. The number of panicles in $0.90m^2$area from net plot of each treatment was counted and converted for one meter square area. Length of ten panicles from each net plot was measured from the base of whorl i.e. peduncle up to the tip of the panicle and average length of panicle was worked out. The number of filled grains, unfilled grains and weight of grains $panicle^{-1}$was recorded from ten panicles selected for measuring length from each net plot and average number of filled grains, unfilled grains and weight of grains $panicle^{-1}$ was worked out. A representative sample of grains was taken from the total produce of each net plot and 1000 grains were counted and weight was recorded as per the treatments. The grain yield obtained after threshing the produce from each net plot was sun dried for about 5 days and weight was recorded and then converted in hectare basis. The straw yield was obtained by weighing sun dried straw which remained after threshing from each net plot. The figures were then converted in hectare basis.The plot wise grain and straw yield were summed up to get the total biological yield per net plot. This was converted on hectare basis.

Result and Discussion

Rice crop grown by adopting full recommended package shown significantly more values of all growth characters. Significantly more plant height (71.83 cm), number of functional leaves (4.82) $hill^{-1}$, number of tillers (13) $hill^{-1}$ and dry matter production (24.33 g) $hill^{-1}$ was recorded in treatment of full recommended package over all other treatments under study. This increase in growth characters was might be due to application of recommended manures and fertilizers to the crop at different growth stages, timely weed control reduced the competition of weeds with rice crop for nutrients, sunlight and space, and timely control of pests throughout the growth period of the crop. These results are in agreement with the results reported by Balsubramaniyan (1984), Deshmukh *et al.* (1988), Hari Prasad (1993) and Singh *et al.* (1989).

Treatments	Growth Characters			
	Plant height (cm)	Number of functional leaves $hill^{-1}$	Number of tillers $hill^{-1}$	Dry matter $hill^{-1}$(g)
T_1 – Full recommended package	71.83	4.82	13.00	24.33
T_2 – FRP – Fertilizer (Fert.)	62.81	3.59	11.07	23.33
T_3 – FRP –Plant Protection (PP)	57.26	3.40	9.20	22.33
T_4 – FRP – Weed Management (WM)	66.85	4.30	12.37	24.00
T_5 – FRP – (Fert. + PP)	47.30	2.45	8.00	19.67
T_6 – FRP – (Fert. + WM)	54.50	3.48	8.17	18.67
T_7 – FRP – (PP + WM)	50.84	2.90	8.27	18.33
T_8 – FRP – (Fert. + PP + WM)	44.81	2.22	7.23	17.33
S.Em±	0.88	0.33	0.21	0.56
C.D at 5%	2.67	0.99	0.64	1.69

General Mean	**57.02**	**3.39**	**9.53**	**21**

Table1. Effect of Different Treatments on Growth Characters of Rice at Harvest.

Higher values of yield attributes *viz.*, number of panicles m^{-2}(439.58) , length of panicle (23.29 cm), number of filled grains $panicle^{-1}$ (136.35), weight of filled grains $panicle^{-1}$ (1.87) and test weight (16.09) were recorded in case of the treatment of full recommended package. The increased yield attributes might be due to increased growth and development parameters which ultimately resulted in increased yield. These findings are close conformity with those Hari Prasad (1993) and Singh et al. (1989).

Table 2. Yield Attributes as Influenced By Different Treatments

Treatments	Yield Attributes					
	No. of panicles m^{-2}	**Length of panicle**	**No. of filled grains $panicle^{-1}$**	**No. of unfilled grains $panicle^{-1}$**	**Weight of filled grains $panicle^{-1}$**	**Test weight (g)**
T_1 – Full recommended package	439.58	23.29	136.35	40.13	1.87	16.09
T_2 – FRP – Fertilizer (Fert.)	365.96	20.08	109.34	43.83	1.27	15.87
T_3 –FRP – Plant Protection (PP)	303.05	19.57	103.73	52.17	1.23	15.50
T_4 – FRP – Weed Management (WM)	367.03	21.38	129.39	41.00	1.60	15.97
T_5 – FRP – (Fert. + PP)	269.40	18.23	60.46	61.70	0.87	15.75
T_6 – FRP – (Fert. + WM)	264.12	19.54	79.49	47.07	1.10	15.30
T_7 – FRP – (PP + WM)	272.28	21.05	81.36	58.83	1.37	15.15
T_8 – FRP – (Fert. + PP + WM)	238.03	17.56	58.67	63.33	0.77	14.90
Range	238.03-439.58	17.56-23.29	58.67-136.35	40.13-63.33	0.77-1.87	14.9-16.09
S.Em±	9.97	0.69	6.45	5.25	0.16	0.26
C.D at 5%	30.23	2.10	19.55	15.92	0.48	N. S.
General Mean	**314.93**	**20.09**	**94.85**	**51.01**	**1.26**	**15.57**

Significantly highest values of grains(45.18 q ha^{-1}) , straw (55.26 q ha^{-1}) and total biological yield (100.43 q ha^{-1}) were recorded due to the treatment T_1, where full recommended package was given to the crop followed by the treatment T_4. The increase in grain, straw and biological yield was due to increase in growth characters like plant height, number of functional leaves $hill^{-1}$ and dry matter accumulation $hill^{-1}$ due to recommended package of practices given to the crop. The better plant growth and improved yield attributes finally led to higher grains and straw yields. These results confirm the findings of Rajkumar *et al*. (1991) and Sujathamma and Srinivasulu (2004).The maximum reduction in grain (49.09%) and straw yield (53.16%) over full recommended package was observed in case of the treatment T_8, where no any recommended package was followed. From the data presented in Table 3 it is clearly seen that among the three important aspects *viz*., manures and fertilizers, plant protection and weed management, plant protection aspect was the major factor responsible drastic reduction in grain (26.56%) and straw yield (31.37%) followed by manures and fertilizers. In the present investigation weed management aspect caused least reduction in gain (9.14 %) and straw (4.84%) yield of rice. In the present investigation weed management aspect caused least reduction in yield of rice mainly because of the fact that puddling operation before transplanting destroy weeds more effectively. Moreover, weeds emergence during post transplanting period is generally reduced due to water stagnation in the field.

Table 3.
Grain yield q ha^{-1}, straw yield q $ha^{-1}$and biological yield q ha^{-1}, of rice as influenced by different treatments

Treatments	Grain yield (q ha^{-1})	%reduction in grain yield over T_1	Straw yield (q ha^{-1})	% reduction in straw yield over T_1	Total biological yield(q ha^{-1})
T_1 – Full recommended package	45.18	-	55.26	-	100.43
T_2 – FRP – Fertilizer (Fert.)	37.25	17.55	38.92	29.56	76.17
T_3 –FRP – Plant Protection (PP)	33.18	26.56	37.92	31.37	71.10
T_4 – FRP – Weed Management (WM)	41.05	9.14	52.58	4.84	93.63
T_5 – FRP – (Fert. + PP)	23.78	47.36	28.95	47.61	52.73
T_6 – FRP – (Fert. + WM)	25.53	43.49	32.50	41.18	58.03
T_7 – FRP – (PP + WM)	27.45	39.24	35.94	34.96	63.39
T_8 – FRP – (Fert. + PP + WM)	23.00	49.09	25.88	53.16	48.88
S.Em±	1.19		4.45		4.92
C.D at 5%	3.62		13.49		14.93
General Mean	**32.05**		**38.49**		**70.55**

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