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Effects of Constraints of Various Input Resources on Nutrient Uptake and Economics of Rice

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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 reveals that the full recommended package (T_1) was found to be better in terms yield, nutrient uptake and economics 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. Also treatment full recommended package (T_1) recorded significantly more N, P and K contents in grains and straw, uptake of N, P and K by grain and straw and total N, P and K uptake by the rice crop than the other treatments, except treatments T_3, T_7 and T_4. From the economic point of view, gross returns (Rs. 67522.17 ha^{-1}), net returns (Rs. 7773.49 ha^{-1}), and B: C ratio (1.13) were higher under treatment full recommended package (T_1) over rest of the treatments, except treatment T_4.*

Keywords: *Fertilizer, Nutrient uptake and economics.*

INTRODUCTION

Rice (*Oryza sativa* L.) is important staple food grain crop of more than 60 per cent of the worlds 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. The Asia-Pacific region produces and consumes more than 90 per cent of the worlds rice. Poor people spend up to half of their income on rice alone and in many cases, receive more than half of their calories from rice. Therefore rice is not only a staple food but also a way of life.

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 worlds 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). In Maharashtra, the total area occupied by this crop is about 14.87 lakh hectares with annual production of 26.01 lakh tonnes and productivity is about 1.74 tonnes ha^{-1} (Anonymous, 2010-11). In *Konkan* region of Maharashtra state, rice occupies an area of 4.12 lakh hectares with production 9.82 lakh tonnes and productivity is 2.38 tonnes ha^{-1} (Anonymous, 2010-11).

Among various Agronomic inputs, manures and fertilizers, weed management at right time and plant protection measures are the most important

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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.

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), medium in available phosphorus (14.02) and available potassium (166.89). 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 for transplanting. After layout of the experimental plot, the F.Y.M. at the rate of 7.5 tonnes ha^{-1}, basal dose of 40 per cent nitrogen and full dose of phosphorus and potassium was applied as per the treatments and thoroughly mixed in the puddled field. Remaining 40 per cent nitrogen was given at maximum tillering stage (30 DAT) and 20 per cent nitrogen was at flowering stage (60 DAT) as per the treatments. Twenty three days old seedlings were transplanted on 13th July, 2013 at 20 × 15 cm spacing. 2-3 seedlings $hill^{-1}$ were transplanted at a depth of 2-3 cm. The experimental crop was harvested when 90 per cent of the grains in panicles were ripened and straw turned yellow.

Before transplanting, the initial soil samples were collected from experimental plot, air dried and properly sieved. Soil analysis for chemical properties was done by appropriate methods. After harvesting of crop, soil samples were collected from each net plot, air dried and properly sieved. Soil analysis for available nitrogen, phosphorus and potash was done by appropriate methods. Treatment wise grain and plant sample from each net plot was taken to know the pattern of nitrogen, phosphorus and potassium content in grain and straw and to study uptake of these nutrients by rice crop. The dried samples of grain and straw were powdered (100 mesh) separately and about 20gm of representative samples from each treatment was stored in a brown paper bag, properly labeled and used for estimation of nitrogen, phosphorus and potassium content. From the respective per cent figure, nitrogen, phosphorus and potassium accumulation in grain and straw was calculated by multiplying the grain and straw yield per hectare. The cost of production was worked out by considering the existing rates of inputs used and actual cultivation charges incurred. Cost of cultivation of crop under individual treatment was worked out. The net profit or loss and cost benefit ratio (B:C) was worked out.

RESULT AND DISCUSSION

The recommended package (T_1) recorded significantly more N, P and K contents in grains and straw, uptake of N, P and K by grain and straw and total N, P and K uptake by the rice crop than the other treatments, except treatments T_3, T_7 and T_4.

The increased N, P and K contents in grains

Table 1
Nitrogen content (%), nitrogen uptake (kg ha^{-1}) in grain and straw of rice and total uptake of nitrogen (kg ha^{-1}) as influenced by different treatments.

Treatments	*N content in grain (%)*	*N content in straw (%)*	*N uptake in grain (Kg ha^{-1})*	*N uptake in straw (Kg ha^{-1})*	*Total uptake of N (Kg ha^{-1})*
T_1 – Full recommended package	1.500	1.073	67.93	59.66	127.597
T_2 – FRP – Fertilizer (Fert.)	1.167	0.873	43.21	34.02	77.235
T_3 – FRP – Plant Protection (PP)	1.400	1.033	46.37	39.42	85.787
T_4 – FRP – Weed Management (WM)	1.343	1.000	55.21	52.58	107.798
T_5 – FRP – (Fert. + PP)	1.100	0.843	26.28	24.38	50.659
T_6 – FRP – (Fert. + WM)	1.167	0.833	29.57	27.09	56.657
T_7 – FRP – (PP + WM)	1.353	1.067	37.21	38.04	75.258
T_8 – FRP – (Fert. + PP + WM)	1.033	0.800	23.77	20.72	44.486
Range	1.033-1.500	0.800-1.073	23.77-67.93	20.72-59.66	44.486-127.597
S.Em±	0.08	0.06	3.03	5.47	7.08
C.D at 5%	0.24	0.17	9.20	16.58	21.48
General Mean	1.26	0.94	41.19	36.99	78.18

Table 2
Phosphorus content (%),Phosphorus uptake (kg ha^{-1}) in grain and straw of rice and total uptake of Phosphorus (kg ha^{-1}) as influenced by different treatments.

Treatments	*P content in grain (%)*	*P content in straw (%)*	*P uptake in grain (Kg ha^{-1})*	*P uptake in straw (Kg ha^{-1})*	*Total uptake of P (Kg ha^{-1})*
T_1 – Full recommended package	0.227	0.160	10.31	8.84	19.15
T_2 – FRP – Fertilizer (Fert.)	0.117	0.077	4.34	2.98	7.32
T_3 –FRP – Plant Protection (PP)	0.223	0.157	7.34	5.98	13.32
T_4 – FRP – Weed Management (WM)	0.177	0.150	7.27	7.89	15.16
T_5 – FRP – (Fert. + PP)	0.110	0.070	2.62	1.94	4.56
T_6 – FRP – (Fert. + WM)	0.107	0.067	2.64	2.16	4.80
T_7 – FRP – (PP + WM)	0.180	0.147	4.99	5.38	10.36
T_8 – FRP – (Fert. + PP + WM)	0.100	0.060	2.30	1.53	3.83
Range	0.100-0.227	0.060-0.160	2.30-10.31	1.53-8.84	3.83-19.15
S.Em±	0.02	0.01	0.67	0.72	0.54
C.D at 5%	0.05	0.02	0.02	2.17	1.65
General Mean	0.16	0.11	5.23	4.59	9.81

and straw, nutrient uptake in grains and straw and total uptake by crop might be due to application recommended dose of manures and fertilizers and weed management. Due to this, there was a least competition of weeds for nutrients. These results are similar to with those of Pandey and Thakur (1988), Nanjappa and Krishnamurthy (1980), Rao and Singh (1993) and Shanmugasundaram *et al.* (2002) in case of weed management, while in case of fertilizer management similar results were found by Prasad and Jha (1973), RabeyaKhanam *et al.* (1997) and Jadhav *et al.* (1997).

Economics

Regarding economics of the treatments, full recommended package (T_1) resulted in significantly maximum, gross returns (Rs. 67522.17 ha^{-1}) , net returns (Rs. 7773.49 ha^{-1}) , and B:C ratio (1.13), over

Table 3
Potassium content (%), Potassium uptake (kg ha^{-1}) in grain and straw of rice and total uptake of Potassium (kg ha^{-1}) as influenced by different treatments.

Treatments	*K content in grain (%)*	*K content in straw (%)*	*K uptake in grain (Kg ha^{-1})*	*K uptake in straw (Kg ha^{-1})*	*Total uptake of K (Kg ha^{-1})*
T_1 – Full recommended package	0.407	1.460	18.29	79.93	98.22
T_2 – FRP – Fertilizer (Fert.)	0.270	1.270	10.07	49.44	59.51
T_3 – FRP – Plant Protection (PP)	0.383	1.447	12.79	55.30	68.10
T_4 – FRP – Weed Management (WM)	0.350	1.437	14.35	75.51	89.86
T_5 – FRP – (Fert. + PP)	0.243	1.287	5.78	36.97	42.75
T_6 – FRP – (Fert. + WM)	0.220	1.280	5.62	41.60	47.22
T_7 – FRP – (PP + WM)	0.360	1.433	9.90	51.63	61.53
T_8 – FRP – (Fert. + PP + WM)	0.217	1.267	4.97	32.71	37.69
Range	0.217-0.407	1.267-1.460	4.97-18.29	32.71-79.93	37.69-98.22
S.Em±	0.02	0.02	0.83	6.03	5.98
C.D at 5%	0.06	0.05	2.51	18.30	18.14
General Mean	0.31	1.36	10.22	52.89	63.11

Table 4
Economics of rice as influenced by different treatments

Treatments	*Gross returns (Rs. ha^{-1})*	*Cost of cultivation (Rs. ha^{-1})*	*Net returns (Rs. ha^{-1})*	*B:C ratio*
T_1 – Full recommended package	67522.17	59748.68	7773.49	1.13
T_2 – FRP – Fertilizer (Fert.)	54350.00	51730.16	2619.84	1.05
T_3 –FRP – Plant Protection (PP)	49062.50	51703.70	–2641.20	0.95
T_4 – FRP – Weed Management (WM)	61829.17	56169.31	5659.85	1.10
T_5 – FRP – (Fert. + PP)	35519.17	39176.72	–3657.55	0.91
T_6 – FRP – (Fert. + WM)	38409.00	41256.61	–2847.61	0.93
T_7 – FRP – (PP + WM)	41504.67	48066.14	–6561.47	0.86
T_8 – FRP – (Fert. + PP + WM)	33925.33	35862.43	–1937.10	0.95
S.Em±	1943.72	333.92	1610.53	–
C.D at 5%	5895.65	1012.85	4885.03	–
General Mean	47765.25	47964.22	–198.97	0.98

rest of the treatments, except treatment T_4, which were similar with each other. These increased gross returns, net returns and B:C ratio were mainly due to increased grain and straw yield under full recommended package of practices over all other treatments. These results are similar with those ofGawade (1998), Sahoo and Mahapatra (2004) and Jose *et al.* (1991) in case of fertilizer application, Lamkane*et al.* (2002) and Mane *et al.* (2002) in case of weed management and Bhattacharjee and Ray (2012) in case of plant protection.

References:

Anonymous (2012), World Area, Production, Productivity.

Anonymous (2010), Crop wise, District wise Area, Production and Productivity, Department of Agriculture, Government of Maharashtra.

Anonymous (2011), Agricultural Statistics at a Glance 2011. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

Bhattachrjee, P.P. and Ray, D.C. (2012), Bioefficacy of insecticides against rice hispa, *Dicladispaarmigera* (Olivier) (Coleoptera: Chrysomeloidea) on paddy. *J. Ent. Res.* 36(2): 151-155.

Gawade, D.G. (1998), Response of sweet corn (Zea mays L. saccharata) to nutrient management.M.Sc. (Agri.) Thesis, Dr. BalasahebSawant Konkan Krishividyapeeth, Dapoli, Dist. Ratnagiri (M.S.).

Jadhav, A.D., Talashilkar, S.C. and Powar, A.G. (1997), Influence of the conjunctive use of FYM, vermicompost and urea on growth and nutrient uptake in rice. *Journal of Maharastra Agriculture University.* 22(2): 249-250.

Jose, B.K., Pearson, A.J. and Spiers, T.M. (1991), Crop uptake of phosphorus from soil amendments with chicken manure and green waste compost in sweet corn (*Zea mays* L. *saccharata*). Proc. Ann. Conference, Agronomy Society of New Zealand. 28: 31-34.

Lamkane, M.V., Murudkar, U. and Murudkar, R.D. (2002), Weed management in transplanted rice. A paper presented in State Level Seminar on *integrated weed management in new millennium,* Abstract of the paper. pp. 14.

Mane, M.J., Murudkar, R.D., Khadase, R.R., Shinde, P.P., Patil, R.A. and More, V.G. (2002), Effect of weed control measures and plant population on transplanted rice. A paper presented in State Level Seminar on *integrated weed management in new millennium,* Abstract of the paper. pp. 13.

Nanjappa, H.V. and Krishnamurthy, S. (1980), Nutrient losses due to weed competition in Tall and Dwarf varieties of rice.*Indian J. Agron*. 25(2): 273-278.

Pandey, J. and Thakur, K.N. (1988), Effect of herbicides and nitrogen on nutrient removal by weeds in transplanted rice.*Indian J. Agron*. 33(4): 350-363.

Prasad, B. and Jha, J. (1973), Effect of different level of nitrogen on the uptake of N, P and K by rice (TN-1).*The Indian Journal of Agronomy.* 18(3): 357-361.

Rabeya K., Sahu, S.K. and Mitra, G.N. (1997), Yield maximization through integrated Nutrient Management on AericUstochrept. *Journal of the Indian Society of Soil Science.* 45(2): 396-397.

Rao, A.S. and Singh, R.P. (1993), Effect of herbicide mixture and their sequential applications on nutrient uptake by rice (Oryza sativa L.) and associated weeds.Oryza. 31: 115-118.

Sahoo, S.C. and Mahapatra, P.K. (2004), Response of sweet corn (*Zea mays* L.) to nitrogen levels and plant population.*Ind. J. Agric. Sci*. 74(6): 337-338.

Shanmugasundaram, R., Kundasamy, O. S. and Chitdeshwari, T. (2002), Effect of nitrogen sources and weed control methods on soil physiochemical properties and nutrient uptake by rice.