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Effects of Constraints of Various Input Resources on Weed Density 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 performance of kharif rice under conditions of Konkan region" at Agronomy Farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.). 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 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. At 60 DAT and at harvest, treatment T_4 recorded significantly more number of grasses, sedges and broad leaf weeds than rest of the treatments, except treatments T_7 and T_8. At 60 DAT significantly more dry weight of grasses, sedges, broad leaf weeds and total weeds was recorded due to the treatment T_4 over rest of the treatments, except treatments T_7, T_8 and T_6. At harvest significantly more dry weight of grasses and sedges was recorded due to the treatment T_4 over rest of the treatments, except treatments T_8 and T_7 which remained statistically at par with each other. 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.*

Key words: *Kharif rice, Weed density 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).

Weed is most important factor responsible for reduction in crop yield. The weeds compete with

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crops for one or more plant growth factors such as mineral nutrients, water, solar energy and space as well as they limit the crop cultivation operations. Due to these reason weed management is an important factor in obtaining higher crop yield. As weeds are silent, malignant and massive forces, which reduce yield drastically. Though manual weeding is considered to be the best, the availability of labours and increased wages are the constraints. It is also time consuming and uneconomical. This phenomenon in recent past warrants the use of herbicides to achieve timely and effective weed control. The extent of yield reduction in transplanted rice due to weed infestation was reported to be 15-20 per cent where as in case of directly seeded rice it was 50-60 per cent under Indian conditions.

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. Different weed species of grasses, sedge and broad leaf weeds observed in a 0.25 m^2 area was counted at 60 DAT and at harvest. After taking weed count, the weed from each net plot were uprooted and grouped as grasses, sedges and broad leaf weeds and its roots were removed. The aerial part were chopped and put in a brown paper bag. Then it was dried in thermostatically controlled oven at a temperature of 60 ^{0}C till constant weight was obtained. Twenty three days old seedlings were transplanted on 13th July, 2013 at 20 x 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.

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

Significantly more number of grasses, sedges and broad leaf weeds were recorded in case of the treatment T_4 than rest of the treatments, except treatments T_7 and T_8 which remained at par with each other both at 60 DAT and at harvest. On the other hand, the treatment of full recommended package (T_1) recorded significantly least weed population than remaining treatments and it was followed by treatments T_2 and T_3. The increased weed density in T_4 treatment might be due to addition of manures and fertilizers and skipping of weed management aspect. These results are similar with those of Nandal and Singh (1993) and Halder and Patra (2005).

Table 1
Mean number of grasses, sedges and broad leaf weeds per 0.25 m² area at 60 DAT as influenced by various treatments

Treatments	*Grasses*	*Sedges*	*Broad leaf*	*Total*
T_1 – Full recommended package	0.67 (1.17)	0.33 (1.17)	1.00 (1.30)	2.00 (3.64)
T_2 – FRP – Fertilizer (Fert.)	1.00 (1.30)	1.33 (1.64)	2.00 (1.83)	4.33 (4.77)
T_3 –FRP – Plant Protection (PP)	1.00 (1.50)	1.00 (1.30)	1.33 (1.44)	3.33 (4.24)
T_4 – FRP – Weed Management (WM)	11.6 (3.65)	6.67 (3.07)	11.00 (3.63)	29.33(10.35)
T_5 – FRP – (Fert. + PP)	1.33 (1.91)	1.67 (1.77)	5.00 (2.73)	8.00 (6.41)
T_6 – FRP – (Fert. + WM)	4.67 (2.65)	4.67 (2.65)	6.00 (2.94)	15.33 (8.24)
T_7 – FRP – (PP + WM)	11.33 (3.65)	6.00 (2.85)	10.33 (3.35)	27.67 (9.85)
T_8 – FRP – (Fert. + PP + WM)	9.00 (3.31)	5.00 (2.65)	7.33 (3.20)	21.33 (9.16)
Range	0.67-11.67 (1.17-3.65)	0.33-6.67 (1.17-3.07)	1.00-11.00 (1.30-11.00)	2.00-29.33 (3.64-10.35)
S.Em±	1.85 (0.25)	0.92 (0.30)	0.95 (0.27)	1.59 (0.32)
C.D at 5%	5.6 (0.77)	2.78 (0.91)	2.88 (0.83)	4.82 (0.98)
General Mean	5.08 (2.39)	3.33 (2.14)	5.50 (2.55)	13.92 (7.08)

Note: Figures in parenthesis denotes values of square root transformation

Table 2
Mean number of grasses, sedges and broad leaf weeds per 0.25 m² area at harvest as influenced by various treatments

Treatments	*Grasses*	*Sedges*	*Broad leaf*	*Total*
T_1 – Full recommended package	1.00 (1.30)	0.67 (1.17)	1.33 (1.64)	3.00 (4.11)
T_2 – FRP – Fertilizer (Fert.)	3.00 (2.23)	2.67 (2.12)	2.67 (2.12)	8.33 (6.48)
T_3 –FRP – Plant Protection (PP)	2.67 (2.12)	2.33 (1.74)	2.33 (1.99)	7.33 (5.85)
T_4 – FRP – Weed Management (WM)	11.67 (3.57)	5.33 (2.79)	9.33 (3.55)	26.33 (9.90)
T_5 – FRP – (Fert. + PP)	4.33 (2.58)	3.00 (2.23)	4.00 (2.49)	11.33 (7.29)
T_6 – FRP – (Fert. + WM)	5.67 (2.87)	3.33 (2.29)	6.33 (3.00)	15.33 (8.16)
T_7 – FRP – (PP + WM)	10.33 (3.50)	4.33 (4.49)	7.00 (3.13)	21.67 (9.12)
T_8 – FRP – (Fert. + PP + WM)	8.33 (3.20)	3.67 (2.41)	6.67 (3.06)	18.67 (8.67)
Range	1-11.67 (1.30-3.57)	0.67-5.33 (1.17-2.79)	1.33-9.33 (1.64-3.55)	3-26.33 (4.11-9.90)
S.Em±	1.18 (0.19)	0.95 (0.33)	0.67 (0.16)	1.95 (0.48)
C.D at 5%	3.56 (0.56)	2.89 (1.01)	2.04 (0.49)	5.91 (1.46)
General Mean	**5.88 (2.67)**	**3.17 (2.16)**	**4.96 (2.62)**	**14.00 (7.45)**

Note: Figures in parenthesis denotes values of square root transformation

Significantly more dry weight of grasses, sedges and broad leaf weeds was recorded in case of the treatment T_4 over rest of the treatments, except treatments T_8, T_7 and T_6 which remained at par with each other both at 60 DAT and at harvest. On the other hand, the treatment of full recommended package (T_1) recorded significantly least weed dry matter than remaining treatments and it was followed by treatments T_2 and T_3. The increased weed dry matter in case of the treatment T_4 might be due to vigorous growth of weeds, due to addition of manures and fertilizers. These result are similar to those of Halder and Patra (2005).

Economics: Regarding economics of the treatments, full recommended package (T_1) resulted in significantly maximum , gross returns (Rs.

Table 3
Mean dry weight (g) of grasses, sedges and broad leaf weeds per 0.25 m^2 area at 60 DAT as influenced by various treatments

Treatments	*Grasses*	*Sedges*	*Broad leaf*	*Total*
T_1 – Full recommended package	0.29 (1.01)	0.22 (0.96)	0.40 (1.01)	0.91 (2.98)
T_2 – FRP – Fertilizer (Fert.)	0.59 (1.21)	0.48 (1.15)	0.43 (1.15)	1.50 (3.50)
T_3 –FRP – Plant Protection (PP)	0.54 (1.20)	0.45 (1.14)	0.41 (1.12)	1.41 (3.46)
T_4 – FRP – Weed Management (WM)	1.70 (1.80)	1.37 (1.67)	1.74 (1.80)	4.81 (5.26)
T_5 – FRP – (Fert. + PP)	0.77 (1.37)	0.64 (1.28)	1.20 (1.59)	2.61 (4.23)
T_6 – FRP – (Fert. + WM)	1.27 (1.62)	1.10 (1.54)	1.22 (1.60)	3.58 (4.76)
T_7 – FRP – (PP + WM)	1.47 (1.70)	1.21 (1.59)	1.29 (1.62)	3.97 (4.91)
T_8 – FRP – (Fert. + PP + WM)	1.40 (1.67)	1.17 (1.58)	1.29 (1.62)	3.85 (4.87)
Range	0.29-1.70 (1.01-1.80)	0.22-1.37 (0.96-1.67)	0.40-1.74 (1.01-1.80)	0.91-4.81 (2.98-5.26)
S.Em±	0.21 (0.13)	0.14 (0.10)	0.19 (0.12)	0.33 (0.21)
C.D at 5%	0.64 (0.38)	0.43 (0.31)	0.58 (0.37)	1.01 (0.63)
General Mean	1.00 (1.45)	0.82 (1.36)	1.00 (1.44)	2.82 (4.25)

Note: Figures in parenthesis denotes values of square root transformation

Table 4
Mean dry weight (g) of grasses, sedges and broad leaf weeds per 0.25 m^2 area at harvest as influenced by various treatments

Treatments	*Grasses*	*Sedges*	*Broad leaf*	*Total*
T_1 – Full recommended package	0.58 (1.23)	0.50 (1.20)	0.76 (1.36)	1.85 (3.79)
T_2 – FRP – Fertilizer (Fert.)	0.99 (1.49)	0.89 (1.42)	0.80 (1.38)	2.67 (4.29)
T_3 –FRP – Plant Protection (PP)	0.97 (1.47)	0.66 (1.25)	0.79 (1.37)	2.42 (4.10)
T_4 – FRP – Weed Management (WM)	2.78 (2.16)	2.18 (1.96)	2.58 (2.30)	7.55 (6.22)
T_5 – FRP – (Fert. + PP)	1.12 (1.55)	0.95 (1.46)	0.86 (1.42)	2.94 (4.44)
T_6 – FRP – (Fert. + WM)	1.91 (1.87)	1.54 (1.74)	1.82 (1.85)	5.28 (5.45)
T_7 – FRP – (PP + WM)	2.27 (1.99)	1.91 (1.86)	2.17 (2.10)	6.35 (6.15)
T_8 – FRP – (Fert. + PP + WM)	2.14 (1.95)	1.69 (1.80)	1.86 (1.84)	5.69 (5.59)
Range	0.58-2.78 (1.23-2.16)	0.50-2.18 (1.20-1.96)	0.76-2.58 (1.36-2.10)	1.85-7.55 (3.79-6.22)
S.Em±	0.22 (0.09)	0.21 (0.10)	0.19 (0.13)	0.35 (0.20)
C.D at 5%	0.67 (0.28)	0.64 (0.31)	0.57 (0.40)	1.06 (0.62)
General Mean	1.59 (1.71)	1.29 (1.59)	1.46 (1.70)	4.34 (5.00)

Note: Figures in parenthesis denotes values of square root transformation

67522.17 ha^{-1}) , net returns (Rs. 7773.49 ha^{-1}) , and B: C ratio (1.13), over 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 of Gawade (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.

Table 5
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

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