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Effects of Constraints of Various Input Resources on Pest Infestation 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 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. The per cent infestation of blue beetle was significantly higher in case of treatment T_8 over rest of the treatments,except treatment T_7, T_5 and T_3, 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.*

Keywords: *Pest infestation, Blue beetle 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).

Incidence of serious insects, pests and diseases is important factor responsible for the low yield of rice. Pests like gall midge, stem borer, brown plant hopper, rice hispa, blue beetle and army worm are of major significance limiting rice production. Nath

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and Dutta (2002) reported that highest yield loss by rice hispa (27.65%) was observed in completely unprotected plots and no yield loss in completely protected plots. Yield losses ranges from 21 to 51% due to insect pests.

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. Infestation of blue beetle was observed on experimental crop. Total two spray 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. 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.

To workout the infestation percentage by blue beetle, numbers of infected and total leaves of five randomly selected hills were counted one day before spraying and five days after spraying. 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

Data on number of healthy leaves and infested leaves by rice blue beetle (L. *pygmaea*) were recorded when the incidence was noticed. From the data presented in Table 1, it was observed that the incidence of blue beetle recorded one day before first spraying showed non-significant results. However incidence of blue beetle recorded five days after spraying shown significant result.

In case of post count of both the spray and pre count of second spray, the percent infestation of blue beetle was significantly higher in treatment T_8 over rest of the treatment, except treatment T_7, T_5 and T_3, which remained statistically at par with each other.

The significantly lowest per cent infestation was noticed in treatment T_1 over rest of the treatment, except treatments T_6, T_2 and T_4 in case of post count of first spraying and also in case of pre and post count of second spraying, which remained statistically similar with each other.

Table 1
Percent infested leaves by blue beetle

		Per cent infested leaves			
		1st spray		*2nd spray*	
Sr. No.	*Treatments*	*Pre-count*	*5 DAS*	*Pre-count*	*5 DAS*
1.	T_1 – Full recommended package	36.62(37.24)	33.35(35.26)	19.50(26.14)	15.53(23.10)
2.	T_2 – FRP – Fertilizer (Fert.)	39.79(39.08)	36.01(36.83)	24.88(29.86)	20.26(26.69)
3.	T_3 –FRP – Plant Protection (PP)	40.42(39.47)	49.61(44.77)	41.62(40.15)	46.33(42.89)
4.	T_4 – FRP – Weed Management (WM)	36.64(37.15)	33.56(35.28)	22.75(28.48)	19.47(26.17)
5.	T_5 – FRP – (Fert. + PP)	36.29(37.04)	46.71(43.10)	42.03(40.33)	45.29(42.26)
6.	T_6 – FRP – (Fert. + WM)	44.75(41.98)	40.13(39.30)	27.36(31.49)	22.86(28.53)
7.	T_7 – FRP – (PP + WM)	42.43(40.64)	49.42(44.67)	40.35(39.40)	46.22(42.83)
8.	T_8 – FRP – (Fert. + PP + WM)	48.98(44.42)	56.37(48.66)	46.82(43.17)	54.51(47.60)
	S.Em. ±	-	1.94	1.85	1.98
	CD at (p = 0.05)	N. S.	5.89	5.62	6.00

Note: Figures in parenthesis denotes ARC values. DAS – Day after spraying.

Table 2
Weekly weather data during the crop growth period (*Kharif* 2013)

		T max	*T min*	*RH-I*	*RH-II*	*Rain*	*RD*	*BSS*
Period	*MW*	*(°C)*	*(°C)*	*(%)*	*(%)*	*(mm)*	*day*	*(hrs.)*
18.06-24.06	25	28.1	23.5	94	95	250.2	6	3.0
25.06- 1.07	26	28.2	23.9	94	92	213.2	7	2.5
02.07- 8.07	27	27.6	24.2	93.9	93.6	305.8	6	0.9
09.07-15.07	28	26.6	23.2	97	95	498.9	7	0.2
16.07-22.07	29	26.4	23.3	97	93	495.8	7	0.2
23.07-29.07	30	26.5	23.3	96	93	388.4	7	0.0
30.07- 5.08	31	27.1	23.7	95	92	253.4	7	2.4
06.08-12.08	32	28.1	23.9	92	85	98.0	7	4.1
13.08-19.08	33	27.8	24.0	96	87	138.4	7	2.2
20.08-26.08	34	28.3	23.8	91	87	106.4	6	4.3
27.08-02.09	35	28.7	22.9	93	86	41.2	4	6.0
03.09-09.09	36	29.4	23.1	91	87	18.4	3	5.8
10.09-16.09	37	29.9	23.2	94	88	71.4	5	2.9
17.09-23.09	38	28.2	23.7	94	92	78.0	4	1.9
24.09-30.09	39	28.1	23.0	96	90	113.6	6	3.6
01.10-07.10	40	28.9	23.4	95	85	306.4	5	4.0
08.10-14.10	41	29.8	22.4	91	84	39.8	1	4.6
15.10-21.10	42	32.3	23.4	90	74	8.8	1	6.1
Mean		28.33	23.43	93.8	88.8	3426.1	96	3.03

The increased infestation of blue beetles might be due to the exclusion of plant protection measures especially in case of the treatments T_3, T_5, T_7, and T_8 during 32nd meteorological week when pest incidence increased due to sudden decrease in rainfall quantum (Table 2). These results confirm with the findings of Karthikeyan and Jacob (2009).

Table 3
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

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 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.

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