Production potential and economic analysis of direct wet seeded aromatic rice (*Oryza Sativa* L.) Cv. Pusa Basmati 1 as influenced by fertility levels and weed management practices

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ABSTRACT

A field experiment was conducted on sandy loam soil during wet season of 2003 and 2004 to evaluate the grain yield and economic feasibility of direct wet seeded aromatic rice under different fertility levels viz. 80: 40: 40; 100: 50: 50; 120:60:60 kg ha^{-1} of N, P_2O_5 and K_2O respectively and weed management practices viz. anilofos @ 0.4 kg a.i ha^{-1}, butachlor @ 1.5 kg a.i ha^{-1}, 2 handweedings and weedy check. There was increase in yield and net income by subsequent increase in fertility levels. Among weed management practices, 2 handweeding recorded highest grain yield followed by anilofos. The maximum grain yield was observed in plots treated with 120: 60: 60 kg ha^{-1} of N: P_2O_5: K_2O respectively and 2 handweedings, however, higher net return and benefit cost ratio(BCR) was observed in 120: 60: 60 kg ha^{-1} of N: P_2O_5: K_2O and anilofos. treatment. Maximum weed index was observed in weedy check plots (67-69 %). The unit increase in intensity of monocots, dicots and weed dry weight causes decrease in rice grain yield by 2.18, 1.64 and 2.85 q ha^{-1} respectively.

Key words: *Direct seeded rice, fertility levels, weed management*

Pusa Basmati 1 is a popular aromatic rice variety among farmers because of its excellent grain, cooking quality, soft texture and pleasant aroma, besides yielding almost double than that of traditional basmati rice varieties. Asian farmers are gradually shifting to direct seeding mainly to reduce labour inputs, drudgery, other nursery management, transplanting expenditures and by 7–10 days early maturity of crop. However, an attempt to introduce direct sowing of rice often fails because large number of weeds flourish in field due to slow initial growth of crop, wide spacing between crop rows and frequent irrigations. Weed menance is 50 – 60 % more in direct seeded rice than in transplanted rice (Subbaiah and Sreedevi, 200). Manual weeding becomes difficult because of possible damage to rice plants, problems in differentiating grassy weeds, labour scarcity and cost, besides being time consuming and relatively less effective The objective of this study was to evaluate the performance of direct wet seeded basmati rice under different fertility levels and weed management practices.

MATERIALS AND METHODS

The experiment was conducted with rice variety Pusa Basmati 1 during wet season of 2003 and 2004. The soil was sandy clay loam, organic carbon: 0.60%, available P: 50 kg ha^{-1} and K: 235 kg ha^{-1}, pH: 7.5 and EC: 0.28 mmhos/cm. The experiment was laid out in two factor RBD consisting 3 levels of NPK kg ha^{-1} viz 80:40:40 ; 100 : 50 : 50 and 120 : 60 : 60 of N : P_2O_5 : K_2O and four weed management practices i.e. Pre-emergence application of anilofos @ 0.4 kg a.i h^{-1}; pre-emergence application of butachlor @ 1.5 kg a.i ha^{-1} ; two handweedings (30 and 60 days after sowing) and weedy check with 3 replications. Sprouted seeds were sown in last week of June during both the years. Total amount of P and K and half of N was applied as basal. The rest of nitrogen was applied in two splits at mid

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tillering and panicle initiation stages. The crop was grown under assured irrigated conditions. The crop was harvested in first fortnight of November during both the years. Weed count and weed dry weight was recorded by least count quadrate method .The growth, yield attributes, yields were recorded and relative economics was worked out. All the other recommended agronomic and plant protection measures were adopted to raise the crop.

RESULTS AND DISCUSSION

Fertility levels and weed management practices had significant effect on growth and yield attributes viz plant height, dry weight hill^{-1}, effective tillers hill^{-1} and test weight during both the years (Table 1). The growth and yield attributes increased with the increasing fertility and were recorded more in plots receiving 120: 60: 60 kg ha^{-1} of N: P_2O_5: K_2O respectively. This might be due to the greater response of crop to available nutrients, resulting in increased biomass. Amongst weed management practices two hand weeded plots were found to be significantly superior, which registered more growth and yield attributes followed by anilfos @ 0.4 kg a.i ha^{-1} during both the years. The application of anilofos and butachlor do not control all the weeds and also might had caused phytotoxicity to the emerging crop seedlings leading to lesser record of growth and yield attributes compared to two handweedings. These findings are in agreement with the findings of Govindra *et al*. (2004). Due to stiff competition between weeds and crop, the growth and yield attributes were recorded least in weedy check plots.

Anilofos treated plots gave higher yield than butachlor treated plots reflecting its superiority in terms of weed control and low crop phytotoxicity. The more effectiveness of anilofos over butachlor for reducing weed infestation loss was also reported by Bali *et el*. (2006). The grain yield was significantly influenced by interaction between fertility levels and weed management practices (Table 2). The maximum grain yield was observed in plots treated with two hand weedings and higher fertilizer dose. Grain yield showed a significant positive correlation with WCE (R = 0.858*). However, grain yield recorded negative correlation with population of monocots (r = -0.866*) and dicots (r = -0.85**) as well as weed dry weight (r = -0.861**) (Table 5). The regression equations also revealed negative relationship of grain yield with monocot weed population (Y= 47.87 – 2.18X); dicot weed population (Y= 49.4 – 1.64X) and with weed dry weight (Y= 48.82 – 2.85X). These results were in agreement with the findings of Laxminarayan and Mishra (2001). The regression equations predicted linear reduction in the grain yield with the unit increase in population and biomass of weeds. The regression of yield on monocot, dicot and dry weight of weeds revealed that 1 unit increase in these parameters leads to decrease in rice grain yield by 2.18, 1.64 and 2.85 q ha^{-1} respectively.

Table 1. Growth and yield attributing parameters and yield of direct seeded rice as affected by fertility levels and weed management practices.

Treatments	Plant height (cm)		Dry weight hill^{-1} (g)		Effective tillers hill^{-1}		1000 seed weight (g)		Grain yield (q ha^{-1})	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Fertility levels										
80 : 40 : 40	90.4	87.8	36.6	34.4	11	9	19.1	18.7	22.9	21.5
100 : 50 : 50	95.6	93.2	40.5	38.1	12	10	19.7	19.5	27.5	26.0
120 : 60 : 60	105.1	102.4	44.9	42.7	14	12	20.6	20.5	37.1	35.9
CD (P=0.05)	0.712	0.72	0.42	0.41	0.13	0.14	0.07	0.07	0.72	0.71
Weed management practices										
Anilofos @ 0.4 kg a.i ha^{-1}	99.6	97.3	44.3	42.2	13	12	20.4	20.1	34.2	32.4
Butachlor @ 1.5 kg ai ha^{-1}	96.6	93.9	40.6	38.3	12	10	19.9	19.7	28.7	27.1
Two hand weedings	112.3	109.9	48.4	46.1	15	13	21.3	21.1	43.2	41.6
Weedy check	79.3	76.6	29.4	27.0	9	7	17.7	17.4	10.6	10.3
CD (P=0.05)	0.82	0.84	0.49	0.47	0.15	0.16	0.09	0.08	0.83	0.82

Table 2. Grain yield as affected by interaction between fertility levels and weed management practices.

Weed management practices	Fertility levels					
	Low fertility		Medium fertility		High fertility	
	2003	2004	2003	2004	2003	2004
Anilofos @ 0.4 kg a.i ha^{-1}	24.3	22.6	31.3	29.6	47.1	45.0
Butachlor @ 1.5 kg ai ha^{-1}	23.0	21.70	25.0	23.3	38.3	36.3
Two hand weedings	35.0	33.0	43.3	41.0	51.3	50.8
Weedy check	9.3	9.0	10.6	10.3	12.0	11.7
CD (P=0.05)	1.44	1.42				

The decrease in grain yield by increase in these parameters has also been reported by Kurmi, 1997.

Dominant weed flora observed in the experimental field were *Echinochloa colounum*, *Echinochloa* crussgalli, *Digitaria sanguinalis, Cyperus rotundus and Cyperus difformis* among monocot weeds while *Ammania baccifera, Commelina bengalensis* among dicot weeds. Weed intensity (monocot and dicot) and weed dry weight were significantly increased with the increase in fertility and were found higher in plots treated with 120, 60, 60 kg ha^{-1} of N, P_2O_5 and K_2O respectively (Table 3). However, weed infestation and weed dry weight were found more in weedy check plots. Weeds owing to their more competitive ability than crop plants put forth more biomass under weedy check conditions. Anilofos treatment registered more weed control efficiency than butachlor as it was more effective in controlling the monocot weeds which mostly infest the rice crop (Vaishya and Tomar, 2000). The reduction in yield due to presence of weeds was observed more in weedy check plots with weed index of 67 – 69 % and was recorded least in anilofos treated plots. Similar findings were reported by Bindra *et al*, 2002.

Table 3. Weed intensity (Monocot and Dicot), weed dry weight, weed control efficiency and weed index as affected by fertility levels and weed management practices.

Treatments	Monocot weeds/ 0.25 m^2 at Flowering stage		Dicot weeds/ 0.25 m^2 at Flowering stage		Weed dry weight/ 0.25 m^2 at Flowering stage		WCE(%)		WI(%)	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Fertility leevels										
80 : 40 : 40	2.83 (8.2)	2.91 (8.6)	3.32 (11.4)	3.36 (10.79)	5.4 (32.3)	5.53 (33.3)	43.8	42.41	46.9	48.1
100 : 50 : 50	2.87 (8.6)	2.80 (8.1)	3.46 (12.4)	3.51 (11.82)	5.6 (34.1)	5.65 (34.8)	40.69	39.75	36.21	37.4
120 : 60 : 60	2.96 (9.3)	3.13 (10.0)	3.56 (13.2)	3.59 (12.38)	5.7 (35.4)	5.75 (35.8)	38.50	38.07	13.95	13.57
CD (P=0.05)	0.044	0.038	0.0508	0.051	0.09	0.086	—	—	—	
Weed Management practices										
Anilofos @ 0.4 kg a.i ha^{-1}	2.98 (8.4)	2.71 (7.1)	3.50 (11.7)	3.54 (12.03)	5.88 (34.0)	5.92 (34.6)	40.9	40.1	20.75	22.08
Butachlor @ 1.5 kg ai ha^{-1}	3.13 (9.2)	3.26 (10.2)	3.77 (13.6)	3.80 (13.94)	6.27 (38.8)	6.30 (39.3)	32.6	32.10	33.44	34.84
Two hand weedings	1.41 (1.5)	1.80 (2.7)	1.88 (2.9)	1.90 (3.11)	2.47 (5.6)	2.72 (6.8)	90.15	88.13	0.00	0.00
Weedy check	4.03 (15.8)	4.03 (15.8)	4.64 (21.1)	4.72 (21.77)	7.62 (57.5)	7.63 (57.8)	0.00	0.00	75.32	75.2
CD (P=0.05)	0.051	0.0439	0.0587	0.0589	0.104	0.09	—			

The weed data is subjected to square root transformation $\sqrt{x + 0.5}$. ; Values within parenthesis indicate original values.

Table 4. Net income and benefit: cost ratio as affected by interaction among establishment methods, fertility levels and weed management practices in rice.

Weed management practices	Fertility levels (N: P_2O_5 : K_2O kg ha^{-1})					
	80 : 40 : 40		100 : 50 : 50		120 : 60 : 60	
	Net income (Rs ha^{-1})	BCR	Net income (Rs ha^{-1})	BCR	Net income (Rs ha^{-1})	BCR
Anilofos@ 0.4 kg a.i ha^{-1}	2,128	1.09	8,576	1.37	23,102	1.97
Butachlor @ 1.5 kg ai ha^{-1}	855	1.03	1,849	1.08	14,506	1.61
Two HW (30 and 60 DAS)	9,138	1.35	15,667	1.59	23,224	1.75
Weedy check	-16,305	0.46	-11,225	0.49	-10,876	0.53

On the basis of two years mean, (Table 4) the maximum net return and benefit : cost ratio were obtained with application of 120: 60: 60 kg ha^{-1} N: P_2O_5: K_2O and anilofos followed by 120: 60: 60 kg ha^{-1} N: P_2O_5: K_2O and 2 handweedings. The corresponding values being Rs 23,102 and 1.97 and Rs 23,224 and 1.75, respectively. Though two handweedings increased the grain yield of rice, but it had lower net returns and benefit cost ratio on account of higher cost involved.

It can be concluded that under existing agro climatic conditions, the higher net profit of direct sown sprouted rice in puddled soil can be obtained by applying 120 : 60 : 60 kg ha^{-1} of N : P_2O_5 : K_2O ha^{-1} and anilofos @ 0.4 kg a.i ha^{-1}.

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