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Performance of scented rice variety Basmati 370 under organic farming

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Abstract: Two season trials were conducted in the same field during *Kharif* (May-Sep.) and *Rabi* (Oct-Feb) seasons of 1999-2000 at wetland farm of Tamil Nadu Agricultural University, Coimbatore in order to assess the performance of scented rice variety Basmati 370 to organic N source. The experiments involved three nitrogen levels *viz.*, 50 (N_1), 75 (N_2) and 100 (N_3) kg ha^{-1} and five source combinations *viz.*, 100% organic N - 75% through FYM and 25% through Azolla (C_1), 100% organic N-75% through *Sesbania rostrata* and 25% through Azolla (C_2), 100% organic N-75% through FYM and 25% through Azolla + 50 kg P_2O_5 + 50 kg K_2O ha^{-1} (C_3) 100% organic N-75% through *Sesbania rostrata* and 25% through Azolla + 50 kg P_2O_5 + 50 kg K_2O ha^{-1} (C_4) and 100% inorganic N, P_2O_5 and K_2O (C_5). Fifteen treatment combinations were tested in a randomized block design replicated thrice. Required quantities of FYM, *Sesbania rostrata* and Azolla were incorporated in to the soil one week before transplanting of rice as per the treatments. The results revealed significant improvement in growth characters and yield components with higher N levels that ultimately resulted in higher grain yield. The grain yield increase was to the tune of 25 and 45 per cent for 100 kg N ha^{-1} over 50 kg N ha^{-1} in kharif and rabi seasons, respectively. Inorganic NPK application produced higher values for growth and yield attributes. Application of 100 per cent inorganic NPK (C_5) recorded higher grain yield in both the seasons. However, green manuring with *Sesbania rostrata* along with Azolla and with or without supplementation of inorganic P and K (C_4 or C_2) registered on par values with C_5.

Key words : Basmati 370 rice, organic farming, inorganic, growth and yield)

Introduction

Basmati rice is considered to Providence's exclusive gift to the Indian sub-continent mainly because of the existence of favourable climate in the traditional basmati growing regions. Though there is plethora of aromatic rice varieties being grown in the world, basmati surpasses all because of its high quality. Basmati rice is characterized by super fine slender grain, exquisite aroma, sweet taste, soft texture, delicate curvature and extra elongation with a least breadth-wise swelling on cooking (Rutger,1990). In India, scented rice varieties occupy about 0.7 m.ha (1.5% of the total area under rice) yielding about 0.6 m.t of milled rice (Anon., 1993).

Sharma *et al.* (1990) reported that chemical residues were a major problem in modern agriculture and could be minimized by resorting to organic agriculture. An optimum combination of organic sources is to be tailored to meet the requirements of higher yield without sacrificing the quality of scented rice. Reports indicate that successful cultivation of basmati is feasible in Tamil Nadu also (Nagarajan, 1993). In that case, fertilizer recommendations are to be arrived at for basmati as there is no such information relating to Tamil Nadu. Keeping these in mind, a study was, taken up to assess the quality and productivity of scented rice variety Basmati 370 under organic farming at three levels of nitrogen in conjunction with different organic nutrient sources.

Table 1. Weather data for Coimbatore from May 1999-April 2000.

Year & Month	Standard Week Number	Date	Max (07.22)	Min (07.22)	RH (07.22)	RH (14.22)	EVP (mm)	Wind (kpH 8)	Rain fall (mm)	SR	SS
1999 May	19	7-13	33.6	23.2	80	46	6.9	10.5	0.0	458.7	10.2
	20	14-20	33.9	24.0	77	45	7.3	14.0	0.0	421.1	8.1
	21	21-27	31.5	23.1	80	56	5.0	17.9	1.2	324.3	4.4
	22	28-3	32.6	23.4	84	50	6.1	14.8	0.0	394.1	7.3
June	23	4-10	32.5	22.7	83	52	6.0	14.3	0.7	373.7	6.7
	24	11-17	30.8	23.0	78	58	6.5	25.6	1.3	357.4	5.3
	25	18-24	30.1	22.6	77	94	5.9	21.7	1.4	358.5	5.3
	26	25-1	33.0	20.8	87	41	6.8	14.1	0.0	446.6	9.6
July	27	2-8	32.6	19.4	86	49	6.9	19.3	0.0	400.5	7.2
	28	9-15	31.9	22.4	83	49	6.5	20.3	0.1	348.5	4.6
	29	16-22	28.3	22.4	79	69	4.8	28.7	3.0	251.9	1.3
	30	23-29	29.5	23.3	74	56	6.0	37.0	0.5	324.5	4.1
	31	30-5	31.0	23.2	71	49	7.0	27.6	0.0	374.6	5.4
Aug	32	6-12	31.2	23.1	81	55	6.6	28.0	0.4	324.6	4.8
	33	13-19	32.7	22.3	87	50	5.7	14.8	0.0	383.9	8.2
	34	20-26	32.0	21.8	88	52	5.0	13.4	2.7	337.0	5.6
	35	27-2	32.9	21.5	85	46	5.6	17.6	0.0	385.4	6.8
Sep.	36	3-9	32.3	21.3	78	43	7.1	23.3	0.0	421.8	7.9
	37	10-16	33.0	22.7	83	43	6.9	20.4	.0	439.7	9.3
	38	17-23	33.7	22.4	89	50	5.6	12.9	0.0	394.3	8.0
	39	34-30	33.5	23	91	46	4.3	8.2	4.0	351.4	6.1
Oct.	40	1-7	29.9	22.5	94	68	3.9	6.0	10.3	282.7	3.9
	41	8-14	31.0	22.3	94	60	4.2	3.1	4.6	386.0	7.7
	42	15-21	30.0	21.9	95	74	3.4	3.8	22.2	282.7	3.4
	43	22-28	30.0	22.2	94	65	3.0	-	6.4	334.4	5.5
	44	29-4	30.0	20.2	94	64	3.2	-	0.3	389.6	6.9
Nov	45	5-11	30.1	19.8	91	51	3.5	-	9.2	421.4	8.0
	46	12-18	29.7	18.4	88	47	3.5	1.7	0.0	463.1	9.9
	47	19-25	27.4	21.1	93	71	3.5	3.3	5.0	292.4	3.5
	48	26-2	28.4	21.1	91	63	3.2	3.9	0.9	373.8	6.3
Dec.	49	3-9	28.3	19.1	91	59	2.7	2.0	0.0	388.3	6.1
	50	10-16	28.0	19.3	91	62	2.9	1.9	0.4	351.0	5.1
	51	17-23	27.9	18.3	88	57	2.9	3.4	1.4	363.9	5.2
	52	24-31	26.8	19.3	90	54	3.2	4.4	1.1	416.3	7.4
2000 Jan	1	1-7	28.3	19.9	87	52	3.4	5.0	0.0	379.2	5.7
	2	8-14	28.8	20.5	87	62	3.5	6.1	0.3	281.5	2.9
	3	15-21	30.5	18.1	91	39	4.1	6.2	0.0	479.2	9.2
	4	22-28	31.6	16.9	90	35	4.7	6.2	0.0	500.7	9.5
	5	29-4	31.0	18.3	89	40	4.4	6.7	0.0	420.6	7.5

Contd...

Year & Month	Standard Week Number	Date	Max (07.22)	Min (07.22)	RH (07.22)	RH (14.22)	EVP (mm)	Wind (kpH 8)	Rain fall (mm)	SR	SS
Feb.	6	5-11	32.0	22.0	89	48	3.9	4.4	0.0	406.6	7.4
	7	12-18	32.2	19.9	88	36	4.9	5.8	0.0	468.6	9.2
	8	19-25	32.7	20.9	91	52	4.7	4.5	2.6	366.1	5.7
	9	26-4	30.5	19.6	90	45	3.6	4.8	2.4	383.7	8.0
Mar	10	5-11	34.0	19.7	86	35	4.6	3.6	0.0	418.0	9.4
	11	12-18	35.0	21.9	86	33	4.9	4.0	0.0	425.7	9.3
	12	19-25	35.0	21.9	85	31	6.4	6.2	0.0	452.0	9.8
	13	26-1	35.3	22.3	87	38	6.8	5.7	0.0	391.8	7.0
Apr	14	2-8	34.5	23.1	85	43	5.5	5.1	0.4	378.5	8.0
	15	9-15	35.9	23.0	86	44	6.8	7.1	1.0	418.3	9.5
	16	16-22	34.6	23.6	87	49	5.9	5.8	1.5	382.1	8.0
	17	23-29	35.6	23.7	84	43	6.9	8.5	0.0	441.4	9.7

Table 2. Nutrient contents of organic manures used during *Kharif* and *Rabi*

S. No.	Organic Manure	Season	Nutrient content (%)			Quantity applied on dry weight basis in t ha^{-1}		
			N	P	K	37.5 kg N ha^{-1} (75% of required 50 kg N ha^{-1})	56.25 kg N ha^{-1} (75% of required 75 kg N ha^{-1})	75 kg N ha^{-1} (75% of required) 100 kg N ha^{-1})
1.	FYM	*Kharif*	0.45	0.36	0.60	8.33	12.50	16.67
		Rabi	0.50	0.39	0.60	7.50	11.25	15.00
2.	*Sesbania rostrata*	*Kharif*	3.80	0.40	2.20	0.99	1.48	1.97
		Rabi	3.65	0.38	2.15	1.03	1.54	2.05
3.	Azolla	*Kharif*	4.60	1.15	2.90	0.27*	0.41**	0.54***
		Rabi	4.50	1.07	2.60	0.28*	0.42**	0.56***

* To supply 12.50 kg N ha^{-1}
** To supply 18.75 kg N ha^{-1}
*** To supply 25 kg N ha^{-1}

Materials and Methods

Field experiments were conducted in the same layout during both *Kharif* (May-Sep.) and *Rabi* (Oct-Feb) seasons of 1999-2000 at wetland farm of Tamil Nadu Agricultural University, Coimbatore. The experiments involved three nitrogen levels *viz.*, 50 (N_1), 75 (N_2) or 100 (N_3) kg ha^{-1} and five source combinations *viz.* 100% organic N-75% through *Sesbanic rostrate* and 25% through Azolla (C_1), 100% organic N-75% through FYM and 25% through Azolla (C_2), 100% organic N-75% through *Sesbania rostrata* and 25% through Azolla+50 kg P_2O_5 + 50 kg K_2O ha^{-1}) (C_3), 100% organic N-75% through FYM and 25% through Azolla + 50 kg P_2O_5 + 50 kg K_2O(C_4) and 100% inorganic N, P_2O_5 and K_2O (C_5). Fifteen treatment combinations were tested in a randomized block design replicated thrice. Gross and net plots were of 6m x 5m and 5.4m x 3.8m dimension, respectively.

Twenty eight day old seedlings @ two hill^{-1} were transplanted at a spacing of 20cm x 10 cm during both the seasons. *Sesbania rostrata* and Azolla were raised in separate fields for subsequent use. Required quantities of FYM, *Sesbania rostrata* and Azolla were incorporated into the soil one week before transplanting of rice as per the treatments (Table 2). In case of 100 per cent inorganic treatments (C_5), nitrogen was applied as urea in three splits at basal (50%), active tillering (25%) and panicle initiation (25%). For the treatments encompassing external application of P_2O_5 and K_2O, the entire quantity of P_2O_5 was applied as super phosphate at basal and K_2O was applied as muriate of potash in two equal splits, at basal and panicle initiation. Neem oil sprays were given to protect the crops from insect pests. All other recommended practices were followed.

Observations on growth characters such as plant height, leaf area index, tiller number and dry matter production, yield components *viz.*, productive tillers, filled grains per panicle and test weight of grain were recorded.

Results and Discussion

Seasonal Influence

Weather that prevailed during *Kharif* and *Rabi* (Table 1) crucially influenced the growth and yield of Basmati rice. In *Kharif* season, all growth attributes *viz.*, crop height, LAI tiller number and DMP were higher than in *Rabi* planted crop. Similar was the response for yield components like productive tillers m^{-2} and filled grains panicle^{-1} indicating that a conducive weather prevailed during *Kharif* season. Between the two seasons, very high variability in yield was obtained with *Rabi* recording nearly 68 per cent low yield than *Kharif* crop, if the maximum yields recorded in the respective seasons were compared. Apart from the seasonal effect, very low yield recorded during the *Rabi* season was due to the heav incidence of leaf folder just before panicl initiation stage of the crop. This was agai an indirect effect of the weather. Baby Ra (1999) had also observed higher incidence an damage of leaf folder during September an December months due to change in maximun and minimum temperature. As the crop wa grown organically without spraying any toxi chemical, the pest could not be controlled befor it reached the economic threshold level.

Response of Basmati 370 rice to highe levels of N tested was low but steady upt 100 kg N ha^{-1} in terms of growth, yield component and grain yield during both the seasons, *khari* and *rabi* (Table 4). Tillers and consequentl the number of panicles increased significantl when nitrogen level was increased from 5 kg N ha^{-1} to 75 kg N ha^{-1} but 75 kg ha^{-1} was on par with 100 kg N ha^{-1}. Th is in consonance with the observation mad by Mangat Ram *et al.* (1995). Increased numbe of panicles with application of nitrogen was due to favourable effect of the nutrient on tiller production. Number of grains per panicle also significantly increased with 75 kg and 100 kg N ha^{-1} owing to the fact that with increase in levels of N, the plants remained green for a longer period resulting in greater contribution of carbohydrates from current photosynthates.

The significant improvement in growth and yield components with higher N levels ultimately resulted in higher grain yield and the response was significant up to 75 kg N ha^{-1}. The grain yield increase was to tune of 25 and 45 per cent for 100 kg N ha^{-1} over 50 kg N ha^{-1} in *kharif* and *rabi* seasons, respecively. Similar results were reported by Dhiman *et al.* (1997). As Basmati 370 rice in an old indica type, with very low HI varying from 0.21-0.23, it could respond only upto 75 kg N ha^{-1}.

Table 3. Growth characters of Basmati 370 rice as influenced by nitrogen levels and source combinations

Treatments	Plant height (cm)		Leaf Area Index		Number of tillers m^{-2}		DMP (kg ha^{-1})	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
Nitrogen levels								
N1	115.2	83.4	6.11	4.24	415	380	7438	4891
N2	117.4	88.0	6.99	4.77	419	383	7799	5631
N3	118.7	88.0	6.94	4.70	427	400	8072	6018
SEd	1.0	1.7	0.33	0.18	4.0	4.2	91	396
CD (P=0.05)	2.1	3.5	0.67	0.37	8.2	8.7	176	812
Source combinations								
C1	112.6	80.1	4.94	3.81	365.	328	6521	4792
C2	116.6	85.9	6.45	5.26	424	406	7731	5758
C3	116.4	84.1	6.30	3.72	387	361	7162	4985
C4	119.2	87.8	6.40	4.67	453	387	8579	5001
C5	127.4	94.4	9.32	5.40	455	461	8856	7031
SEd	4.2	2.2	0.42	0.23	51	5.5	217	512
CD (P=0.05)	8.6	4.6	0.87	0.48	10.5	11.2	444	1048

Table 4. Yield and Yield attributes of Basmati 370 rice as influenced by nitrogen levels and source combinations

Treatments	Per cent of productive tillers		No. of filled grains m^{-2}		Grain yield (kg ha^{-1})		Harvest Index	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
Nitrogen levels								
N1	87.7	88.7	415	380	1979	909	0.21	0.15
N2	88.3	94.0	419	383	2248	1072	0.22	0.15
N3	88.3	92.7	427	400	2472	1323	0.23	0.17
SEd	NA	NA	4.0	4.2	136	139	0.13	0.011
CD (P=0.05)	NA	NA	8.1	8.7	278	285	NS	NS
Source combinations								
C1	89.3	88.1	365	328	1868	908	0.20	0.15
C2	90.3	90.9	424	406	2204	1101	0.19	0.14
C3	88.9	89.2	387	361	2226	1008	0.22	0.16
C4	86.7	96.1	453	387	2280	1142	0.19	0.19
C5	91.6	88.5	455	461	2420	1437	0.20	0.16
SEd	NA	NA	5.1	5.5	175	180	0.017	0.014
CD (P=0.05)	NA	NA	10.5	11.2	359	368	NS	NS

Effect of source combination

The number of tillers m^{-2} was the highest with 100% inorganic fertilizers (C_5) in both the seasons. It was followed by 100% organic N as *Sesbania rostrata* + Azolla with (C_4) and without (C_2) inorganic P and K. The least was recorded in FYM + Azolla without (C_1) inorganic P and K. The same trend was noticed in the number of productive tillers in both the seasons. C_4 (*S.rostrate* and Azolla - inorganic P&K) was on par with C_2 (*S.rostrata* + Azolla) indicating that there is no effect for inorganic

P and K on the other hand inorganic P and K with FYM + Azolla (C_3) has definite effect on productive tillers. The average percentage of productive tillers to that of total tillers was 89.4 and 90.6 in *kharif*, and *rabi* seasons respectively without much variation between treatments. As far as number of filled grains panicle^{-1} is concerned in *kharif*, 100 per cent inorganic fertilizers (C_5) was better (100 panicle^{-1}) than other sources but in *Rabi* it was on par with C_4 and C_2. Among the organic sources of N, *Sesbania rostrata* + Azolla (with or without P and K) was definitely superior to FYM+ Azolla with or without P and K.

As far as grain yield is concerned the grain yield was the highest with 100 per cent inorganic fertilizer (C_5) in both the seasons. But this was on par with C_4, C_3 and C_2 treatments in *Kharif* and C_4 and C_2 alone in *Rabi* indicating that FYM is not an efficient source to substitute inorganic N. This might have been due to slow mineralization of FYM under flooded condition. Another interesting point to note is the absence of response to inorganic P and K when applied along with *Sesbania rostrata* and Azolla in both the seasons. This might have been due to high content of P and K in Azolla and quick mineralization of the same under flooded condition. The treatments did not alter the Harvest Index significantly.

Thus, it may be concluded that application of 100 per cent organic N-75 per cent through *Sesbania rostrata* and 25 per cent through Azolla with or without external P and K application could produce grain yields similar to that obtained under 100 per cent inorganic fertilizer application and hence can be resorted to as viable organic farming practice for the scented rice variety Basmati 370.

References

Anonymous (1993). Suitable varieties and agronomic management of scented rice in Orissa. *Rice India*, March 1993: 27-30.

Baby Rani, W. (1999). Studies on ecology, host plant resistance and management of leaf folder complex on rice. Ph.D. Thesis, submitted in the Dept. of Agricultural Entomology, AC & RI, Madurai under TNAU, Coimbatore.

Choudhari, B.T., Turkhede, A.B., Chore, C.N., Jiotode, D.J. and Thorat, W. (1998). Performance of Basmati rice varieties under various levels of N with organic manure. *J.Soil and Crops.* **8:** 41-43.

Dhiman, S.D., Nandal, D.P. and Hari Om (1997). Effect of transplanting time and nitrogen levels on productivity of Basmati rice. *Haryana J. Agron.* **13:** 45-48.

Geethalakshmi, V. (1996). Studies on the direct and residual effect of non-conventional green leaf manures with N for rice cropping system. Ph.D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India.

Helepyati, A.S. and Sheelavantar, M.N. (1993). Effect of *Sesbania rostrata* and nitrogen substitution rates on grwoth and yield of rice. *Oryza*, **30:** 67-72.

Kenchaiah, K. (1993). Organic farming studies in rice. Ph.D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India.

Lizhihin, Sarkar, R.S., and Nayak, S.K. (1997). Physiological effect of N application on aromatic rice. *J. South China Agric. Univ.*, **18:** 13-17, 23.

Mangat Ram, Tejinder Singh, Hari Om, Ishwar Singh and Dhiman, S.D. (1995). Studies on nitrogen management in tall scented rice. *Haryana J.Agron.* **11:** 23-26.

Nagarajan, S.S. (1993). Basmathy under organic farming. *Kissan World*, **20:** 34-35.

Rutger, R.J. (1990). Speciality rice markets. *Rice J.* **93:** 20-24.

Sharma, K.K., Ahmed, T. and Baruah, D.K. (1990). Grain characteristics of some aromatic rice varieties of Assam. IRRN, **15:** 13.

Singh, S., Prasad, R., Singh, B.V., Goyal, S.K. and Sharma, S.N. (1990). Effect of green manuring blue green algae and neem cake coated urea on wetland rice. *Biol. Fertil. Soils*, **9:** 235-238.

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