

Response of brown sarson (*Brassica campestris* subsp. *oleifera* var. brown sarson) to residual effect of organic manure, nitrogen and transplanting dates of rice (*Oryza sativa*)

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ABSTRACT

A field experiment was conducted at Shalimar campus of Sher-e-Kashmir University of Agricultural Sciences and Technology, during the rainy and winter seasons of 1995–96 and 1996–97 on silty clay-loam soil. The treatments comprised 2 dates of transplanting (15 and 30 June) and 3 levels of organic manure (control, rice straw litter and FYM @ 10 tonnes/ha) assigned to main plots and 4 levels of N (0, 50, 100 and 150 kg/ha) in subplots, tested in split-plot design with 3 replications. In the subsequent winter season brown sarson [*Brassica campestris* L. ssp. *oleifera* (Metzger) Sinsk. var brown sarson] was sown on 15 October during both the years in each plot. Seed yield, yield attributes, siliquae/plant, 1,000-grain weight and nutrient uptake of brown sarson increased significantly as result of residual effect of application of organic manure and nitrogen on preceding rice (*Oryza sativa* L.) crop. However, 15 June transplanting of rice with higher levels of nitrogen (100 and 150 kg/ha) with organic manure (rice straw litter and FYM) application, followed by brown sarson over 2 years recorded positive net gain of soil nitrogen.

Key words : Brown sarson, Organic manure, Residual effect, Nitrogen balance, Yield and yield attributes

Rice in Kashmir valley is cultivated as a wetland rice culture, where soil is puddled and kept flooded for whole life cycle of rice crop. Wetland rice culture destroys the soil structure and presents poor soil physical environment for the succeeding brown sarson crop. Therefore for maintenance of soil structure, organic manure plays vital role in sustaining high yield of the system (Verma and Bhagat, 1992). Further the

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residual effect on succeeding brown sarson crop of organic material also needs to be considered in view of their slow decomposition and mineralization over a period of time. Organic manure in conjunction with inorganic nitrogen in rice-brown sarson system to sustain high level of yields was attempted in this study.

MATERIALS AND METHODS

A field experiment was conducted during 1995–96 and 1996–97 on the silty clay-loam soil, having 0.91% organic carbon and 283, 19.9 and 265 kg/ha N, P and K, respectively. The treatment combinations comprised 2 dates of transplanting (15 and 30 June) and 3 levels of organic manure (control, rice straw litter and FYM @ 10 tonnes/ha) assigned to main plots and 4 levels of nitrogen (0, 50, 100 and 150 kg/ha) in subplots, were taken in split-plot design with 3 replications. The FYM and rice straw litter low in N content with wide C: N ratio of 43.2 and 61.4, respectively, were applied 20 days before transplanting. A common basal dose of 45 and 30 kg P_2O_5 and K_2O was applied to the rice crop at final puddling along with one-half of N as per treatments. Thirty five-day-old seedlings of 'SKAU 5' were transplanted at 15 cm × 15 cm spacing. Brown sarson 'KS 101' cultivar was sown in subsequent winter season on 15 October during both the years in each plot. A common fertilizer schedule of 60, 30 and 20 kg N, P_2O_5 and K_2O was given to the crop. A plant spacing of 30 cm × 10 cm was maintained by thinning 20 days after germination. At harvest of each crop available soil N content and N, P and K(%) in seed and

stover was estimated treatment-wise. Nitrogen balance was worked out after harvest of 4 crops and net gain/loss was assessed.

RESULTS AND DISCUSSION

Yield and yield-attributing characters

Residual effect of transplanting date of rice was not observed on succeeding brown sarson. However residual effect of FYM and rice straw litter being at par was significantly noticed on seed yield of brown sarson compared with the control (Table 1). As a result of residual effect of organic manures, yield attributes like siliquae/plant and 1,000-grain weight increased significantly. The residual effect of organic manure is probably due to highly persistent material, viz. cellulose of FYM and rice straw litter, which requires long time for complete decomposition. Thus, nutrients released from organic manures may not have been fully utilized by rice crop in the first year and notably benefited the succeeding brown sarson crop. Rajput (1995) and Jana and Ghosh (1996) also reported residual effect of FYM and nitrogen on succeeding crops following rice. Besides organic matter incorporated in to the preceding rice crop might have also improved soil physical condition, as soil physical condition deteriorates after prolonged submergence of soil during rice crop growth (Verma and Bhagat, 1992).

Seed and stover yields of brown sarson increased significantly due to residual effect of different levels of nitrogen compared to 0 kg N/ha. Increases in yield-attributing characters like silquae/plant and 1,000 grain weight contributed to higher seed yield

Table 1. Yield, yield attributes and nutrient uptake of brown sarson as influenced by residual effect of transplanting date, organic manure and nitrogen on rice

Treatment	Silquae/ plant	Seeds/ silqua	1,000- grain weight (g)	Seed yield (q/ha)	Uptake (kg/ha)		
					Nitrogen	Phosphorus	Potassium
<i>Transplanting date</i>							
15 June (D ₁)	96.01	11.4	2.97	6.94	30.80	8.08	29.07
30 June (D ₂)	96.5	12.2	2.97	7.05	30.99	7.98	29.17
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
<i>Organic manure (10 tonnes/ha)</i>							
Control (F ₀)	94.10	11.4	2.96	6.56	29.08	7.49	27.94
RSL (F ₁)	97.10	12.1	2.98	7.24	31.96	8.30	34.55
FYM (F ₂)	97.40	11.9	2.97	7.18	31.65	8.29	29.86
CD (P=0.05)	1.57	NS	0.009	0.15	0.93	0.28	0.92
<i>Nitrogen level (kg/ha)</i>							
0 (N ₀)	93.3	11.2	2.96	6.83	28.09	7.11	26.94
50 (N ₅₀)	95.9	11.8	2.96	6.78	29.72	7.65	28.18
100 (N ₁₀₀)	97.0	12.3	2.98	7.25	33.07	8.60	30.86
150 (N ₁₅₀)	98.8	11.8	2.98	7.10	32.64	8.76	30.50
CD (P=0.05)	2.01	NS	0.010	0.19	1.07	0.29	1.16

RSL, Rice straw litter

(Table 1). However, difference between N₀ and N₅₀ and between N₁₀₀ and N₁₅₀ was not significant.

Nutrient uptake

The brown sarson following rice transplanted on different dates did not influence nutrient uptake (Table 1). The data revealed that FYM and rice straw litter, being at par recorded significantly higher N, P and K uptake compared with the control. However, rice straw litter, recorded significantly higher K uptake than FYM and control.

Nitrogen uptake was significantly

influenced by residual effect of nitrogen levels. Increasing levels of nitrogen in rice significantly increased N, P and K uptake of brown sarson up to N₁₀₀. Difference between N₁₀₀ and N₁₅₀ was not marked.

Continuous application of FYM and rice straw litter, built up nutrients in soil with time. Our results confirm the findings of Sharma and Sharma (1994) and Sen *et al.* (1994). The accumulated nutrients gradually mineralized and utilized by successive crop might have resulted in higher nutrient uptake. This is also evident from nitrogen balance sheet (Table 2).

Table 2. Components of nitrogen balance (kg N/ha) of rice–brown sarson cropping system as evaluated over 2 years

Treatment	Total native and added available N (kg/ha)*	N removed by crops (kg/ha)**	Computed balance (kg N/ha)	Soil net grain (kg N/ha)
D_1F_0				
N_0	403	166.0	237.0	-67.0
N_{50}	503	226.4	276.3	-36.3
N_{100}	603	289.9	313.1	-3.0
N_{150}	703	326.5	376.5	+12.1
D_1F_1				
N_0	403	167.5	235.5	-58.9
N_{50}	503	253.8	249.2	-26.0
N_{100}	603	337.6	265.4	+30.1
N_{150}	703	366.8	336.2	+41.9
D_1F_2				
N_0	403	186.6	216.4	-47.5
N_{50}	503	255.9	247.1	-23.3
N_{100}	603	324.2	278.8	+19.1
N_{150}	703	371.7	331.3	+35.0
D_2F_0				
N_0	403	130.9	272.1	-76.5
N_{50}	503	170.0	332.1	-16.6
N_{100}	603	198.5	404.5	+21.0
N_{150}	703	220.8	482.4	+30.0
D_2F_1				
N_0	403	146.9	256.1	-37.0
N_{50}	503	195.5	307.5	-16.3
N_{100}	603	229.0	374.0	+41.5
N_{150}	703	256.6	451.4	+53.1
D_2F_2				
N_0	403	149.4	253.6	-38.5
N_{50}	503	199.5	303.5	-14.5
N_{100}	603	234.4	368.6	+28.1
N_{150}	703	266.9	436.1	+44.8

* Initial soil N 283 kg/ha

** uptake of 2 annual cropping cycle of 2 years

Nitrogen balance

Nitrogen balance sheet (Table 2) revealed that there was a positive net gain of nitrogen at higher doses of nitrogen (N_{100} and N_{150}) in combination with organic manure. Lower doses of N (N_0 and N_{50})

alone or in combination with manure resulted in negative N gain of available soil nitrogen. Prasad (1994) also reported similar findings. Transplanting rice on 30 June recorded more N net gain than 15 June transplanting. This may be because the

nitrogen-utilized by crops in sequence was between 41.2 and 56.0 with 15 June transplanting compared to 30 June transplanting ranging from 31.1 to 39.6%.

This confirms the positive role of organic manure incorporation in increasing crop yield in sequence which commensurate with resultant increase in available soil nitrogen and crop productivity.

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Key words: Cropping system, Production potential, Economic, Wheat.

was to find out to study the effect of organic manure on the response of crops to nitrogen. The study was conducted in a field of brown sarson (oilseed rape) and wheat.

EXPERIMENTAL AND METHODS

A field experiment was conducted in the winter season of 1993–94 at the Agricultural Research Station, Ludhiana (Punjab) in India. The experiment was conducted in a randomized block design with three replications. The treatments were organic manure (0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 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