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Performance of basmati rice (*Oryza sativa*) through organic source of nutrients*

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In Punjab, 60% of the cropped area is under rice (*Oryza sativa* L.)–wheat (*Triticum aestivum* emend. Fiori. & Paol.) cropping system and production of these two crops in this region has played a pivotal role in the food security of India. Rice–wheat cropping system removes about 600–700 kg/ha NPK as compared to 390 kg/ha applied when producing 11 tonnes/ha of productivity. This negative nutrient balance every year led to affect the soil health so, the productivity levels are not increasing. The problem further aggravates in rice as puddling is done and ponding of water creates reduced conditions affecting physical and biological properties of soil. In this direction, organic sources of nutrients are the best alternative for improving physical and biological properties of soil and improving crop productivity of rice (Khan *et al.*, 2004). Basmati crop is having high export potential and can successfully be grown using organic source of nutrition. The demand of organic product is increasing all over the world as increasing number of people are becoming health conscious. In this direction, organic farming of basmati rice may increase the profitability of the farmers by earning foreign exchange. Organic rice production has played an important role in boosting the income of farmers in north-east Thailand by expanding market demand in European countries (Stockdale *et al.* (2001)). As Punjab is the highest productivity zone of India, farmers rely on heavy use of fertilizers and information on the performance of basmati rice through organic source of nutrients in this region is scanty. So, with such background, the present investigation was undertaken to evaluate the relative efficacy of different organic source of nutrients on the performance of basmati rice at Punjab Agricultural University, Ludhiana during rainy (*kharif*) season of 2006 and 2007. The texture of the soil is loamy sand with *p*H 7.09, organic matter content 0.27%, available P 8.6 ppm and exchangeable K 11.2 ppm. The experiment was laid out in a randomized complete block design with three replications comprising of six treatments which include: (i) untreated control, (ii) recommended level of N (40 kg/ha), (iii) green leaf manuring (GLM) 10 tonnes/ha, (iv) vermicompost (VC) 2.5 tonnes/ha, (v) GLM 5 tonnes/ha + VC 2.5 tonnes/ha, and (vi) Neem-cake 2.5 tonnes/ha. All plots had not received any inorganic P and K fertilizers. Each plot in the experiment had a gross plot size of 15 m^2. For GLM, 45 days old *Sesbania aculeate* crop that was raised nearby field was chopped with the help of chopper and then applied to the plots as per treatment on air dry weight basis. Similarly, VC and neem-cake were also applied to their respective plots as per treatments on air dry weight basis. Seedlings of 30 days old nursery of Superbasmati variety were transplanted on a puddle field with a spacing of 20 cm between rows and 15 cm between hills in the second week of July during both the years. Puddling was done by running cultivator in standing water (75 mm), followed by planking. All the treatments except recommended N treatment were imposed at the time of puddling. In recommended N treatment, N was applied in two equal splits as top-dressing 21 days after transplanting (DAT) and 42 DAT. We randomly collected four samples to measure the amount of nutrients (N, P and K) in each organic source. On that basis, Green leaf manure had (10 tonnes/ha) supplied 50 kg N + 25 kg P_2O_5 and 30 kg K_2O/ha to the crop. Vermicompost had (2.5 tonnes/ha) supplied 37.5 kg N + 20 kg P_2O_5 and 22.5 kg K_2O/ha to the crop. Neem cake (2.5 tonnes/ha) had supplied 50.5 kg N + 20 kg P_2O_5 and 12.5 kg K_2O to the crop. GLM (5 tonnes/ha) +VC (2.5 tonnes/ha) had supplied 62.5 kg N + 32.5 kg P_2O_5 and 37.5 kg K_2O to the crop. Irrigation management comprised of continuous flooding for 15 days after transplanting, followed by intermittent irrigation at 3 days interval up to 14 days before harvest. Hand-weeding was done once at 30 DAT. No insecticides and fungicides were used in this experiment. Five plants from the border rows of each plot were randomly selected for leaf and stem dry weight measurement at 30 DAS and at panicle initiation (PI)

*Short note

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stage. The nitrogen, phosphorus and potassium contents of leaves and stems were determined at PI during 2006 only. At harvest; grain yield was measured at 14% grain moisture content. At the same time, five hills were selected randomly from each plot for measuring agronomic parameters including plant height, number of productive tillers/m^2, grains/panicle and sterility. In a combined analysis of data, the interaction of years and treatments was non-significant; therefore, the data were pooled over the years (a total of six replications) for further analyses . Treatment means were separated using least significant differences at the 5% level of significance.

The growth, yield-attributing parameters and yield of basmati rice have been significantly affected by various organic sources of nutrients. The data on leaf and stem dry weight at 30 DAT and at PI stage; (Table 2) indicate that these parameters were improved with recommended level of N (RN) as compared to untreated control, while RN proved significantly inferior than organic sources of nutrient, viz GLM, VC, GLM+VC and Neem cake. During both the stages of crop growth (30 days after transplanting and at panicle initiation stage) highest leaf dry weight was observed with GLM+VC, followed by GLM and both these treatments were found significantly superior than control and recommended level of N respectively. Similar trend was noticed for stem dry weight at both the stages. The data on plant height at harvest stage of crop revealed that plants were significantly taller in all the treatments as compared to untreated control. Prakash *et al.* (2003) reported that growth characters of basmati rice were improved with various organic sources of nutrients.

The maximum grain yield (3.56 tonnes/ha) of basmati rice was obtained where nutritional need was fulfilled through GLM+VC, which was found at par with GLM alone and neem cake, but significantly superior than vermicompost, recommended N and control treatments respectively.

Grain yield with GLM+VC, GLM and neem-cake increased to the extent of 52.7, 46.3 and 43.8% respectively

Table 1 Leaf, stem dry weight (g) and final plant height (cm) as affected by various treatments

	UC	RN	GLM	VC	GLM+VC	Neem cake	LSD (P=0.05)
Leaf dry weight (30 DAT)	42.5	45.3	60.3a	53.6	62.9	60.3a	2.3
Leaf dry weight (PI)	135.4	139.7	177.0a	157.5	182.8	174.6a	3.4
Stem dry weight (30 DAT)	57.2	60.2	83.8	73.3	90.5	80.1	3.7
Stem dry weight (PI)	290.7	315.6	393.0a	346.7	394.5	388.0a	4.2
Plant height (cm)	116.7	124.8a	126.8a	126.1a	126.3a	126.0a	2.4

UC, Untreated control; RN, recommended nitrogen 40 kg/ha; GLM, green leaf manuring; VC, vermicompost

Table 2 Yield attributes and yield (tonnes/ha) as affected various treatments

	UC	RN	GLM	VC	GLM+VC	Neem-cake	LSD (P=0.05)
Panicles/m^2	316	315	374a	355	382a	370	16.7
Grains/Panicle (no.)	59	63	74a	69b	77a	72b	3.0
Spikelet sterility (%)	21.0	19.2a	18.6	18.9a	18.1	18.8a	0.5
1000-grain weight (g)	19.8	20.3	20.9a	20.5	21.2a	20.8a	0.4
Grain yield	2.33	2.84	3.41a	3.10	3.56a	3.35a	0.30

UC, Untreated control; RN, recommended nitrogen 40 kg/ha; GLM, green leaf manuring; VC, vermicompost

Table 3 Leaf and stem nutrient content (%) at PI stage as affected various treatments

	UC	RN	GLM	VC	GLM+VC	Neem-cake	LSD (P=0.05)
Leaf N	2.32	2.44	2.67a	2.38	2.65a	2.64a	0.09
Leaf P	0.21	0.26	0.36a	0.36a	0.38a	0.35a	0.05
Leaf K	2.50	2.60	3.24	4.10a	3.99a	3.98a	0.06
Stem N	1.56	1.58	1.65a	1.50	1.66a	1.63a	0.05
Stem P	0.32	0.32	0.31	0.30	0.30	0.30	NS
Stem K	1.88a	1.89a	1.63	2.50	1.80	2.10	0.04

UC, Untreated control; RN, recommended nitrogen 40 kg/ha; GLM, green leaf manuring; VC, vermicompost

as compared to untreated control. Treatments RN and VC caused 21.9 and 33% increase in yield over untreated control (Table 1). The availability of nutrients through organic sources continue for a long time and its application at the time of transplanting helped to establish the crop vigour better as evident from the yield attributes (Table 1) and hence more yield was obtained. Since organic manures contain secondary and micro nutrients, so their addition also improved the physical condition of soil (Prasad 2005). As a result the response to organic manure is favourably accrued. Relatively higher grain yield with GLM +VC and neem-cake application due to addition of more volume and higher N content. Data pertaining to leaf and stem nutrient% at panicle initiation stage (Table 3) revealed that leaf N and P% were at par in treatments, viz GLM, GLM+VC and neem-cake, but significantly higher than control and recommended level of N. Similar trend was noticed for stem N%. As the C:N of GLM was very low, so it decomposed in a short span of time, released the nutrients for the development of crop. Whereas, in vermicompost treatment, less quantity of nutrient was applied as compared to GLM. Yield attributes, viz panicles/m^2, grains/panicle and 1000-grain weight were found at par with treatments GLM, GLM+VC and neem-cake while, significantly higher than untreated control and RN (Table 3). GLM+VC found to be more beneficial than VC alone with respect to grain yield. This may be because of lower C:N of GLM that helped very fast decomposition of organic manure and caused very quick availability of nutrients. Maximum grain yield due to organic manures has been reported by various workers (Urkurkar *et al.* 2010, Polthanee *et al.* 2008).

SUMMARY

Grain yield of basmati rice improved with organic source of nutrients as compared to recommended level of N and untreated control. GLM (5 tonnes/ha) + VC (2.5 tonnes/ha), GLM (10 tonnes/ha), neem cake (2.5 tonnes/ha) caused 20.2, 16.7 and 15.2% higher grain yield than recommended level of N respectively. So, it was concluded that GLM (10 tonnes/ha) or GLM (5 tonnes/ha) + VC (2.5 tonnes/ha) or neem cake (2.5 tonnes/ha) are an ideal organic nutrition module/dose to meet the nutritional requirement of basmati crop and is best alternative to inorganic fertilizer without significant loss in grain yield.

REFERENCES

Polthanee A, Tre-loges V and Promsena K. 2008. Effect of rice straw management and organic fertilizer application on growth and yield of dry direct-seeded rice. *Paddy Water Environment* **6**: 237–41.

Prakash YS, Bhadoria PBS, Rakshit A and Wais A. 2003. Response of basmati rice to integrated nutrient sources in lateritic soil of eastern India. *Italian Journal of Agronomy* **6**: 143–50.

Prasad R. 2005. Organic farming vis-à-vis modern agriculture. *Current Sci*ence, India **89**: 252–4.

Stockdale EA, Lampkin NH, Hovi M, Keating R, Lennartsson EKM, Macdonald DW, Padel S, Tattersall FH, Wolfe MS and Watson, CA 2001. Agronomi and environmental implications of organic farming systems. *Advances in Agronomy* **70**: 261–327.

Urkurkar JS, Tiwari A, Chitale S. and Bajpai RK 2010. Influence of long-term use of inorganic and organic manures on soil fertility and sustainable productivity of rice (*Oryza sativa*) and wheat (*Triticum aestivum*) in inceptisols. *Indian Journal of Agricultural Sciences* **80**: 208–12.