



Effect of vermicompost and fertility levels on growth, yield, nutrient uptake and net returns in pearl millet (*Pennisetum glaucum*)

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Pearl millet (*Pennisetum glaucum* L.) known as bajri or bajara is one of fourth most important food crop in India after rice, wheat and sorghum and it is well adapted to drought, low soil fertility and acidic soil. It's generally grown as a rainfed crops during *kharif* season in Rajasthan. Rajasthan has largest area of pearl millet in the country 54.89 lakh hectare with a production of 60.91 lakh tonnes and an average productivity of 1110 kg/ha (Anonymous 2010-11). It is nutritionally better than many cereals as it is a good source of protein (11.6%) and minerals particularly iron (2.8%). Increased uses of chemical fertilizers without adequate organic recycling has not only aggravated multi-nutrients deficiencies in soil plant system but also deteriorated soil health and created environmental pollution. Efficiencies of organic manures like vermicompost not only for improving and building up of soil fertility but also increasing efficiency of chemical fertilizer. Vermicompost is a rich mixture of macro and micro plant nutrients. It also increases microbial availability of nitrogen and phosphorus and improves microbial action in the soil. The integration of chemical fertilizers with organic source of nutrients will be able to maintain soil fertility and sustain crop productivity. The interactive advantage of combining inorganic and organic sources of nutrients generally proved superior to the use of each component separately (Singh and Yadav 1992). Keeping in view of the above situation, the present in investigation was carried out to study the response of pearl millet to suitable dose of RDF in conjunctive with vermicompost on growth, yield and quality.

A field experiment was conducted during the rainy (*kharif*) season of 2010 at Agronomy farm of SKN College of Agriculture, Jobner (Rajasthan) to study the effect of vermicompost and fertilizers on growth, yield attributes, yield and economics of rainfed pearl millet. The pearl millet hybrid HHB 67 was sown at 45 cm × 10 cm spacing on 10 July 2010 and harvested on 25 September 2010. The

experiment was laid out in factorial randomized block design comprising of four levels of vermicompost (control, 2, 4 and 6 tonnes/ha) and four levels of fertility (control, 50% RDF, 75% RDF and 100% RDF) and replicated thrice. The experimental soil was loamy sand in texture, slightly alkaline in reaction (PH 8.2), poor in organic carbon (0.13%) available nitrogen (128.3 kg/ha), available potassium (154.3 kg K₂O/ha) and medium in phosphorus (16.1 kg P₂O₅/ha). Vermicompost was applied as per treatments at time of sowing and thoroughly incorporated in open furrows with the help of spade. The recommended dose of fertilizer to pearl millet was 60 kg N and 30 kg P₂O₅/ha. 50% dose of N and full dose of P₂O₅ was applied as basal at 8-10 cm depth by *pora* method prior to sowing in each treatments and the remaining dose of nitrogen was applied as top dressing at 30 DAS through urea under all the treatments.

Significantly higher plant height and effective tillers per metre row length was obtained with the application of vermicompost and RDF. The plant height was significantly at par with the different levels of vermicompost but at 100% RDF it was higher over 50% RDF. Application of 100% RDF (60 kg N and 30 kg P₂O₅/ha) increased the plant height by 15.6, 9.2 and 3.2 percent over control, 50 and 75% RDF, respectively. Effective tiller per metre row length was increased successively with the higher doses of vermicompost and RDF (Table 1). It is established fact that vermicompost improves the physical and biological properties of soil including supply of almost all that essential plant nutrients for the growth and development of plant, ultimately increased the plant height and number of effective tillers per meter row length. The results are in agreement with finding of Rajput (2008) and Narolia *et al.* (2009).

Vermicompost and fertility level influenced the grain weight per ear head of the Bajri crop. Grain weight per ear head was recorded significantly at par with 4 and 6 tonnes/ha vermicompost and higher over 2 tonnes/ha and control. Application of 75 and 100% RDF was found significantly at par and higher over 50% RDF in terms of grain weight per ear head. The in creasing levels fertility up to significantly increased plant height at all the stage of crop growth. At

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Table 1 Effect of vermicompost and fertility levels on the nutrient content, uptake and net returns in pearl millet

Treatment	Nitrogen content (%)		Nitrogen uptake	Phosphorus content (%)		Phosphorus uptake (kg/ha)	Net returns (₹/ha)
	grain	stover		grain	stover		
<i>Vermicompost (t/ha)</i>							
Control	1.63	0.55	44.21	0.276	0.102	7.81	10798
2 tonnes/ha	1.80	0.59	57.90	0.291	0.109	10.03	11785
4 tonnes/ha	1.85	0.62	67.42	0.301	0.114	11.60	11234
6 tonnes/ha	1.90	0.64	73.80	0.308	0.116	12.65	9407
SEm ±	0.04	0.01	2.37	0.007	0.003	0.43	244
CD (P = 0.05)	0.1	0.04	6.81	0.019	0.007	1.23	705
<i>Fertility levels</i>							
Control	1.52	0.51	42.60	0.234	0.098	7.40	7420
50% RDF	1.72	0.58	56.21	0.276	0.107	9.69	9875
75% RDF	1.89	0.65	68.02	0.316	0.115	11.64	12134
100% RDF	2.04	0.68	76.20	0.350	0.120	13.37	13794
SEm ±	0.04	0.01	2.37	0.007	0.003	0.43	244
CD (P = 0.05)	0.11	0.04	6.8	0.019	0.007	1.23	705

harvest the treatment recorded an

Grain and stover yield of pearl millet was increased successively with the higher doses of vermicompost and RDF (Table 1). The grain yield at the application of 6 tonnes/ha vermicompost (1.99 tonnes/ha) was increased by 51.4, 20.1 and 7.3 percent, however, stover yield was increased by 42.0, 19.3 and 6.8 percent over control, 2 and 4 tonnes/ha, respectively. Increasing levels of fertility significantly enhanced all the yields. Application of 100 % RDF significantly increased grain yield by 37.7, 16.4 and 6.5, whereas, stover yield by 33.9, 16.2 and 6.5 percent over control, 50% and 75% RDF respectively. The test weight was recorded higher with the application of 4 and 6 tonnes/ha vermicompost over control. Application of 100 % RDF improved the test weight significantly over control and 50% RDF and it was at par with 75 % RDF.

Vermicompost and fertility levels increased the nutrient content and uptake of pearl millet (Table 2). Application of

vermicompost @ 6 tonnes/ha recorded significantly higher N content in grain (1.90%) and stover (0.64%) indicating an increase of 10.4 and 16.3 over control, 13.5 and 8.4 over 2 tonnes/ha and 16.6 and 3.2 percent over 4 tonnes/ha, respectively. While, use of 100% RDF topped the list by recording remarkably higher N content in grain (2.04%) and stover (0.68 %). Phosphorus content @ 6 tonnes/ha vermicompost in grain (0.308) and stover (0.116) was significantly higher by 11.6 and 13.7 percent over control. Phosphorus content in grain (0.308%) and stover (0.116%) @ 100% RDF enhanced the P content in grain by 49.6, 26.8 and 10.8 percent over control, 50 and 75% RDF, respectively. The increase in phosphorus content was also reported by Kar *et al.* (2006), Singh *et al.* (2006) in pearl millet.

An application of vermicompost attributed significant influence on nitrogen and phosphorus uptake by pearl millet. Considerably higher uptake of N (73.8 kg/ha) and P (12.65%) by pearl millet was observed with vermicompost @ 6

Table 2 Effect of vermicompost and fertility level on growth and yield parameters of pearl millet

Treatment	Plant height (cm)	Effective tillers/ metre row length	Grain weight/ ear head (g)	Yield (t/ha)		Test weight (g)
				Grain	Stover	
<i>Vermicompost (t/ha)</i>						
Control	160.8	18.2	5.81	1.26	3.89	6.99
2 tonnes/ha	171.0	21.7	6.51	1.64	4.64	7.30
4 tonnes/ha	177.2	23.5	6.93	1.85	5.20	7.54
6 tonnes/ha	180.6	25.1	7.24	1.99	5.54	7.64
SEm ±	3.9	0.42	0.14	0.04	0.11	0.18
CD (P = 0.05)	11.4	1.2	0.39	0.11	0.32	0.51
<i>Fertility levels</i>						
Control	15.8	19.2	5.64	1.39	4.05	6.93
50% RDF	168.5	21.5	6.46	1.65	4.68	7.25
75% RDF	178.2	23.1	7.11	1.80	5.10	7.53
100% RDF	184.0	24.4	7.28	1.92	5.43	7.77
SEm ±	3.9	0.42	0.14	0.04	0.11	0.18
CD (P = 0.05)	11.4	1.2	0.39	0.11	0.32	0.51

tonnes/ha as compared to other levels of vermicompost. However, application of vermicompost @ 4 tonnes/ha remained at par with 6 tonnes/ha (Table 2). An increase in total nitrogen and phosphorus uptake of pearl millet were observed under 100% RDF over 75, 50 and control. This could be due to the fact that the nitrogen fertilization increases the cation exchange capacity of plant roots and makes them more efficient which resulted in higher growth and yield attributes and consequently more nitrogen uptake by the crop. Application of full dose of fertilizer (100%RDF) recorded maximum and significantly higher uptake of N over control, 50 and 75% RDF and represented an increase of 78.0, 35.6 and 12.0 percent, respectively. The highest phosphorus uptake was recorded with application of 100% RDF which showed an increase of 80.0, 38.5 and 14.7 percent, over control, 50 and 75%, respectively. The result obtained in the present investigation was in close conformity with the work done by Chaturvedi and Chandel (2005).

An increasing levels of vermicompost up to 2 tonnes/ha significantly increased the net return (₹ 11 785/ha) over other doses but it was found at par with 4 tonnes/ha vermicompost application. The highest net return was obtained when vermicompost was applied 2 tonnes/ha and minimum (₹ 9 407/ha) with 6 tonnes/ha vermicompost, because in each addition of higher dose of vermicompost increase the cost whereas the addition in terms of return is too low. The highest (₹ 13 794/ha) net return was recorded under 100% RDF as compared to rest of the treatment (Table 2). The cost involved under this treatment was comparatively lower than its additional income, which led to more return under this treatment.

SUMMARY

A field experiment was conducted during 2010 in semi-arid climate of Rajasthan to assess the effect of vermicompost and fertility levels on the pearl millet. Application of vermicompost @ 6 tonnes/ha significantly improved the growth and yield attributes and yields of the pearl millet. Application of vermicompost @ 6 tonnes/ha increased the

grain yield of pearl millet by 51.4, 20.1 and 7.3% and stover yield by 42.4, 19.3 and 6.3 percent respectively over control, 2 and 4 tonnes/ha vermicompost, respectively. Application of vermicompost @ 6 tonnes/ha recorded significantly higher N content in grain and stover indicating an increase of 10.4 and 16.3 over control, 13.5 and 8.4 over 2 tonnes/ha and 16.6 and 3.2 percent over 4 tonnes/ha, respectively. Phosphorus content in grain and stover were significantly higher by 11.6 and 13.7% over control. Application of 6 tonnes/ha of vermicompost significantly increased N and P uptake in pearl millet. The highest net return (₹ 11 785) was obtained with vermicompost @ 2 tonnes/ha and minimum with 6 tonnes/ha vermicompost. Application of 100% RDF significantly increased nutrient content, nutrient uptake and net return (₹ 13 798/ha) and proved significantly superior to all the lower levels of fertility.

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