

# Yield performance of different pearl millet varieties under organic nutrient management

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## ABSTRACT

A field experiment entitled "Yield performance of different pearl millet varieties under organic nutrient management" was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during the *Kharif* season, 2023 on loamy sand soil. The pearl millet crop under the influence of variety RHB-233, being at par with RHB-234 significantly enhanced plant height, number of leaves plant<sup>-1</sup> and dry matter accumulation plant<sup>-1</sup> at harvest, LAI at 40 DAS, LAR at 30-60 DAS and NAR 30-60 DAS stage over RHB-223 and HHB-299. In variety RHB-233, improvement manifested in the production of higher effective tillers (2.67), ear-head length (20.79 cm) and 1000 grains weight (8.32 g) with the concomitant increase in productivity in terms of grain (2388 kg ha<sup>-1</sup>), stover (5960 kg ha<sup>-1</sup>) and biological yield (8348 kg ha<sup>-1</sup>). Results showed that application of 100% RDN through vermicompost + 3% panchgavya significantly improved growth parameters *viz.*, plant height, number of tillers plant<sup>-1</sup>, number of leaves plant<sup>-1</sup> and dry matter accumulation plant<sup>-1</sup> at successive growth stages and yield attributes *viz.*, effective tillers (2.77), earhead length (21.29 cm) and 1000-grains weight (7.90 g) thereby grain (2484 kg ha<sup>-1</sup>), stover (6147 kg ha<sup>-1</sup>) and biological yield (8632 kg ha<sup>-1</sup>) of pearl millet crop over rest of the treatments.

**Key words:** Organic nutrient management, panchgavya, pearl millet, vermicompost, yield attributes.

## INTRODUCTION

Pearl millet [*Pennisetum glaucum* (L.) R. Br. Emend Stuntz] is one of the important millet crop of India as well as in Rajasthan. It is a short day, C<sub>4</sub> plant with high photosynthetic efficiency and dry matter production capacity adapted to hot climate. It is a warm weather coarse cereal crop grown in arid and semi-arid climate of tropical and subtropical regions of the country. It is staple food of poor and small land holders and also provides source of fodder and feed for livestock in the rainfed area in the Rajasthan. In India, pearl millet is the third most widely cultivated food

crop after rice and wheat on area basis. Pearl millet is nutritionally better than many other cereals as 100 grams of pearl millet has the nutritional values *viz.*, energy (361 kcal), moisture (12 g), fiber (1.2g), fat (5 g), carbohydrate (67.5 g), protein content (12.1 g), calcium (42 mg), phosphorus content (296 mg), iron (8 mg), zinc (3.1 mg), vitamin-E and B-complex and many amino acids (ICMR, 2010; Saleh *et al.*, 2013).

Recently, in pearl millet several high yielding hybrids with good adaptation to various environments have been developed. Despite the availability of newly developed hybrids, many of the obsolete varieties and traditional land races are quite occupying high area under cultivation and contributing to penurious productivity of pearl millet. Hence, there is a severe need to replace them with

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newly developed high potential hybrids for better production and profitability of the farmers. Presently, different studies are being conducted to evaluate released hybrids of pearl millet for grain and stover yield for arid and semi-arid climate of Rajasthan. Pearl millet hybrids play an important role in boosting crop productivity and the superiority of hybrids over varieties of pearl millet has already been proved. Many of these hybrids, however, had to become susceptible to downy mildew disease which needs to be replaced (Sharma, 2014).

Vermicompost is a sustainable organic source of nutrients regenerated from organic wastes using earthworms. It is a rich source of nutrients (1.67% N, 1.2% P, 1.05% K and 7.61% Ca, 0.56% Mg, 0.11% Zn, 1.33% Fe). Besides containing a good proportion of exchangeable Ca, Mg and Na etc., it adds organic carbon to the soil and helps to release the nutrients slowly and effectively to root zone of the crop plants. Vermicompost also help in reducing C: N and increase humus content of the soil. In Sanskrit, panchgavya means blend of five substance obtained from desi cow, which is mixture of 5 products of cow such as dung, urine, milk, curd and ghee in a proper (5:3:2:2:1) with this banana, jaggery and coconut water is added that allows it to ferment and the product is known as panchgavya. In the past decade, the use of panchgavya is getting adaptive popularity in Indian agriculture. It has got reference in the scripts of Vedas and Vrikshayurveda (Natarajan, 2002).

#### MATERIALS AND METHODS

The experiment entitled "Yield performance of different pearl millet varieties under organic nutrient management" was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during the *Kharif* season, 2023 on loamy sand soil. The experiment was laid out in split plot design comprising combinations of four pearl millet varieties (RHB-223, RHB-233, RHB-234 and HHB-299) and five organic nutrient management treatments (Control, 100% RDN through VC, 100% RDN through VC + 3% PG, 75% RDN through VC + 3% PG and 50% RDN through VC + 3% PG). Experimental farm is situated in

South-Eastern part of Rajasthan at an altitude of 427 meter above mean sea level with 26° 05' N latitude and 75° 28' E longitude and this area falls under agro-climatic zone III-A (Semi-Arid Eastern Plain) of Rajasthan. Observations on growth, physiological parameters, yield attributes and yield of pearl millet were recorded from five randomly selected and tagged plants in each plot. Plant height and number of leaves plant<sup>-1</sup> were measured at harvest, while dry matter accumulation was determined after oven drying the sampled plants at harvest.

Leaf area index (LAI) at 40 DAS calculated by formula (Watson, 1952)

$$LAI = \frac{\text{Leaf area per plant (cm}^2\text{)}}{\text{Ground area occupied per plant (cm}^2\text{)}}$$

Leaf area ratio (LAR) at 30-60 DAS calculated by following formula (Radford, 1967)

$$LAR = \frac{\text{Leaf area (cm)}}{\text{Total plant dry wt (W)}}$$

Net assimilation rate (NAR) at 30-60 DAS were computed using standard formulas.

$$NAR = \frac{(W_2 - W_1)}{(T_2 - T_1)} \times \frac{(\text{Log}_e L_2 - \text{Log}_e L_1)}{(L_2 - L_1)}$$

Yield attributes such as effective tillers plant<sup>-1</sup>, ear-head length and test weight were recorded at maturity. Grain and stover yields were obtained from net plot area after harvesting and converted into kg ha<sup>-1</sup>, and biological yield was calculated as the sum of grain and stover yield. Harvest index (HI) were computed by using formula (Donald (1962).

$$HI = \frac{\text{Economical yield}}{\text{Biological yield}} \times 1000$$

The data were analyzed statistically using analysis of variance (ANOVA) for randomized block design. The observation were recorded at harvest and analysed by statistical methods (Fisher, R.A. 1950).

#### RESULTS AND DISCUSSION

The results of the experiment revealed that different pearl millet varieties significantly im-

proved yield attributes and productivity of pearl millet, Variety RHB-233 recorded the higher growth parameters *viz.*, plant height (193.2 cm), number of leaves plant<sup>-1</sup> (15.4), dry matter accumulation plant (540.3 g mrl<sup>-1</sup>) at harvest presented in Table 1. Whereas; growth indices such as LAI (3.89) at 40 DAS, LAR (71.07 cm<sup>2</sup> g<sup>-1</sup>) at 30-60 DAS and NAR (2.92 g/m<sup>2</sup>/day) 30-60 DAS presented in Table 2.

Among the yield attributes *i.e.*, effective tillers (2.63), ear-head length (20.47 cm) with the con-

comitant increase in productivity in terms of grain (2344 kg ha<sup>-1</sup>), stover (5895 kg ha<sup>-1</sup>) and biological yield (8239 kg ha<sup>-1</sup>) presented in Table 3 which was statistically at par with RHB-234 and were superior to the RHB-223 and HHB-67. It is well established fact that growth, development and yield potential of pearl millet varieties is an outcome of environmental, genomic and agronomic interrelationship. Since, all the pearl millet varieties were grown under identical agronomic management and environmental situation, the ob-

**Table 1. Effect of varieties and organic nutrient management on growth attributes of pearl millet**

Treatment	Growth attributes		
	Plant height (cm)	Dry matter accumulation (g mrl <sup>-1</sup> )	Number of Leaves/plant
<i>Pearlmillet varieties</i>			
RHB-223	182.0	471.6	13.5
RHB-233	194.0	599.2	15.5
RHB-234	193.2	583.9	15.4
HHB-299	168.0	540.2	14.5
SEm±	3.20	10.42	0.28
CD (P=0.05)	10.07	36.07	0.86
<i>Organic nutrient management</i>			
Control	157.0	483.5	12.4
100% RDN through VC	185.4	567.8	15.2
100% RDN through VC + 3% PG	198.2	605.0	16.3
75% RDN through VC + 3% PG	184.2	563.4	15.1
50% RDN through VC + 3% PG	170.62	524.0	14.00
SEm±	3.30	12.26	0.37
CD (P=0.05)	12.39	35.31	1.05

**Table 2. Effect of varieties and organic nutrient management on physiological parameters of pearl millet**

Treatment	Growth indices		
	LAI(40 DAS)	LAR (cm <sup>2</sup> g <sup>-1</sup> ) at 30-60 DAS	NAR (g/m <sup>2</sup> /day) At 30-60 DAS
<i>Pearlmillet varieties</i>			
RHB-223	3.29	59.87	2.53
RHB-233	3.89	73.33	2.96
RHB-234	3.86	71.07	2.92
HHB-299	3.60	65.29	2.72
SEm±	0.06	1.24	0.05
CD (P=0.05)	0.21	4.30	0.17
<i>Organic nutrient management</i>			
Control	3.46	58.02	2.48
100% RDN through VC	3.95	69.78	3.00
100% RDN through VC + 3% PG	4.16	74.92	3.32
75% RDN through VC + 3% PG	3.92	69.41	2.97
50% RDN through VC + 3% PG	3.69	64.01	2.73
SEm±	0.07	1.66	0.06
CD (P=0.05)	0.19	4.77	0.19

served variation in overall growth of varieties seems to be due to their genetic milieu. The improvement in these growth parameters might have led to greater interception and absorption of radiant energy, resulting to higher photosynthesis and ultimately dry matter accumulation. These results are in close conformity with the finding of Rana and Reddy (2020), and Sutaliya *et al.*, (2022).

Further; findings indicate that different combinations of panchgavya and vermicompost significantly influenced the growth and yield parameters of pearl millet, among the combinations application 100% RDN through vermicompost + 3% panchgavya recorded the higher growth parameters *viz.*, plant height (198.16 cm), number of leaves plant<sup>-1</sup> (16.31), dry matter accumulation (605.01 g mrl<sup>-1</sup>) at harvest given in Table 1, among growth indices *i.e.*, LAI (4.16) at 40 DAS, LAR (74.92 cm<sup>2</sup> g<sup>-1</sup>) at 30-60 DAS and NAR (3.32 g/m<sup>2</sup>/day) 30-60 DAS (Table 2), whereas; yield attributes *viz.*, effective tillers (2.77), earhead length (21.29cm) and 1000-grains weight (7.90 g) thereby grain (2484 kg ha<sup>-1</sup>), stover (6147 kg ha<sup>-1</sup>) and biological yield (8632 kg ha<sup>-1</sup>) presented in Table 3, over rest of the combinations while the lowest values for these parameters were observed under the control. The significant improvement in growth, yield attributes and productivity of pearl millet with different combinations of

panchgavya and vermicompost can be attributed to their complementary roles in nutrient supply and physiological stimulation. (Somasundaram *et al.*, 2007). Application of 100% RDN through vermicompost along with 3% panchgavya resulted in superior plant height, leaf production, dry matter accumulation, leaf area index, leaf area ratio and net assimilation rate, indicating enhanced nutrient availability, improved photosynthetic efficiency and greater biomass production during the critical growth period (Patil *et al.*, 2019). Vermicompost supplies nutrients in a slow and sustained manner while improving soil physical and biological properties, whereas panchgavya acts as a bio-stimulant by providing growth-promoting substances, enzymes and beneficial microorganisms, collectively enhancing source strength and assimilate production. The improved vegetative growth under this combination was effectively translated into better sink development, as reflected by higher effective tillers, longer ear heads and greater 1000-grain weight, leading to increased grain, stover and biological yields (Sutaliya *et al.*, 2022). In contrast, the lower values observed under the control treatment may be due to limited nutrient availability and reduced physiological activity, which restricted biomass accumulation and assimilate partitioning. Harvest index found non-significant under both different pearl millet varieties and organic nutrient man-

**Table 3. Effect of varieties and organic nutrient management on yield attributes of pearl millet**

Treatment	Effective tillers/plant	Ear-head length (cm)	Grain yield (kg ha <sup>-1</sup> )	Stover yield (kg ha <sup>-1</sup> )	Biological yield (kg ha <sup>-1</sup> )	Harvest index (%)
<i>Pearlmillet varieties</i>						
RHB-223	2.41	19.17	2185	5134	7319	29.92
RHB-233	2.67	20.79	2388	5960	8348	28.66
RHB-234	2.63	20.47	2344	5895	8239	28.42
HHB-299	2.15	17.62	2005	5552	7557	26.48
SEm±	0.04	0.31	41	89	88	0.55
CD (P=0.05)	0.15	1.07	143	307	305	NS
<i>Organic nutrient management</i>						
Control	2.12	17.45	1938	5036	6974	27.90
100% RDN through VC	2.55	20.08	2316	5799	8114	28.56
100% RDN through VC + 3% PG	2.77	21.29	2484	6147	8632	28.77
75% RDN through VC + 3% PG	2.53	20.00	2297	5777	8073	28.46
50% RDN through VC + 3% PG	2.34	18.75	2118	5417	7535	28.16
SEm±	0.05	0.39	57	116	120	0.71
CD (P=0.05)	0.16	1.12	164	334	345	NS

agement (Sharma *et al.*, 2013).

### CONCLUSION

Based on the results of above experiment, it is concluded that among the pearl millet variety RHB-233 performed best while in case of organic nutrient management treatment 100% RDN

through vermicompost + 3% panchgavya registered significantly higher grain yield, net return and B:C ratio. Thus, variety RHB-233 along with 100% RDN through vermicompost + 3% panchgavya may be recommended for achieving higher productivity and profitability of pearl millet.

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