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Research Article

Cultivars and Integrated Nutrient Management Influence on Summer Pearl Millet

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ABSTRACT

The effect of different cultivars and integrated nutrient management practices on summer pearl millet has been studied in an experiment conducted at College of Agriculture, Rajendranagar. This study was carried out during Summer season, 2017 in sandy loam soil. It comprised of three cultivars namely, ICMV-221 (C_1), Dhanashakti (C_2) and PHB-3 (C_3) and three integrated nutrient management practices i.e 100% RDF (F_1), 75% RDF + 25% N through vermicompost (F_2) and 75% RDF + Biofertilizers @ 5 kg ha^{-1} (F_3) incubated with vermicompost @ 500 kg ha^{-1} (F_3) which were tested under Factorial randomised block design in three replications. Growth, yield and economics was found to rise with C_3 among the three cultivars. Application of integrated nutrient management practices resulted in increased growth, yield and economics of pearl millet with F_3.

Keywords: *Pearl millet, Cultivars, Integrated nutrient management, Growth, Yield and economics*

INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) known as bajri or bajra 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 conditions. It is grown in poor sandy soil due to drought escaping character and also provides staple food in short period relatively in dry tracts of the country. It is adopted to stress intensive environment, versatile, input responsive and high quality cereal with great potential to become a valuable component of non-traditional season like summer under irrigated and high input management conditions (Jakhar et al., 2013). Pearl millet is an indispensible arid and semi-arid crop of India cultivated as dual purpose (food and fodder) crop in over 7.67 million hectares producing 9.10 million tonnes with productivity of 1188 kg ha^{-1} and covers about 9.5% of irrigated area (Directorate of economics and statistics, 2015).

The main reason for low productivity is that the crop is raised under rainfed conditions on low fertility soils. Selection of a proper hybrid/variety is an important consideration that affects pearl millet production and productivity levels.

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Cultivars with different make up respond differently to various climatic conditions. Use of organic manures in crop production and beneficial effect of its integration with inorganic fertilizers is often regarded as panacea to sustain higher levels of productivity coupled with environment safety. Improved pearl millet cultivars respond well to nutrient application. However, unless the nutrients are replenished, higher yields cannot be expected from the succeeding crop. Since information pertaining to above aspects is meager and keeping the above facts under consideration, the present experiment was conducted to study the influence of cultivars and integrated nutrient management on growth, yield and economics of summer pearl millet.

MATERIALS AND METHODS

The field experiment was conducted at College farm, College of Agriculture, Rajendranagar during *Summer*, 2017. The soil of experimental plot was sandy loam in texture with slightly alkaline, low in available nitrogen, medium in organic carbon, high in available phosphorus and available potassium. Experiment was carried out with three cultivars namely, ICMV-221 (C_1), Dhanashakti (C_2) and PHB-3 (C_3) as first factor and three integrated nutrient management practices i.e 100% RDF (F_1), 75% RDF + 25% N through vermicompost (F_2) and 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with vermicompost @ 500 kg ha^{-1} (F_3) as second factor comprising nine treatment combination, laid out in randomized block design with factorial concept, replicated thrice.

The crop was sown with spacing of 45 cm ×15 cm using 4 kg ha^{-1} on 16th January, 2017. Basal application of nitrogen was performed according to the treatments. Nitrogen was applied through urea in two equal splits, first as basal and the remaining dose at 30 DAS (days after sowing) i.e. at knee high stage, whereas full dose of P_2O_5 (40 kg ha^{-1}) and full dose of K_2O (30 kg ha^{-1}) were applied through single super phosphate and muriate of potash respectively, as basal dose to all the experimental plots.

Data on different characters *viz.*, growth, yield components, yield of summer pearl millet were subjected to analysis of variance procedures as outlined for randomized block design factorial concept (Gomez & Gomez, 1984). Statistically significance was tested by F-value at 0.05 % level of probability and critical difference was worked out where ever the effect were significant. Treatment differences that were non–significant were denoted as 'NS'.

RESULTS AND DISCUSSION

Cultivar C_3 *i.e* PHB-3 registered highest plant height, no.of tillers m^{-2} and LAI, followed by Dhanashakti (C_2) and ICMV -221(C_1) (Table 1). Interaction effect on cultivars and integrated nutrient management on plant height of pearl millet was found to be non-significant.

The plant height recorded at harvest stage of crop was significantly higher in hybrid *i.e* PHB-3 over the remaining cultivars due to the variation in genetic constitution of different cultivars which utilized available resources such as nutrient, water and sunlight efficiently. Thereby, resulting in higher nitrogen absorption for synthesis of protoplasm responsible for rapid cell division increasing the plant height. The plant height difference between the cultivars in this study may be attributed due to hybrid vigour of the cultivar. These results are in conformity with Srikanth et al. (2000) and Munirathnam & Gautam (2004).

The maximum plant height due to 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1}supplied nutrients like N and P throughout crop growth stages by nitrogen fixation through *Azospirillum* and phosphorus availability by PSB, which encouraged the formation of new cell, cell division, cell elongation and root development. The vigorous growth of root system ultimately helped in better absorption and utilization of nutrients from soil solution which reflected in overall plant growth and ultimately higher plant height. These findings corroborates with the findings of Lakum et al. (2011) and Patel et al. (2014).

Table 1: Effect of Cultivars and INM on growth of summer pearl millet

Treatments	Plant height	No. of tillers m^{-2}	LAI	Days to to flowering
Cultivars				
C_1: ICMV-221	170.2	20.7	2.68	49.1
C_2: Dhanashakti	182.0	23.2	2.84	46.5
C_3: PHB-3	194.1	26.5	3.01	51.3
SEm±	3.82	0.68	0.051	0.83
CD (P=0.05)	11.44	2.05	0.151	2.48
Integrated nutrient management				
F_1 :100% RDF	173.6	22.3	2.75	50.2
F_2 :75% RDF + 25% N through V.C	180.4	22.7	2.81	49.7
F_3 :75% RDF + Biofertilizers incubated with V.C @ 500 kg ha^{-1}	192.3	24.9	2.96	47.1
SEm ±	3.82	0.68	0.051	0.83
CD (P=0.05)	11.44	2.05	0.151	2.48
Interaction				
SEm ±	6.61	1.18	0.087	1.43
CD (P=0.05)	NS	NS	NS	NS

The maximum number of tillers of PHB-3 at all growth stages might be due to its higher tillering ability compared to rest of other cultivars, which can also be attributed to the genetic makeup of the cultivars. The results are in accordance with those of Meena et al. (2012) and Pathan & Bhilare (2009).

Significantly higher LAI with PHB-3 could be attributed to maximum plant height and number of tillers m^{-2}. The difference in the growth among the cultivars is attributed to the differences in their genetic constitution. These results are in concurrence with Prakash et al. (2014)

The significant effect of LAI, as consequence of vermicompost, biofertilizers and chemical fertilizers is attributed to the favourable nutritional status of soil and increased availability of N due to N fixation by *Azospirillum* and increased solubilization of native and applied P by PSB. This might have accelerated growth of new tissues and development of shoots that have ultimately increased leaf area index. These findings are in conformity with Raman and Krishnamoorthy (2016).

Days to 50% flowering

Among all the cultivars, Dhanashakti (C_2) (46.5 days) came to early flowering, followed by ICMV-221 (C_1) (49.1 days) and PHB-3 (C_3) (51.3 days). (Table 1)

With respect to integrated nutrient management 75 % RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} (F_3) recorded significantly minimum number of days to 50 percent flowering (47.1 days) followed by 75% RDF + 25% N through V.C (F_2) (49.7). Maximum number of days to 50 percent flowering was found with 100% RDF (F_1) which was at par with 75% RDF + 25% N through V.C.

Interaction effect of cultivars and integrated nutrient management was found to be non-significant.

Considerable variation in days to 50 percent flowering observed among the cultivars was due to variation in the duration of cultivars. The cultivar PHB-3 being long duration took more days to reach 50 percent flowering and Dhanashakti being short duration reached 50 percent flowering early.These results also substantiate the findings of Yadav et al. (2003).

Advancement in days to 50 percent flowering was observed due to integrated nutrient management treatments. Application of vermicompost and biofertilizers along with inorganic fertilizers increased production of organic acids which might have induced earliness in flowering. This is in conformity with the findings of Patel et al. (2014).

Table 2: Effect of Cultivars and INM on grain yield, stover yield and harvest index of summer pearl millet

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Cultivars			
C_1: ICMV-221	2389	4607	34.2
C_2: Dhanashakti	2605	4910	34.6
C_3: PHB-3	3239	5458	37.2
SEm±	58.3	90.0	0.7
CD (P=0.05)	174.8	269.7	1.97
Integrated nutrient management			
F_1 :100% RDF	2572	4803	35.22
F_2 :75% RDF + 25% N through V.C	2693	4932	35.27
F_3 :75% RDF + Biofertilizers incubated with V.C @ 500 kg ha^{-1}	3001	5240	35.54
SEm ±	58.3	90.0	0.7
CD (P=0.05)	174.8	269.7	NS
Interaction			
SEm ±	100.9	155.8	1.1
CD (P=0.05)	NS	NS	NS

Scrutiny of data revealed that significantly higher grain yield, stover yield and Harvest index was observed with PHB-3 (C_3) followed by Dhanashakti (C_2) and ICMV-221(C_1) . Among the integrated nutrient management treatments 75 % RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} (F_3) yielded maximum grain yield, stover yield and Harvest index compared to 75% RDF + 25% N through V.C (F_3) (2693kg ha^{-1}) and 100% RDF (F_1) (2572 kg ha^{-1}).(Table 2)

Difference in yields among the cultivars might be attributed due to better response of hybrid over the two composites resulting in increased number of effective tillers, better ear head length, girth and more no. of filled grains with higher test weight. Significantly better development of source in the form of dry matter accumulation, had contributed to the more yield attributes and higher yield. Similar results were also reported by Srikanth et al. (2000) and Satyajeet et al. (2007).

The biofertilizers, *Azospirillim*and PSB played an important role in supplying nitrogen and phosphorus to the plant and helped in higher growth and yield attributes. Increase of grain yield might also be due to the increased photosynthetic activity which resulted in higher accumulation of photosynthates and translocation to sink due to better source and sink channel which resulted in higher grain yield. These observations corroborate with those made by Satyajeet et al. (2007) and Patil & shete (2008).

Table: 3 Effect of Cultivars and INM on economics of summer pearl millet

Treatments	Cost of cultivation (₹ha^{-1})	Gross returns (₹ha^{-1})	Net returns (₹ha^{-1})	B:C ratio
Cultivars				
C_1: ICMV-221	16046	34470	18424	2.17
C_2: Dhanashakti	16046	37469	21422	2.37
C_3: PHB-3	16246	45941	29695	2.86
SEm±	-	831	732	-
CD (P=0.05)	-	2490	2194	-
Integrated nutrient management				
F_1 :100% RDF	14340	37720	23380	2.63
F_2 :75% RDF + 25% N through V.C	18590	38792	20202	2.09
F_3 :75% RDF + Biofertilizers incubated with V.C @ 500 kg ha^{-1}	15410	41368	25958	2.68
SEm ±	-	831	732	-
CD (P=0.05)	-	2490	2194	-
Interaction				
SEm ±	-	1439	1268	-
CD (P=0.05)	-	NS	NS	-

Economics

The data pertaining to economics of pearl millet showed that cultivars and integrated nutrient management differed significantly as shown in table 3

The highest gross returns, net returns and B: C ratio were obtained with PHB-3 (C_3) which was significantly superior over net returns and B: C ratio of Dhanashakti (C_2) and ICMV-221 (C_1).With regard to economics of pearl millet significantly influenced by integrated nutrient management revealed that higher gross returns, net returns and B:C ratio were recorded with 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} (F_3) compared to 100% RDF (F_1) and 75% RDF + 25% N through V.C (F_2) Experimental results revealed that interaction effect of cultivars and integrated nutrient management was found to be non-significant.

Higher growth parameters, yield attributes and yield produced by the hybrid PHB-3 resulted in maximum economics. These results are in accordance with Jayara (2011).Higher level of biomass accrual and efficient translocation to the reproductive parts due to supply of adequate nutrients through integrated nutrient management might be responsible for production of elevated yield attributes and thereby yield which resulted in higher monetary returns and B:C ratio. Similar findings were reported by Patil et al. (2014).

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