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Yield Attributes and Yield of Summer Pearl Millet as Influenced by Cultivars and Integrated Nutrient Management

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A B S T R A C T

A field experiment was conducted during *summer* season, 2017 on sandy loam soil of college Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. The experiment was laid out in Factorial Randomized Block design with 9 treatments and each treatment replicated three times. PHB-3 recorded significantly higher yield attributes, grain yield and stover yield compared to ICMV-221 and Dhanashakti. Among integrated nutrient management practices, 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} recorded significantly higher yield attributes, grain yield and stover yield over 75% RDF + 25% N through vermicompost and 100% RDF.

Introduction

Pearl millet (*Pennisetum glaucum*) is grown in arid and semi-arid regions of India for both grain and fodder. In India it is the fifth most important cereal grain crop next to rice, wheat, maize and sorghum. It is an imperative drought escaping cereal crop. India is the largest producer of pearl millet in the world occupying 7.32 Million hectares with annual production of 9.18 Million tonnes and average productivity of 1255 kg ha^{-1} (Directorate of Economics and Statistics, 2016). The Pearl millet growing countries are India, China, Nigeria, Pakistan, Sudan, Egypt, Arabia, and Russia. Pearl millet grain is more nutritious and the grain contains 11-19 % protein, 60-78% carbohydrates and 3.0-4.6% fat and also has good amount of phosphorous and iron (Reddy *et al.*, 2016). Though various breeding efforts in pearl millet have produced agronomical elite cultivars-both hybrids and varieties with high yielding potential, their adoption has been low in arid areas. Selection of a proper hybrid/variety is an important consideration that affects pearl millet production and productivity levels. Cultivars with different make up respond differently to various climatic conditions. Hybrids performs well with irrigation facilities or with good and evenly distributed rainfall, whereas varieties are well adapted to harsh growing areas and usually perform better than modern cultivars (Yadav *et al.*, 2003). Main reason for low productivity of this crop is water and nutritional stresses. One of the easiest ways for boosting productivity of pearl millet is the use of balanced fertilizers to the undernourished crop. Integrated use of chemical fertilizers with organic manures has been found to be quite promising in maintaining high productivity and providing greater stability to crop production (Patidar and Mali, 2004). Keeping in view of the importance the study was aimed to investigate the effect of cultivars and integrated nutrient management on yield, yield attributes and economics of summer pearl millet.

Materials and Methods

Field experiment was conducted in sandy loamy soil at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. The pH of the experimental site was 7.7, organic carbon was 0.65%, available nitrogen, phosphorus and potassium were 180 kg ha-1, 85 kg ha^{-1} and 360 kg ha^{-1} respectively. The treatments consisted of 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 V.C @ 500 kg ha^{-1} (F_3) as second factor comprising nine treatment combination, laid out in randomized block design with factorial concept, replicated thrice. Pearl millet was sown on 16th January, 2017 and harvested on 20th April. During the growing season, the mean weekly maximum, minimum temperature, relative humidity, sunshine hour day^{-1} and evaporation were 34.7ºC, 16.8 ºC, 76.1%, 26.2%, 8.7 hrs dy^{-1} and 6mm. Pearl millet was planted at a spacing of 45 cm x 15 cm using seed rate of 4 kg ha^{-1}. The N, P and K were applied through urea, vermicompost, SSP and MOP as per the treatments. Entire dose of phosphate and potash and half dose of N were incorporated into the soil basally at the time of final land preparation. The remaining half N was applied as split application at 30 DAS. *Azospirillum* and PSB each @ 5kg ha^{-1} were incubated with vermicompost @ 500 kg ha^{-1} at room temperature for 15 days and incorporated in the soil thoroughly with the help of spades before sowing.

At harvesting, 5 plants were sampled from the net plot from the plot-border of each plot to observe the yield attributes like girth of ear head, ear head length, no. of grains per ear head, grain weight per ear head and test weight. To determine grain yield, ear heads from the net plot were harvested and sun dried. Threshing was done by beating the ear heads with sticks. The separated grains were cleaned, dried in sun to bring down the moisture content to 12%.

To determine stover yield, stalks were cut at ground level and weighed after sun drying. The data were subjected to analysis of variance procedures as outlined for randomized block design factorial concept (Gomez and 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.

Results and Discussion

Yield attributes

Among the three cultivars PHB-3 registered significantly higher yield attributes *viz*., no. of effective tillers m^{-2}, girth of ear head, ear head length, no. of grains per ear head, grain weight per ear head and test weight compared to ICMV-221 and Dhanashakti (Table 1). The difference in number of effective tillers of these cultivars could be attributed to the higher tillering ability and conversion of total tillers into reproductive tillers.

Table.1 Yield attributes and yield as influenced by cultivars and integrated nutrient management

Treatments	No. of effective tillers m^{-2}	Girth of ear head (cm)	Ear head length (cm)	No. of grains per ear head	Grain weight per ear head (g)	Test weight (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Cultivars								
C_1: ICMV-221	12.4	10.3	21.4	2075	19.6	9.64	2389	4607
C_2: Dhanashakti	13.7	10.9	23.1	2205	21.7	10.25	2605	4910
C_3: PHB-3	15.2	11.6	26.2	2423	24.0	11.12	3239	5458
SEm$\pm$	0.30	0.19	0.48	42	0.7	0.18	58.3	90.0
CD (P=0.05)	0.90	0.58	1.4	126	2.0	0.55	174.8	269.7
Integrated nutrient management								
F_1 : 100% RDF	12.9	10.6	22.6	2154	20.5	9.98	2572	4803
F_2 : 75% RDF + 25% N through V.C	13.6	10.8	23.2	2210	21.3	10.24	2693	4932
F_3 : 75% RDF + Biofertilizers incubated with V.C @ 500 kg ha^{-1}	14.7	11.5	24.8	2339	23.4	10.80	3001	5240
SEm $\pm$	0.30	0.19	0.48	42	0.7	0.18	58.3	90.0
CD (P=0.05)	0.90	0.58	1.4	126	2.0	0.55	174.8	269.7
Interaction								
SEm $\pm$	0.52	0.33	0.83	72.7	1.18	0.32	100.9	155.8
CD (P=0.05)	NS	NS	NS	NS	NS	N.S	NS	NS

RDF= 80:40:30 kg ha^{-1} N: P_2O_5:K_2O, 25% N through V.C = 1.7 tonnes of vermicompost, Biofertilizers = (*Azospirillum* + PSB) each @ 5 kg ha^{-1}

Among the cultivars better partitioning of photosynthates from source to sink might have resulted in higher length of ear head. Test weight is mainly controlled by genetic makeup of the cultivars. Higher test weight of PHB-3 might be attributed to increase in transformation of assimilates in grain and subsequent development of more bold seeds. These results also substantiate the findings of Munirathnam and Gautam (2002) and Kumar *et al.,* (2004). Among the integrated nutrient management 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1}(F_3) recorded higher yield attributes over other treatments F_1 and F_2 (Table 1). The increase in yield attributes may be due to the fact that INM application of fertilizer make more availability of nutrients which is provide to a higher availability of nutrient to the plant, while vermicompost improves the soil-physical properties, hydraulic conductivity of the soil and also the availability of NPK, which promoted plant growth and development and resulting in increasing yield attributes of pearl millet. Use of bio-fertilizer (*Azospirillum* + PSB) led to higher availability of N and P as well as promoted the root growth, which promoted yield attributes characters. Corroborative results have also been reported by Lakum *et al.,* (2011) and Patel *et al.,* (2016), Bana *et al.,* (2012).

Grain yield

It was revealed from the results (Table 1) that the highest grain yield was produced with PHB-3 compared to ICMV-221 and Dhanashakti. It is well known fact that grain yield is the outcome of yield attributing characters, which also showed differentiation with different cultivars. These results corroborates with the findings of Satyajeet *et al.,* (2007). 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1}(F_3) produced maximum grain yield of pearl millet and was significantly superior over rest of the treatments. 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 Patil and shete (2008).

Stover yield

Higher stover yield was observed with PHB-3 which was significantly superior over ICMV-221 and Dhanashakti (Table 1). The more plant height, higher tiller number and dry matter accumulation recorded in the cultivar PHB-3 may have contributed for its higher stover yield over other two cultivars. The results were in accordance with Yadav and Kumar (2013). 75% R DF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} (F_3) recorded higher stover yield compared to F_1 and F_2. An increase in uptake of plant nutrients empowered the plant to manufacture more quantity of photosynthates resulting in more stover yield. Similar results were reported by Thumar *et al.,* (2016).

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