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IMPACT OF CULTIVARS AND INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF SUMMER PEARL MILLET

G Divya[1], K P Vani[2], P Surendra Babu[3] and K B Suneetha Devi[4]
[1,2,3,4] *Department of Agronomy, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar-500030.*

Abstract

A field experiment was conducted at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad during summer season, 2017 to evaluate the effect of cultivars and integrated nutrient management on growth, yield and economics of pearl millet. 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 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. Among cultivars PHB-3 recorded significantly higher plant height (194.1cm), dry matter production (8902 kg ha^{-1}), grain yield (3239 kg ha^{-1}), stover yield (5458 kg ha^{-1}), harvest index (37.23) gross returns (Rs. 45,940 ha^{-1}), net returns (Rs. 29,695 ha^{-1}) and B:C ratio (2.86). With respect to integrated nutrient management, 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} (F_3) showed maximum plant height (192.3 cm), grain yield (3001 kg ha^{-1}), stover yield (5240 kg ha^{-1}), harvest index (35.54) gross returns (Rs. 41,368 ha^{-1}), net returns (Rs. 25958 ha^{-1}) and B:C ratio (2.68) which was significantly superior over 75% RDF + 25% N through vermicompost (F_2) and 100% RDF (F_1).

Key words- Cultivars, Integrated nutrient management, vermicompost, biofertilizer, grain yield, stover yield

I. 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 (Choudhary *et al*., 2014). Globally, it ranks sixth in terms of area and shares 42 percent of total world production (Patel *et al.,* 2014). It is grown on large scale due to its drought escaping mechanism and lower water requirement as compared to other cereals like sorghum and maize (Meena and Gautam., 2005). 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).

The main reason for low productivity is crop raised under rainfed conditions on low fertility soils. 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.

Now a days, use of chemical fertilizer is increasing to boost up crop production. Simultaneously, cost of chemical fertilizer is increased constantly, besides these, only use of inorganic fertilizers is injurious to soil health and soil productivity. Integrated nutrient management involving chemical fertilizers, biofertilizers and organic manures is the key to the sustained productivity as it reduces dependence on chemical fertilizers and not only improves fertilizer use efficiency, but also improves soil productivity by improving physical, chemical and biological properties of soil.

Since information on pearl millet cultivars and integrated nutrient management is meager, the present investigation is carried out to study the influence of cultivars and integrated nutrient management on growth, yield and economics of summer pearl millet.

II. MATERIALS AND METHODS

A field experiment was conducted during *summer*, 2017 at College of Agriculture, Rajendranagar, Hyderabad to study the response of cultivars and integrated nutrient management on growth, yield and economics of pearl millet. The soil was sandy loam with the available N, P and K content in the soil were 180 kg ha^{-1}, 85 kg ha^{-1} and 360 kg ha^{-1} respectively. The soil was slightly alkaline in reaction having pH 7.7.

The experiment 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} incubated with V.C @ 500 kg ha^{-1} (F_3)which were tested under Factorial randomised block design in three replications.

The crop was sown with spacing of 45×15 cm using 4 kg ha^{-1} on 16th January, 2017. Basal application of nitrogen was done according to the treatments. Nitrogen was applied through urea in two equal splits, first as basal and the remaining dose at 30 DAS i.e. at knee high stage, whereas full dose of P_2O_5 (40 kg ha^{-1}) and 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.

III. RESULTS AND DISCUSSION

Growth characters

Plant height

Data presented in (Table 1) indicated that the plant height was significantly influenced by cultivars and integrated nutrient management. PHB-3 recorded maximum improvement in plant height (194.1 cm) and dry matter accumulation (8902 kg ha^{-1}) compared to Dhanashakti and ICMV-221. Increased plant height with PHB-3 might be 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. These results are in conformity with Munirathnam and Gautam (2004). Plant height of 192.3 cm was attained with 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} compared to 75% RDF + 25% N through V.C and 100% RDF. 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).

Dry matter production

The results revealed that cultivars and integrated nutrient management exerted their significant influence on dry matter production at harvest (Table 1). Significantly higher dry matter production of 8902 kg ha^{-1} was recorded with PHB-3 compared to ICMV-221 and Dhanashakti. Increased dry matter accumulation can be attributed to variability in the plant height and number of tillers. Kumar *et al* (2008) also reported similar results.75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} had produced maximum dry matter (8395 kg ha^{-1}) than 75 % RDF + 25% N through V.C and 100% RDF. Application of vermicompost and biofertilizers along with inorganic fertilizer increased nutrient availability to the crop by fixation and solubilization. Additionally, influenced the plant growth through production of IAA, GA and cytokinin which resulted in increase in plant height and more leaf area which intercepted and utilized solar radiation and consequently driven for more dry matter accumulation. Similar results were also reported by Bana *et al*. (2012).

Yield

Grain yield (kg ha^{-1})

Perusal of data pertaining to grain yield of pearl millet as influenced by cultivars and integrated nutrient management presented in (Table 1) indicates that the higher grain yield (3239 kg ha^{-1}) was obtained with PHB-3 which was significantly superior over Dhanashakti and ICMV-221. Difference in yields among the cultivars might be attributed due to better response of hybrid over the two varieties resulting in increased number of effective tillers, better ear head length, girth and more no. of filled grains with higher test weight. Similar results were confirmed by Patil and shete (2008). 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 of 3001kg ha^{-1} compared to 75% RDF + 25% N through V.C (F_3) (2693 kg ha^{-1}) and 100% RDF (F_1) (2572 kg ha^{-1}). An increase of 10.3% and 14.3% of grain yield was observed with F_3 compared to F_2 and F_1. 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).

Stover yield (kg ha^{-1})

The stover yield data of pearl millet is presented in (Table 1) indicates that the stover yield of pearl millet was significantly influenced by cultivars and integrated nutrient management. Significantly higher stover yield (5458 kg ha^{-1}) was realized with PHB-3 compared to ICMV-221 and Dhanashakti. The more plant height and high tiller number and dry matter accumulation recorded in the cultivar PHB-3 in the present study may have contributed for its higher stover yield over two cultivars. The difference in stover yield among cultivars might be also attributed to the effect of genetic traits of the cultivars. These results also substantiate the findings of Sharma *et al.* (1999) and Kumar *et al*. (2004).With respect to integrated nutrient management, higher stover yield of 5240 kg ha^{-1} was noticed with 75 % RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} compared to 75% RDF + 25% N through V.C. 100% RDF registered lower stover yield of 4803 kg ha^{-1} which was on par with 75% RDF + 25% N through V.C. The increase in stover yield might be due to the fact that phytohormones produced by the bio-fertilizers stimulated root growth and induced changes in root morphology, which in turn affected the assimilation of the nutrients. An increase in uptake of plant nutrients empowered the plant to manufacture more quantity of photosynthates resulting in more stover yield. Similar results were confirmed by Patil and shete (2008).

Harvest index

Harvest index of pearl millet was significantly influenced by cultivars (Table 1). The highest harvest index (37.23 %) was observed with PHB-3 and next best cultivar was Dhanshakti (34.62%) followed by ICMV-221(34.18). The variation in harvest index among the cultivars might be due to difference in partitioning efficiency of photosynthates from source to sink. These observations

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corroborate with those made by Yadav *et al.* (2004). Harvest index was found to be non significant with respect to integrated nutrient management.

Economics

Perusal of the data reveals that the highest gross returns (Rs. 45,941ha^{-1}) net returns (Rs. 29,695 ha^{-1}) and B: C ratio (2.86) were obtained with PHB-3 which was significantly superior over net returns and B:C ratio of Dhanashakti and ICMV-221 (Table 2). 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 gross returns (Rs. 41,368 ha^{-1}) net returns (Rs.25,958 Rs ha^{-1}) and B:C ratio (2.68) were recorded with 75% RDF + Biofertilizers @ 5 kg ha^{-1} incubated with V.C @ 500 kg ha^{-1} compared to 100% RDF (F_1) and 75% RDF + 25% N through V.C. 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).

Table 1 Growth and yield of pearl millet as influenced by cultivars and INM.

Treatments	Plant height (cm)	Dry matter production (kg ha^{-1})	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	H.I (%)
Cultivars					
C_1: ICMV-221	170.2	7213	2389	4607	34.18
C_2: Dhanashakti	182.0	7820	2605	4910	34.62
C_3: PHB-3	194.1	8902	3239	5458	37.23
SEm±	3.82	174	58.3	90	0.66
CD (p=0.05)	11.44	521	174.8	269.7	1.97
Integrated nutrient management					
F_1 : 100% RDF	173.6	7669	2572	4803	35.22
F_2 : 75% RDF + 25% N through V.C	180.4	7871	2693	4932	35.27
F_3 : 75% RDF + Biofertilizers incubated with V.C @ 500 kg ha^{-1}	192.3	8395	3001	5240	35.54
SEm ±	3.82	174	58.3	90	0.66
CD (P=0.05)	11.44	521	174.8	269.7	N.S
Interaction					
SEm ±	6.61	300.9	100.9	155.8	1.1
CD (P=0.05)	NS	NS	NS	NS	NS

*Biofertilizers = (*Azospirillum* + PSB) each @ 5 kg ha^{-1}, RDF= 80:40:30 N:P_2O_5:K_2O kg ha^{-1}

Table 2 Economics of pearl millet as influenced by cultivars and INM

Treatments	**Cost of cultivation (Rs. ha^{-1})**	**Gross returns (Rs. ha^{-1})**	**Net returns (Rs. 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	-

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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	-

*Biofertilizers = (*Azospirillum* + PSB) each @ 5 kg ha^{-1}, RDF= 80:40:30 N:P_2O_5:K_2O kg ha^{-1}

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