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Effect of integrated nutrient management on growth, yield and economics of pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz]

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Abstract

A field experiment was conducted at Agriculture Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jagatpura, Jaipur, Rajasthan during *kharif* season of the year 2018. The materials of the present investigation comprise of promising bajra hybrid viz., "RHB-177" that was regarded with eight different treatments, laid out in a randomized block design (RBD) with three replications. It was perceived from the present research that among - different nutrient management treatments, T₇ treatment that constitutes of 40% RDF+25% FYM+25% +Vermicompost+10% Biomix was found to be significantly far superior in respect to plant height (187.96 cm), dry matter accumulation (7285 kg ha⁻¹), total tillers per metre row length (27.43), grain yield (1905 kg ha⁻¹) and stover yield (5442 kg ha⁻¹). As the economics of the present study is concern, again treatment T₇ (40% RDF+25% FYM+25% Vermicompost+10% Biomix) proved to be exceptional among the rest of the treatments as it recorded maximum net returns (Rs.26405 ha⁻¹) along with B: C ratio (2.14).

Keywords: Biomix, FYM, economics, RDF, vermicompost, pearl millet, and yield

Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz]" is an important millet crop and grown for both food and fodder purpose. India is the largest producer of pearl millet having 7.47 m ha. area with an annual grain production of 9.86 million tonnes and productivity of 1319 kg ha⁻¹ (Anonymous, 2018). Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana are the major pearl millet growing states of our country. The average nutrient composition of the edible portion of the seed is 67% carbohydrates, 12.4% moisture, 11.6% protein, 3.5% fat, 1.5 to 3.0% fiber and 2.7% minerals (Sharma and Burark, 2015) [12]. At present nutrient mining is a major threat to agricultural productivity as there is a wider gap between the quantum of nutrient applied and nutrient utilized by crop, one of the major reasons for lower production is blanket use of fertilizers by the farmers without knowing soil fertility status and improper nutrient management. Several studies show that nitrogen application can increase the millet production efficiency, an adequate supply of nitrogen is associated with vigorous vegetative growth. (Ayub *et al.*, 2009 and Manan and Wan., 2006) [2, 9]. Pearl millet crop responds well to the applied phosphorous (Malik *et al.*, 1990) [8]. Organic manure induced improvement in soil physical, chemical and biological properties. Farmyard manure increased nitrogen use efficiency of the crop and the status of organic carbon, available N, P₂O₅ and trace elements in the soil and countering deleterious effects of soil acidity, salinity and alkalinity. Vermicompost reduces C: N ratio and also helps in increasing the humus content of soil and provides plants with a wide range of readily available nutrients such as Nitrate, Phosphorus, Potassium, Calcium, Magnesium (Talashikar *et al.*, 1999) [13]. Bio-fertilizers play an important role in increasing the availability of native and applied nutrients and also help in sustainably increasing the productivity. The objective of this study is to prove that, as no single farm input is capable of supplying a balanced amount of nutrients, the integrated use of all these input sources is a must to supply balanced nutrients to plants (Hedge and Babu, 2004) [5].

Materials and Methods

A field experiment was conducted at Agriculture Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jagatpura, Jaipur, Rajasthan during *kharif* season of the year 2018. The research area is situated between 26.8° north latitude to 75.8° east longitude with an altitude of 1,273 feet above the mean sea level. The soil of experimental field was sandy loam, pH of soil was 8.4 and, low in available N, medium in available P and high in available K.

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The experiment involving hybrid “RHB-177” was laid out in randomized block design with eight treatments and replicated thrice with gross plot size of 4 m x 3 m. The treatments comprised 8 combinations viz., Recommended dose of fertilizer (60:30:0 NPK kg ha⁻¹), 75% Farm yard manure + 25% Biomix, 75% RDF + 25% Biomix, 70% Vermicompost + 30% Biomix, 75% RDF + 25% FYM, 50% RDF + 50% Vermicompost, 40% RDF+ 25% FYM + 25% Vermicompost + 10% Biomix and control. Recommended dose of fertilizer, FYM, Vermicompost and Biomix for pearl millet under rainfed situation is 60:30:0 NPK kg ha⁻¹, 10 and 5 tonnes ha⁻¹ and 4 kg ha⁻¹ respectively. The potash was not applied since the soil of the experimental field was rich in available potassium. Sowing was done on 13th July, 2018 with the spacing of 45 cm x 15 cm. The N, P and K were applied through urea, SSP, vermicompost, FYM and Biomix as per the treatments. After attaining physiological maturity, the crop was harvested on 7th October, 2018. After complete drying, the harvested produce from each net plot was weighed just before threshing to record biological yield and then the grains were separated by manual threshing followed by winnowing and cleaning. The statistical analysis of data was done using analysis of variance (ANOVA) technique at 0.05 probability level.

Results and Discussion

Growth characters

Appraisal of the Table 1, illustrates the influence of different integrated nutrient management treatments on plant height, dry matter accumulation and total tillers per metre row length. It was found that at harvest the maximum plant height (187.96 cm) dry matter accumulation (7285 kg ha⁻¹) and total tillers per metre row length (27.43) was observed in T₇ treatment (40% RDF+25% FYM+25% Vermicompost+10% Biomix) followed by T₆ (50% RDF+50% Vermicompost), T₅ (75%

RDF+25% FYM) and T₃ (75% RDF + 25% Biomix) whereas minimum plant height (112.60 cm), dry matter accumulation (2012 kg ha⁻¹), and total tillers per metre row length (19.43) was recorded in control (T₀). The variations in plant height due to nutrient sources were considered to be the variation in the availability of major nutrients. Increased dry matter accumulation can be attributed to variability in plant height and number of tillers. The organic fertilizers in combination with inorganic fertilizers enriched the supply of all the essential macro and micronutrients sources. The vermicompost and FYM improved the soil physical, chemical and biological properties and thus overall enhanced vegetative growth of the crop (Bana *et al.* 2012) [4].

Yield characters

A perusal of data presented in Table 2 showed that different combinations of fertilizers and manures caused a remarkable effect on grain, and stover yield of pearl millet over control. The maximum grain yield (1905 kg ha⁻¹) and stover yield (5442 kg ha⁻¹) was obtained in treatment T₇:40% RDF+25% FYM+25% Vermicompost+10% Biomix followed by T₆:50% RDF+ 50% Vermicompost (1798 and 5123 kg ha⁻¹) and T₅:75% RDF + 25% FYM (1402 and 3837 kg ha⁻¹). The rest of the treatments viz., T₃:75% RDF + 25% Biomix, T₃:75% RDF + 25% Biomix, T₂:75% Farm yard manure + 25% Biomix and T₁:Recommended dose of fertilizer (60:30:0 NPK kg ha⁻¹) were at par with each other. The minimum grain yield (650 kg ha⁻¹) and stover yield (1834.41 kg ha⁻¹) was recorded in T₀ (control). The synergistic effect of integration of organic and inorganic sources along with biofertilizers resulted in better nutrient uptake, which accelerated the photosynthetic rate, adequate biomass production that reflected on grain and stover yield. The results are in accordance with Reddy *et al.* (2016) [10] and Sakarvadia *et al.* (2012) [11].

Table 1: Effect of different integrated nutrient management on growth of pearl millet

Treatments	Plant height (cm)	Dry matter accumulation (kg ha ⁻¹)	Total tillers per meter row length
T ₀ : Control	112.60	2012	19.43
T ₁ : Recommended dose of fertilizer (60:30:0 NPK kg ha ⁻¹)	161.33	4202	23.63
T ₂ :75% Farm yard manure + 25% Bio mix	121.56	3813	21.80
T ₃ :75% RDF + 25% Biomix	171.53	4605	24.66
T ₄ :70% Vermicompost + 30% Biomix	138.63	3865	22.36
T ₅ :75% RDF + 25% FYM	175.40	5012	25.90
T ₆ :50% RDF + 50% Vermicompost	183.20	6502	26.63
T ₇ : 40% RDF + 25% FYM + 25% Vermicompost + 10% Biomix	187.96	7285	27.43
SE(m) ±	8.10	255	1.03
C.D at 5%	24.82	783	3.18

Economics

The data pertaining to cost of cultivation in gross returns, net returns and B: C ratio of pearl millet as influenced by different integrated nutrient management treatments were presented in Table 2. The data revealed that maximum gross return (Rs. 49527 ha⁻¹) and net returns (Rs. 26405 ha⁻¹) were obtained with T₇ treatment (40% RDF + 25% FYM+25% Vermicompost + 10% Biomix), which also resulted the highest B: C ratio (2.14). Whereas, the minimum gross return (Rs.16819 ha⁻¹), net return (Rs.1689 ha⁻¹) and B: C ratio

(1.11) was noted with the treatment T₀ (control). The most economic returns of a crop could be achieved either by increasing its production through judicious management practices or improving the quality of the product to get the premium price in the market. Highest gross and net returns might be due to the direct influence of higher grain and stover yields. Thus, there is a greater increase in the monetary value of grain and stover obtained under it. This is in conformity with findings reported by Mahakulkar *et al.* (1998) [7], Kushwaha and Singh (2007) [6] and Angadi *et al.* (2010) [3].

Table 2: Effect of different integrated nutrient management on yield and economics of pearl millet

Treatments	Grain Yield (kg ha ⁻¹)	Stover Yield (kg ha ⁻¹)	Total cost (Rs.ha ⁻¹)	Gross returns (Rs.ha ⁻¹)	Net returns (Rs. ha ⁻¹)	B:C ratio
T ₀ :Control	650	1834	15130	16819	1689	1.11
T ₁ :Recommended dose of fertilizer (60:30:0 NPK kg ha ⁻¹)	1160	3245	17552	29917	12365	1.70
T ₂ :75% Farm yard manure + 25% Biomix	1012	3020	22687	26762	4075	1.17
T ₃ :75% RDF + 25% Biomix	1283	3503	17004	32788	15784	1.92
T ₄ :70% Vermicompost + 30% Biomix	1230	3145	25699	30687	4988	1.19
T ₅ :75% RDF + 25% FYM	1402	3837	19477	35861	16384	1.84
T ₆ :50% RDF + 50% Vermicompost	1798	5123	23842	46698	22856	1.95
T ₇ :40% RDF + 25% FYM + 25% Vermicompost + 10% Biomix	1905	5442	23122	49527	26405	2.14
SE(m) ±	61.50	197.70	-	-	-	-
C.D at 5%	188	605	-	-	-	-

Conclusion

It may be concluded that under different integrated nutrient management practices, T₇ (40% RDF + 25% FYM + 25% Vermicompost + 10% Biomix) was far superior in every respect among rest of the treatments in enhancing growth parameters, yield characters, gross returns (Rs. 49527 ha⁻¹), net returns (Rs. 26405 ha⁻¹) and B:C ratio (2.14) of pearl millet crop. Since the findings are based on the research done in one season it may be repeated for further confirmation.

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