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Impact of Nutrient Management on Yield and Economics of Pearl Millet (*Pennisetum Glaucum* L.)

Niteen Amarghade[1*] and Rajesh Singh[2]
[1]M.Sc. Scholar, Department of Agronomy, NAI, SHUATS, Prayagraj, (Uttar Pradesh), India.
[2]Assistant Professor, Department of Agronomy, SHUATS, Prayagraj, (Uttar Pradesh), India.

(Corresponding author: Niteen Amarghade)*
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ABSTRACT: A field experiment was conducted during *zaid* season 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.) on sandy loam soil to investigate the impact of nutrient management on yield and economics of Pearl millet (*Pennisetum Glaucum* L.). The experiment was laid out in Randomized Block Design with seven treatments each replicated thrice. It was consisted of combination of two levels of inorganic sources I_1 - (50% RDN), and I_2 – (75% RDN) and three levels of organic manure, O_1 – (50% FYM), O_2 – (50% Vermicompost), and O_3 – (50% Poultry manure). The treatment combinations are T_1: 50% RDN + 50% FYM, T_2: 50% RDN + 50% Vermicompost, T_3: 50% RDN + 50% Poultry manure, T_4: 75% RDN + 50% FYM, T_5: 75% RDN + 50% Vermicompost, T_6: 75% RDN + 50% Poultry manure, T_7: 100-40-40 kg NPK/ha. Report of study indicate that, among different nutrient levels the application of 75% RDN with 50% Poultry manure produced significantly superior plant height (165. 67cm), plant dry weight (75.81 g), CGR (20.96 g/m^2/day), RGR (0.45 g/g/day), length of ear head/plant (24.81 cm), test weight (8.39 g), grain yield (3.18 t/ha) and biological yield (9.56 t/ha). However gross return (79500.00 INR/ha), net return (45953.47 INR/ha) and B:C ratio (1.36) were recorded with the application of 75% RDN with 50% Poultry manure compared to all other treatments.

Keywords: Pearl millet, Recommended dose of nutrient, Poultry manure, Grain yield.

INTRODUCTION

Pearl millet [*Pennisetum glaucum* L.) R. Br. emend Stuntz] is one of the important millet crop of hot and dry areas of arid and semi-arid climatic condition particularly of Rajasthan. It has been estimated that pearl-millet embodies a tremendous productivity potential particularly in areas having extreme environmental stress condition on account of drought. It is nutritionally better than many cereals as it is a good source of protein having higher digestibility (12.1%), fats (5%), carbohydrates (69.4%) and minerals (2.3%) (Ramesh *et al*., 2006).

Increased use of fertilizers without organic recycling has not only aggravated multi nutrient deficiencies in soil-plant-system but also detrimental to soil health and has created environmental pollution. Moreover, chemical fertilizers are becoming costlier in agriculture. Therefore, it is the right time to evaluate the feasibility and efficiency of organic sources not only for improving and building up soil fertility but also to increase the fertilizer use efficiency. Integration of chemical fertilizer with organic manures has been found quite promising not only in sustaining the soil health and productivity but also in stabilizing the crop production in comparison to the use of each component, separately (Nambiar and Abrol, 1992). Organic amendments such as FYM are the major source of organic manure. Poultry manure contains higher content of N which is readily available to crops and also possess various micro-nutrients (Pratap *et al*., 2008). The combined effect of organic and inorganic source of nutrient help in maintaining yield stability through correction of nutrients deficiencies, enhancing their efficiency and providing favorable soil physiological condition, (Behera *et al*., 2007). Poultry manure was reported to contain plants nutrients than all other organic manures. Nitrogen (N) is typically the nutrient of most concern because it has a strong influence on cereal crop yields. Poultry manure is a good source of nutrients for crops. (Singh *et al*., 2013) reported that a judicious use of organic and inorganic combination of fertilizers will maintain long-term soil fertility and sustained higher levels of productivity. Integration of organic manure and inorganic fertilizer has been found to be promising not only in maintaining higher productivity of crops but also for providing stability in crop production, besides improving soil physical conditions (Verma and Shete 2012). Keeping in view of the above facts, a field experiment was carried out with objection to find out the impact of nutrient management

on yield and economics of Pearl millet (*Pennisetum Glaucum* L.).

MATERIALS AND METHODS

A field experiment was conducted during *Zaid* season 2021, at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.) which is located at 25°39′42″N latitude, 81°67′56″E longitude and 98 m altitude above the mean sea level. The soil was sandy loam in texture, low in organic carbon (0.51%) and medium in available nitrogen (203.7 kg/ha), phosphorous (17.2 kg/ha) and low in potassium (208.8 kg/ha). Nutrient sources were inorganic sources Urea, SSP, MOP and organic sources FYM, Vermicompost and Poultry manure was used as per treatment to fulfill the requirement of Nitrogen, phosphorous and potassium. Half of the Nitrogen applied as basal dose remaining as top dressing. The treatment consisted 2 levels of inorganic fertilizer and 3 levels of organic manure. T_1: 50% RDN + 50% FYM, T_2: 50% RDN + 50% Vermicompost, T_3: 50% RDN + 50% Poultry manure, T_4: 75% RDN + 50% FYM, T_5: 75% RDN + 50% Vermicompost, T_6: 75% RDN + 50% Poultry manure, T_7: 100-40-40 kg NPK/ha used. The Experiment was laid out in Randomized Block Design, with seven treatments which are replicated thrice. After harvest several yield parameters were recorded those parameters are like length of ear head/plant, test weight (1000 seeds), grain yield and biological yield were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design. The economic parameters like gross return (INR/ha), net return (INR/ha), and B:C ratio were evaluated through standard methods. The data were statistically analyzed as procedures given by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Growth attributes. Data pertaining to growth attributes viz. plant height (cm) and plant dry weight (g) of pearl millet are presented in Table 1. There was increasing in plant height and plant dry weight was improved with the advancement of crop experimentation. The highest plant height and plant dry weight was recorded with application of treatment T_6 i.e. 75% RDN + 50% poultry manure (165.67 cm) and (75.81 g) which was significantly superior among all treatment except treatment with application of 75% RDN with 50% Vermicompost, plant height (163.53 cm) statically on par with T_6 i.e. 75% RDN with 50% poultry manure. During initial stages of crop, nutrients are readily available through inorganic fertilizers, whereas during later stages of crop the nutrients are supplied by both inorganic as well as organic forms due to decomposition, thus making higher availability of nutrients which resulted in better root development and high photosynthetic rate. The increased availability of nutrients in the soil through mineralization of organic sources could have triggered cell elongation and multiplication resulting in high growth rate of shoots in turn plant height of pearl millet over control. These results were in agreement with the findings of Kumar *et al*., (2017); Giribabu *et al*., (2010); Dahiya *et al*., (2008). Balanced nutrition due to release of macro and micro nutrients with application of inorganic and organic under favourable environment might have helped in higher uptake of nutrients. This accelerated the growth of new tissues and development of new shoots that have ultimately increased the dry mater accumulation (Togas *et al*., 2017).

CGR and RGR. Data on growth indices *viz* Crop Growth Rate (CGR) and Relative Growth Rate (RGR) were evaluated at 40-60 DAS, 60-80 DAS and presented in Table 1. Crop growth rate (CGR; 20.96 and 14.29) and relative growth rate (RGR; 0.045, 0.014) was obtained significantly higher with T_6 i.e. 75% RDN + 50% poultry manure at 40-60 DAS and 60-80 DAS, respectively. Plant adequately supplied with organic manure along with chemical fertilizer had produced a greater number and size of functional leaves, photosynthesizing area widely and this consequently contributed to better growth and development of individual plant and show the significant result to the crop growth rate and relative growth rate. This was confirmed with the result of Kakarla *et al.,* (2021).

Table 1: Response of pearl millet on growth influenced by nutrient management.

Treatment No.	Treatments	Plant height (cm) 80 DAS	Dry weight (g) 80 DAS	CGR ($g/m^2/day$) 40- 60 DAS	CGR ($g/m^2/day$) 60-80 DAS	RGR (g/g/day) 40-60 DAS	RGR (g/g/day) 60-80 DAS
T_1	50% RDN +50% FYM	150.01	58.45	18.37	12.76	0.035	0.011
T_2	50% RDN + 50% Vermicompost	155.33	61.73	19.58	10.76	0.041	0.013
T_3	50% RDN + 50% Poultry Manure	156.04	64.59	19.91	10.95	0.038	0.012
T_4	75% RDN + 50% FYM	150.40	59.54	19.25	10.09	0.036	0.013
T_5	75% RDN + 50% Vermicompost	163.53	70.98	20.81	12.06	0.039	0.013
T_6	75% RDN + 50% Poultry Manure	165.67	75.81	20.96	14.29	0.045	0.014
T_7	Control-100-40-40 kg/ha NPK	162.25	67.67	20.35	10.91	0.044	0.012
S. EM (±)		0.71	0.53	0.20	0.50	0.001	0.000
C. D. (P = 0.05)		2.18	1.66	0.61	1.54	0.003	0.001

Yield attributes. Data related to yield attributes and yield are tabulated in Table 2. The yield attribute of pearl millet i.e. length of ear head/plant (24.81 cm), and test weight (8.39 g) were recorded maximum with the application of treatment T_6 i.e. 75% RDN + 50% poultry manure which was significantly superior among all treatment and minimum values recorded with (T_1). This might be due to the increase in the yield components might be connected with the release of essential nutrient elements by the poultry litter along with chemical fertilizer activity and increase of nutrient availability crop easily. The result were in agreement with the findings of Udom *et al*., (2007); Silva, *et al*., (2003).

Yield. Sees yield is ultimate goal and all cultivation practices. The maximum seed yield was recorded with T_6 ie.75% RDN + 50% poultry manure (3.18 t/ha) which was significantly superior among all 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. The efficacy of inorganic fertilizer in improving grain yields was much pronounced when it was combined with organic manures (Pratap *et al*., 2008).

Economics. The data pertaining to gross returns, net returns and B: C ratio of pearl millet as influenced by different integrated nutrient management treatments are presented in Table 2. The data revealed that maximum gross return (79500 Rs./ha) and net returns (45953 Rs./ha) were obtained with T_6 treatment 75% RDN + 50% poultry manure, which also resulted the highest B: C ratio (1.36) owing to the higher yields of grain and straw. Whereas, the minimum gross return (50500 Rs./ha), net return (13753 Rs./ha) and B: C ratio (0.37) was noted with the treatment (T_1) due to low yield. Treatment 75% RDN + 50% poultry manure (T_6) fetched Rs. 32200/- more return over 50% RDN + 50% FYM (T_1), Rs. 19700/- over 50% RDN + 50% Vermicompost (T_2), Rs. 11674/- over 50% RDN + 50% Poultry manure (T_3), Rs. 25750 over 75% RDN + 50% FYM (T_4), Rs. 12750 over 75% RDN + 50% Vermicompost (T_5), and Rs. 18298/- 100-40-40 kg NPK/ha (T_7). 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); Kushwaha *et al*., (2007).

Table 2: Response of pearl millet on yield and economics influenced by nutrient management.

T. No.	Treatments	Length of ear head (cm)	Test weight	Grain yield (t/ha)	Biological yield (t/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C Ratio
T_1	50% RDN +50% FYM	13.81	6.09	2.02	6.56	50500.00	13753.00	0.37
T_2	50% RDN + 50% Vermicompost	18.34	6.80	2.54	7.56	63500.00	26253.00	0.70
T_3	50% RDN + 50% Poultry Manure	20.59	7.11	2.66	8.06	66500.00	34279.00	1.06
T_4	75% RDN + 50% FYM	16.30	6.21	2.33	7.45	58250.00	20203.00	0.53
T_5	75% RDN + 50% Vermicompost	23.00	7.65	2.77	8.44	69250.00	33203.00	0.92
T_6	75% RDN + 50% Poultry Manure	24.81	8.39	3.18	9.56	79500.00	45953.00	1.36
T_7	Control-100-40-40 kg/ha NPK	21.72	7.28	2.20	7.71	55000.00	27655.00	1.01
S. EM (±)		0.56	0.24	0.07	0.31	-	-	-
C. D. (P = 0.05)		1.73	0.73	0.22	0.96	-	-	-

CONCLUSION

It is concluded that the application of 75% RDN with 50% poultry manure resulted higher plant height (165.67 cm), plant dry weight (75.81 g), CGR (20.96 g/m^2/day), RGR (0.45 g/g/day), length of ear head/plant (24.81 cm), test weight (8.39 g), grain yield (3.18 t/ha), biological yield (9.56 t/ha), gross return (INR/ha 79500.00), net return (INR/ha 45953.47) and benefit cost ratio (1.36). Comparing the grain yield of pearl millet the application of 75% RDN with 50% Poultry manure had improved the grain yield of pearl millet by 69.18% compared to the control plots.

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Conflict of Interest. None.

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