

Effect of Integrated nutrient management on plant growth parameters and yield of pearl millet (*Pennisetum glaucum* L.) in alluvial soil of Gird region of Madhya Pradesh

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ABSTRACT: The experiment entitled “Effect of Integrated nutrient management on plant growth parameters and yield of pearl millet (*Pennisetum glaucum* L.) in alluvial soil of Gird region of Madhya Pradesh” was carried out in the Department of Soil Science and Agricultural Chemistry, R.V.S.K.V.V., CoA, Gwalior, Districts of Madhya Pradesh during kharif season 2021. There were 12 treatments T₁ – Control, T₂ -50% NPK, T₃-75% NPK, T₄ -100% NPK, T₅ - 150% NPK, T₆ -100% NPK-S, T₇ -100% NPK ZnSO₄, T₈ -100% NPK + FeSO₄, T₉ -50% NPK + FYM, T₁₀ -75% NPK + FYM, T₁₁ -100% NPK + FYM and T₁₂-100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)} and were replicated thrice under RBD. The results indicated that plant growth parameters yield parameters found highest in the treatment T₁₂-100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)} which was found significant with the treatment T₁-Control.

Keywords: Integrated nutrient, plant growth parameter, quality, alluvial soil.

INTRODUCTION

Pearl millet is the fifth most important cereal crop in the world after rice, wheat, maize and sorghum (Reddy 2021). Besides that, India is largest producer in the world occupying an area of 6.93 million ha, with the production of 8.61 million tons in respect pearl millet. Protein having higher digestibility (12.1%), fat (5%), carbohydrate (69.4%) and minerals (2.3%) is the biochemical profile of pearl millet. Grain of pearl millet are mainly used for human consumption in the form of diverse food and dry stover of pearl millet, a basis of ration for a large cattle population, that is look on the most condemnatory component of providing stability in the sepaculated crop-livestock farming system in water confined regions. The extravagant of chemical nitrogen fertilizer and low purchasing power of Indian farmers limit its use on proper amounts, hold back crop production. Reliance on the wide application use of chemical fertilizers and associated hazards draw back attention on organic sources which are effectual in promoting health and productivity of the soil. The fundamental concept of integrated nutrient management is the supply of required plant nutrients for sustaining the desired crop productivity with minimal deleterious effect on soil health environment (Balasubramanian,

1999). In order to reduce the losses and indiscriminate use of chemical fertilizers, substitution of part of the inorganic fertilizer by locally available organic sources of nutrients (Farmyard manure) and bio fertilizers (*Azotobacter* and PSB) is inescapable. Therefore, in the present context, organic, inorganic fertilizers and biofertilizers when applied holistically, preserve soil and crop productivity.

MATERIAL AND METHODS

Conducted during *kharif* season of 2021, at the research farm of the Department of Soil Science & Agricultural Chemistry, College of Agriculture, R.V.S.K.V.V., Gwalior. There were 12 treatments T₁ – Control, T₂ - 50% NPK, T₃-75% NPK, T₄ -100% NPK, T₅ - 150% NPK, T₆ -100% NPK-S, T₇ -100% NPK ZnSO₄, T₈ - 100% NPK + FeSO₄, T₉ -50% NPK + FYM, T₁₀ -75% NPK + FYM, T₁₁ -100% NPK + FYM and T₁₂-100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)} and were replicated thrice under Randomized Block Design. The investigation entitled study the “Effect of Integrated nutrient management on plant growth parameters and yield of pearl millet (*Pennisetum glaucum* L.) in alluvial soil of Gird region of Madhya

Pradesh. The optimum dose of fertilizer under pearl millet as per the treatments were applied (80:40:20 N, P₂O₅ and K₂O kg ha⁻¹, respectively) through of urea, diammonium phosphate, SSP and muriate of potash. In all, 50 per cent of nitrogen and entire dose of P₂O₅ and K₂O was applied at the time of sowing and remaining 50 per cent of nitrogen was top dressed through of urea for pearl millet at 30 days after sowing. In treatment 100 % NPK, phosphorus was added through SSP. Only T6- 100% NPK-S phosphorus source was DAP applied in order to make S free treatment. As per treatment FYM was added @10 tonnes ha⁻¹yr⁻¹ before sowing of crop. *Azotobacter* and PSB were added in soil by seed treatment at the time of sowing. The pH, EC, OC, N, P, and K content before creation of treatments were 7.72, 0.23 dSm⁻¹, 0.39 %, 170 kg ha⁻¹, 12.04 kg ha⁻¹ and 180 kg ha⁻¹ respectively. Weed removal by hands and plant protection techniques were undertaken as per the need and the required plant population was maintained. Harvesting of grain was done at maturity and proper drying of grain, this was followed by recording of seed yield. Plant height, number of tillers per plant, length of cob, grain yield and straw yield were recorded during the time being of investigation. The data processing for various parameters was analyzed using proper statistically methods using Fishers' analysis of variance (ANOVA) technique and the treatments were compared at 5 per cent level of significance.

RESULTS AND DISCUSSION

A. Growth parameters

The application of 100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)} recorded significant differences in pearl millet were obtained (Table 1). The maximum plant height (195.5 cm), length of cob (30.2 cm) and number of tiller/ plant (4.09) were recorded with treatment T₁₂ (100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)}) which was significantly higher T₁ - Control. The increase in plant growth

parameters may be due to application of various treatment of inorganic, organic sources and seed treatment of *Azotobacter* resulted in better growth and PSB containing phosphate solubilising potential due to secretion of phosphate enzyme to mineralized P present in the organic matter applied in the form of FYM for enhancing growth of the crop by concurrently exudation of organic acids and releasing phosphatases enzyme which resulted in increasing the vegetative growth of plants. This might be due to attribution to use of chemical fertilizers in combination with organic and biological sources of nutrients. The outcomes are in line with the findings of Verma (1996) and Sharma *et al.* (2007), Gawai *et al.* (2006), Munda *et al.* (2007), Mahesh *et al.* (2010), Masih *et al.* (2016), Yadav *et al.* (2013) and Tharapureddi Bhargavi, *et al.* (2021).

B. Yield Parameters

Grain yield, Straw yield and Test weight of *kharif pearl millet* were significantly influenced due implementation of various treatment. The data presented in the Table 2 indicate that the highest grain yield (2344.67 kg ha⁻¹), straw yield (5784.07 kg ha⁻¹) and test weight (7.86 g) were obtained under the application of T₁₂ (100% NPK + FYM + {PSB + *Azotobacter* (Seed treatment)}) which was found highly significant over other treatment. This might be due to application of the organic and inorganic nutrient sources enhances the activity of *Azotobacter* + PSB in the presence of organic matter. *Azotobacter* increased the yield significantly over uninoculated control was observed by Badgiri and Bindu (1976). The application of the organic and inorganic nutrient sources including 100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)}) provided balanced nutrients to the pearl millet which resulted into significantly enhance in grain, straw yield and test weight. Similar results were also obtained by Karforma *et al.* (2012), Husain *et al.* (2013), Jat *et al.* (2014) and Verma (2016).

Table 1: Plant height, Length of cob and No. of tillers /plant at harvest as effect by application of treatments.

Sr. No.	Treatment	Plant height (cm)	Length of cob (cm)	No. of tillers/Plant
1.	Control	174.300	25.150	2.130
2.	50% NPK	176.600	26.307	2.657
3.	75% NPK	179.600	26.713	2.757
4.	100% NPK	182.333	27.497	3.600
5.	150% NPK	184.000	27.753	3.753
6.	100% NPK -S	183.933	27.513	3.633
7.	100% NPK + ZnSO ₄	182.333	27.520	3.643
8.	100% NPK + FeSO ₄	182.567	27.623	3.993
9.	50% NPK + FYM	186.500	28.293	2.757
10.	75% NPK + FYM	187.533	28.313	2.893
11.	100% NPK+ FYM	191.567	29.327	2.757
12.	100% NPK + FYM + {PSB+ <i>Azotobacter</i> (Seed treatment)}	195.467	30.223	4.090
S.Em.(±)		1.079	0.018	0.018
CD(0.05)		3.165	0.053	0.053

Table 2: Grain yield, Straw yield and test weight as effect by the application of treatment.

Sr. No.	Treatment	Grain Yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Test weight (g)
1.	Control	869.53	1865.30	7.45
2.	50% NPK	1173.33	2698.67	7.54
3.	75% NPK	1353.33	3112.67	7.59
4.	100% NPK	1550.00	3565.00	7.65
5.	150% NPK	1643.33	4108.33	7.74
6.	100% NPK –S	1516.67	3488.33	7.65
7.	100% NPK + ZnSO ₄	1553.33	3549.67	7.63
8.	100% NPK + FeSO ₄	1546.67	3557.33	7.64
9.	50% NPK + FYM	1650.00	3795.00	7.56
10.	75% NPK + FYM	1893.33	4480.67	7.65
11.	100% NPK+ FYM	2146.67	5079.33	7.71
12.	100% NPK + FYM + {PSB+ <i>Azotobacter</i> (Seed treatment)}	2344.67	5784.07	7.86
S.Em.(±)		42.03	97.60	0.026
CD(0.05)		123.26	286.24	0.078

CONCLUSIONS

It may be drawn to close from the present experiment that pearl millet responded significantly to application of treatment 100% NPK + FYM + {PSB+ *Azotobacter* (Seed treatment)} which was followed by the treatment 100% NPK+ FYM.

FUTURE SCOPE

The integrated management of nutrients is beneficial for the growth and yield of the pearl millet crop.

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Conflict of interest. None.

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