Research Article

Effect of Varying Nitrogen Levels on Yield of Pearl Millet [Pennisetum Glaucum (L.)] and Soil Properties

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Abstract

A field experiment was conducted during *Zaid* season, 2015 at Crop Research Farm, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.). Application of V_3 (Pioneer 86 M 32) + 100:45:45 kg ha^{-1} NPK which give highest seed yield (3.72 t ha^{-1}), uptake of nitrogen (223.3 kg ha^{-1}), phosphorus (22.50 kg ha^{-1}), potash (347 kg ha^{-1}), Organic Carbon (0.46%) and benefit cost ratio (2.65) compared to V_1(Pro Agro 9444) and V_2 (Ganga Kaveri 86 M 32) in *zaid* pearlmillet varieties.

Keywords: Yield, nutrient uptake, zaid, pearlmillet type

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Introduction

Pearl millet [*Pennisetum glaucum* (L.)] is the fifth most important cereal crop in the world after rice, wheat, maize and sorghum. It is a widely grown rainfed cereal crop in the arid and semi-arid regions of Africa and Southern Asia, and can be grown in areas where rainfall is not sufficient (200 to 600 mm yr^{-1}) for the cultivation of maize and sorghum. Its grain is more nutritious and the protein content is not only high but it is also of good quality. The grain contains 11-19 % protein, 60-78 % carbohydrates and 3.0 - 4.6 % fat and also has good amount of phosphorus and iron. It has the maximum potential of all the millets and is mainly grown in drought prone areas and marginal soils. India is the largest producer of pearl millet, both in terms of area (9.3 m ha) and production (9.3 mt), with an average productivity of 1044 kg ha^{-1} during the last five years. Pearl millet occupies fourth place in cereals and second place in coarse cereals and is the most widely cultivated millet next only to Jowar in India. Information on optimum and economic dose of nitrogen requirement for higher grain yield and quality is lacking in rain fed Pearl millet in Allahabad. Keeping the above points in view the present investigation was conducted to studies on response of summer pearlmillet hybrids to levels of nitrogen and to fix the optimum and economic dose of N for pearl millet crop.

Materials and Method

A field experiment was conducted in sandy loam soil at Crop Research Farm, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (U.P.). The experiment was conducted in randomized block design consisting of 9 treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. Bajra variety PRO AGRO- 9444, GANGA KAVERI- 1044, PIONEER 86 M32 was selected for sowing which takes around 80-85 days to mature. Seeds of the crop were sown 5kg ha-1 in lines at the spacing of 45 cm row to row and 15 cm plant to plant. The sowing was done by Transplanting and drilling method in open furrow on 26 March, 2015. Application of Nitrogen in two splits (1/2 basal and ½ top dressing at 30 DAS) P & K applied 45 and 45 kg ha^{-1} through SSP and MOP. Organic carbon was estimated by wet digestion method of Walkley and Black (1947) [1]. Available nitrogen and phosphorus were determined by using alkaline potassium permanganate method as given by [2] and Olsen colorimetric method [3].

Result and Discussion

Grain and straw yield

The significantly highest grain yield (3.72 t ha^{-1}) and straw yield (6.98 t ha^{-1}) was obtained with application of T_9 *i.e.*, V_3 + 100:45:45 kg ha^{-1} NPK followed by T_5 *i.e.*, V_2 + 90:45:45 kg ha^{-1} NPK and T_1 *i.e.*,V_1 + 80:45:45 kg ha^{-1} NPK (2.47 t ha^{-1} and 4.62 t ha^{-1}, respectively), but superior to rest of the treatments (**Table 1**). Low initial N status of soil limited the yield of pearl millet to lower level in control treatment. The increase in grain and straw yields with enhanced N application could be ascribed to increases the activity of cytokinin in plant which leads to the increased cell-division and elongation which leads to better plant growth, dry-matter production and higher photosynthesis. This

was further supported by the fact that soil of the experimental field was low in nitrogen (150.52 kg ha^{-1}). Thus, an increase in nitrogen supply might have increased all the growth parameters, yield attributing characters which ultimately contributed to increase in yields. Increased grain yield due to varying levels of nutrients have also been reported.

Table 1 Response of hybrid and different levels of nitrogen on soil fertility status after harvest of Pearlmillet

S. No	Treatments	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})	Organic Carbon (%)	pH	EC (dS m^{-1})
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	178.6	13.50	235	0.31	7.4	0.21
T_2	V_1 + 90:45:45kg ha^{-1}NPK	182.9	18.00	268	0.37	7.6	0.23
T_3	V_1 + 100:45:45kg ha^{-1} NPK	219.5	22.50	336	0.46	8.3	0.33
T_4	V_2+80:45:45 kg ha^{-1}NPK	189.7	9.00	291	0.43	7.5	0.29
T_5	V_2 +90:45:45 kg ha^{-1} NPK	190.5	13.50	257	0.31	7.7	0.25
T_6	V_2 +100:45:45kg ha^{-1} NPK	195.5	22.50	313	0.42	7.9	0.31
T_7	V_3+80:45:45 kg ha^{-1} NPK	146.3	13.50	268	0.39	7.6	0.27
T_8	V_3+90:45:45 kg ha^{-1} NPK	194.6	18.00	336	0.43	7.9	0.30
T_9	V_3 +100:45:45 kg ha^{-1} NPK	223.3	22.50	347	0.46	8.0	0.31

Soil fertility Status

Maximum available N (223.3 kg ha-1) was obtained by the application of T9 i.e. V3 + 100:45:45 kg ha-1 NPK, the lowest value 146.3 kg ha-1 was observed in treatments T7 i.e. V 3+ 80:45:45 kg ha-1 NPK. [4] and [5]observed the nitrogen availability in soil after harvest was found to be significantly superior with 50 kg N ha-1 applied plots. There was a substantial increase in the available nitrogen status with 50 kg N ha-1 over the controlin foxtail millet (*Setaria italica* L.). Maximum available P_2O_5 (22.50 kg ha-1) was obtained by the application of T_9 i.e. V3 + 100:45:45 kg ha-1 NPK, T_3 i.e.V_1 + 100:45:45 kg ha-1 NPK and T_6 i.e., V_2 + 100:45:45kg ha-1 NPK whereas the lowest value 9.00 kg ha-1 was observed in treatments T4 i.e., 80:45:45 kg ha-1 NPK. Use of N alone, though, maintained the original level of organic C but available P and K in soil decreased. Greater dose of N showed more accumulation of organic C and depletion of P and K. Maximum available K2O (347.00 kg ha-1) was obtained by the application of T9 i.e. V3 + 100:45:45 kg ha-1 NPK, whereas the lowest value 235.00kg ha-1 was observed in treatments T1 i.e.V1 + 80:45:45 kg ha-1 NPK. Maximum Organic carbon (0.46 %) was obtained by the application of T9 i.e. V3 + 100:45:45 kg ha-1 NPK and T3i.e. V1 + 100:45:45kg ha-1 NPK, whereas the lowest value 0.31 % in T1 i.e. V1 + 80:45:45 kg ha-1 NPK and T5i.e.V2 + 90:45:45 kg ha-1NPK.

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