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Effect of inorganic and organic sources of nutrient on growth and yield of pearl millet (*Pennisetum glaucum* L.)

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Abstract
A field experiment was conducted during *zaid* season 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (UP) on sandy loam soil to investigate the effect of inorganic and organic sources of nutrient on growth and yield of pearl millet. The experiment was laid out in Randomized Block Design with seven treatments each replicated thrice. It was consisted of combination of two lavels 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) and plant dry weight (75.81 g). The significantly higher grain yield (3.18 t/ha), stover yield (6.39 t/ha) and harvest index (33.22%) 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.) is one of the most important millet crops for arid and semi-arid conditions. It belongs to the family of Poaceae. This grain is widely grown in Africa and Asia since pre-historic time. It is world's hardiest warm season crop. It grows well in poor soil due to drought escaping characters and it is popular crop for drought prone areas. It is tall tillering annual plant which grows up to 1 meter to 3 meter. Bajra is a coarse grain crops and regarded to be the poor man's staple nourishment and suitable to cultivate in dry lands. It is good source of protein having higher digestibility (12.1%), carbohydrates (69.4%), fats (5%) and minerals (2.3%). Green fodder is used as preserved hay or silage which has proved extremely useful in dry regions (Ramesh *et al*. 2006) [7].

Most of the Indian soils particularly the light textured ones are deficient in nitrogen which is one of the basic plant nutrient. It is involved in the formation of proteins, nucleic acids, growth harmones and vitamins and is an integral part of chlorophyll. Phosphorus plays a vital role in increasing crop yield because it improves crop quality and provides resistance against diseases. Pearl millet crop responds well to applied phosphorus (Malik *et al*. 1990) [4].

The use of inorganic fertilizers without addition of organic matter depletes the fertility status with questionable soil health. FYM increase the adsorptive power of soil for cations and anions particularly phosphates and nitrates. These adsorbed ions are released slowly for the benefit of not only to the current crop but also to succeeding crops (Singh *et al*. 2013) [13].

Vermicompost are good superlatives for organic farming, Vermicompost has significantly higher K contents than the cow dung compost. Vermicompost providing nutrient such as available N, soluble K, exchangeable Ca, Mg, P and micro elements such as Fe, Mo, Zn and Cu, which can easily taken up by plants. Vermicompost has also been advocated as a good organic manure for use in integrated nutrient management practices in field crops (Shroff and Devesthali 1992) [8].

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) [9] reported that a judicious use of organic and inorganic combination of fertilizers will maintain long-term soil fertility and sustained higher levels of productivity.

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 degree 39' 42''N latitude, 81 degree 67'56''E longitude and 98 m altitude above the mean sea level. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen, phosphorous and low in potassium. Nutrient sources were inorganic sources Urea, SSP, MOP and organic sources FYM, Vermicompost, Poultry manure 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. Date of sowing was on 07th april 2021 with the seed rate of 5-6 kg/ha. In the period from germination to harvest several plant growth parameters were recorded at twenty days intervals and at harvest several yield parameters were recorded. The growth parameters are plant height, plant dry weight and the yield parameters are grain yield, stover yield and harvest index.

Results and Discussion

Data related to plant height was periodically recorded at 40, 60 and 80 days after sowing and depicted in Table 1. Plant height (cm) were significantly influenced among all treatments at 40 days after sowing and the higher plant height was observed with application of 100-40-40 kg NPK/ha that is 113.47 cm. The application of 75% RDN with 50% Poultry manure recorded superior plant height at 60 and 80 days after sowing that is 154.81 cm and 165.67 cm respectively. The treatment combination 75% RDN with 50% Vermicompost 163.53 cm was statistically at par with 75% RDN with 50% Poultry manure at 80 DAS. 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. Moreover, the nutrient concentration of pongamia green leaf manure is higher when compared to poultry higher plant height was recorded. 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) [3], Giribabu *et al*., (2010) [2] and Dahiya *et al*., (2008) [1].

The data pertained to plant dry matter accumulation at various growth stages (20, 40, 60 and 80 DAS) are depicted in Table 2. At 40, 60 and 80 DAS maximum dry matter accumulation was resulted with the application of 75% RDN with 50% Poultry manure (28.23 g, 56.52 g, and 75.81 g respectively) and significantly superior to other treatment combinations. 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) [11].

Grain yield (t/ha)

Observation of data on Table 3. clarified that different sources of nutrient significantly affect the grain yield of pearl millet. The application of 75% RDN with 50% Poultry manure resulted significantly higher grain yield (3.18 t/ha) as compared to other treatment combinations. 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 Patil and Shete (2008) [5]. The efficacy of inorganic fertilizer in improving grain yields was much pronounced when it was combined with organic manures (Pratap *et al*., 2008) [6].

Stover yield (t/ha)

The different inorganic and organic sources of nutrient show significant influence on stover yield. Application of 75% RDN with 50% Poultry manure brought about higher stover yield of 6.39 t/ha. Significant increase in yield with organics and inorganics together was attributed to build up of humus, organic carbon which improves the soil properties and increased availability of nutrients with addition of manure. An increase in uptake of plant nutrients empowered the plant to manufacture more quantity of photosynthates resulting in more stover yield. Similar results were reported by Thumar *et al*., (2016) [10].

Harvest index (%)

The data on harvest index as significantly influenced due to different treatment combinations are presented in the table 3 the significantly higher harvest index was observd with the application of 75% RDN with 50% Poultry manure that is 33.22%. The treatment combination 75% RDN with 50% Vermicompost (32.86%) was statistically at par with 75% RDN with 50% Poultry manure.

Table 1: Effect of inorganic and organic sources of nutrient on plant height of pearl millet

		Plant height (cm)			
S. No.	**Treatments**	**20 DAS**	**40 DAS**	**60 DAS**	**80 DAS**
1.	50% RDN +50% FYM	12.31	105.79	145.83	150.01
2.	50% RDN + 50% Vermicompost	12.73	108.52	148.85	155.33
3.	50% RDN + 50% Poultry Manure	12.68	109.69	150.09	156.04
4.	75% RDN + 50% FYM	12.41	107.55	146.33	150.40
5.	75% RDN + 50% Vermicompost	12.83	112.59	152.71	163.53
6.	75% RDN + 50% Poultry Manure	12.97	113.47	154.81	165.67
7.	Control-100-40-40 kg/ha NPK	12.98	113.86	152.10	162.25
S. EM (±)		0.19	1.21	0.26	0.71
C. D. (P = 0.05)		0.58	3.73	0.81	2.18

Table 2: Effect of inorganic and organic sources of nutrient on plant dry weight of pearl millet.

Plant dry weight (g)					
S. No.	**Treatments**	**20 DAS**	**40 DAS**	**60 DAS**	**80 DAS**
1.	50% RDN +50% FYM	0.91	16.43	41.23	58.45
2.	50% RDN + 50% Vermicompost	0.94	20.73	47.16	61.73
3.	50% RDN + 50% Poultry Manure	0.95	22.93	49.81	64.59
4.	75% RDN + 50% FYM	0.91	18.26	45.91	59.54
5.	75% RDN + 50% Vermicompost	0.95	26.61	54.70	70.98
6.	75% RDN + 50% Poultry Manure	0.97	28.23	56.52	75.81
7.	Control-100-40-40 kg/ha NPK	0.91	25.46	52.94	67.67
S. EM (±)		0.02	0.34	0.57	0.53
C. D. (P = 0.05)		0.05	1.05	1.77	1.66

Table 3: Effect of inorganic and organic sources of nutrient on grain yield, stover yield and harvest index of pearl millet.

S. No.	Treatments	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1.	50% RDN +50% FYM	2.02	4.55	30.76
2.	50% RDN + 50% Vermicompost	2.54	5.25	31.00
3.	50% RDN + 50% Poultry Manure	2.66	5.44	31.23
4.	75% RDN + 50% FYM	2.33	5.12	31.22
5.	75% RDN + 50% Vermicompost	2.77	5.67	32.86
6.	75% RDN + 50% Poultry Manure	3.18	6.39	33.22
7.	Control-100-40-40 kg/ha NPK	2.20	5.51	28.59
S. EM (±)		0.07	0.23	0.47
C. D. (P = 0.05)		0.22	0.70	1.45

Conclusion

On the basis of present study, suggests that the application of 75% RDN with 50% Poultry manure resulted higher plant height (165.67 cm), plant dry weight (75.81 g), grain yield (3.18 t/ha), stover yield (6.39 t/ha) and harvest index (33.22%). 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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