Original Research Article

Effect of nitrogen and zinc on yield and economics of Pearl millet

ABSTRACT

The field experiment was conducted on Pearl millet during *kharif* season of 2023 at Crop Research Farm, Department of Agronomy. The treatment consisted of three levels of nitrogen (60,80 and 100 kg/ha) and zinc (Soil application 25 kg/ha, Foliar application 0.5% and Soil application 25 kg/ha + Foliar application 0.5%) along with recommended doses of phosphorus and potash and a control (20-40-20 N-P-K/ha). The experiment was laid out in a Randomized Block Design with 10 treatment and replicated thrice. Application of Nitrogen 100 kg/ha + 0.5% Zinc (treatment 8) recorded significantly highest grain yield (1.77 t/ha) and stover yield (5.15 t/ha) of pearl millet crop. Maximum net returns (60,336.17 t/ha), gross returns (96,361.67 t/ha) and benefit cost ratio (1.67) are observed in same treatment of pearl millet.

Keywords: Economics, Nitrogen, Pearl millet, Yield, Zinc.

Introduction

Pearl millet (*Pennisetum glaucum* L.) is multipurpose cereal crop belongs to the Poaceae family. It is commonly called as Bajra, Bajri, Sajje, Kambu, Kamban, Sajjalu etc in various Indian local languages. Pearl millet is a coarse grain crop suitable to cultivate in drylands and considered the poor man's source of staple nourishment (Ram *et al*., 2021). Pearl millet is the richest sources of nutrition, especially iron, calcium and zinc among cereals and hence can provide all the nutrients at the least cost compared to wheat and rice (Prasad *et al*., 2014). Pearl millet is grown in 6.70 M ha in India with the production level of 9.62 M t and the average productivity is about 1436 kg/ha. Uttar Pradesh is the second largest growing state of rice after Rajasthan in the country. Pearl millet production in Uttar Pradesh was 1.95 M t from an area of 0.90 M ha and productivity of 2156 kg/ha (Agriculturel at a Glance, 2022).

Nitrogen is considered as most important mineral for the production of cereal crops. Nitrogen is essential for plant growth and is known to be present in proteins, nucleic acids and chlorophyll (Gowd *et al.*, 2023). Adequate N nutrition is required for full development of tillers and leaves and also enables the plant to operate at peak photosynthetic capacity (Arsheyar *et al*., 2018). Nitrogen is the major nutrient required by pearl millet and variable growth and yield response to nitrogen application has been demonstrated (Rana and Prasad, 2020).

Zinc deficiency in plants can hinder crop yield and quality, as zinc is essential for structural components and enzymatic cofactors in key biochemical pathways (Girish *et al*., 2023). It increases growth hormone biosynthesis, starch creation, and grain production and maturation (Dwivedi *et al.,* 2021). Zinc is also vital for the oxidation processes in plant cells and helps in the transformation of carbohydrates and regulates sugar in plants. It is important in the synthesis of tryptophan, a component of some proteins and a compound needed for the production of growth hormones like indole acetic acid. Keeping in the view the immense importance of nitrogen and zinc fertilization, the present study "Effect of nitrogen and zinc on yield and economics of Pearl millet" was undertaken.

Material and Methods

The experiment was conducted during the *Kharif* season, at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj Uttar Pradesh, 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 had a sandy loam texture, having pH 7.3, electrical conductivity 0.714 mm /cm and organic carbon 1.227%. In experimental field five plants were selected and tagged randomly from every treatment. The data collected for different parameters were statistically analysed using Gomez and Gomez (1976) analysis of variance for randomized block design.

Results and discussion

Yield: The data regarding grain yield, stover yield and harvest index were embodied in Table 1.

Grain Yield: Significantly higher grain yield (1.77 t/ha) was recorded in (treatment-8) with application of nitrogen 100 kg/ha along with foliar application of zinc 0.5%, whereas treatment-7 and treatment -9 were found to be statistically at par with the highest.

Stover yield: Significantly higher stover yield (5.15 t/ha) was recorded in (treatment-8) with application of nitrogen 100 kg/ha along with foliar application of zinc 0.5%, whereas treatment-6, treatment-7 and treatment -9 were found to be statistically at par with the highest.

Harvest index: Higher harvest index (30.42%) was recorded in (treatment-7) with application of nitrogen 100 kg/ha along with 25 kg/ha $ZnSO_4$, which was found to be statistically at par with all the treatments.

Significant increase in yield attributes might due to zinc in biosynthesis indole acetic acid especially due to its role initiation of primordial reproductive parts promoting photosynthesis towar ds them (Rakesh *et al.,* 2021). Application of nitrogen increases the fertility of flowers and increase in leaf area and duration and resulted into increase in supplying assimilates for the sink. The increase in

grain and stover yields with graded levels of nitrogen could be ascribed to increase the activity of cytokinin
in plant which leads to the increased cell division and elongation and movement of photosynthates to sin k (Neha *et al.*, 2017).

Economics: Data regarding net returns, gross returns and benefit cost ratio was embodied in Table.1

Gross returns: Maximum gross returns (96361.67 INR/ha) was recorded in Nitrogen 100 kg/ha +FA- 0.5% Zinc and minimum gross return (76498.33 INR/ha) was recorded in control.

Net returns: Maximum net returns (60336.17 INR/ha) was recorded in Nitrogen 100 kg/ha +FA- 0.5% Zinc and minimum (42458.33 INR/ha) was recorded in control.

Benefit cost ratio: Higher benefit cost ratio (1.67) was recorded in Nitrogen 100 kg/ha +FA- 0.5% Zinc and lowest (1.14) was recorded in Nitrogen 60 kg/ha + SA-25 kg/ha $ZnSO_4$.

Conclusion

Application of Nitrogen 100 kg/ha and foliar application of zinc (0.5%) resulted higher yield and economics of pearl millet crop.

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Table 1. Effect of nitrogen and zinc on yield attributes, yield and economics of pearl millet.

	Treatment Combinations	Ear head length (cm)	No. of grains/ear head	Test weight (gm)	Grain yield (t/ha)	Benefit cost ratio
1.	Nitrogen 60 kg/ha + SA-25 kg/ha $ZnSO_4$	17.09	1505.33	5.76	1.39	1.14
2.	Nitrogen 60 kg/ha +FA- 0.5% Zinc	16.70	1523.67	6.66	1.49	1.33
3.	Nitrogen 60 kg/ha +SA- 25 kg/ha $ZnSO_4$ +FA- 0.5% Zinc	18.00	1715.33	5.50	1.56	1.24
4.	Nitrogen 80 kg/ha + SA-25 kg/ha $ZnSO_4$	21.33	1685.00	5.80	1.62	1.30
5.	Nitrogen 80 kg/ha +FA- 0.5% Zinc	18.26	1757.67	5.53	1.58	1.43
6.	Nitrogen 80 kg/ha +SA- 25 kg/ha $ZnSO_4$ + FA-0.5% Zinc	21.00	1706.33	6.26	1.60	1.30
7.	Nitrogen 100 kg/ha +SA- 25 kg/ha $ZnSO_4$	23.00	2107.33	6.83	1.65	1.42
8.	Nitrogen 100 kg/ha +FA- 0.5% Zinc	23.03	2272.33	6.43	1.77	1.67
9.	Nitrogen 100 kg/ha + SA-25 kg/ha $ZnSO_4$ +FA- 0.5% Zinc	22.13	2162.67	6.53	1.63	1.39
10.	80-40-40 NPK kg/ha (Control)	16.43	1624.00	6.30	1.36	1.24
	SEm (±)	1.12	104.81	0.54	0.05	-
	CD (p=0.05)	3.34	311.43	-	0.15	-