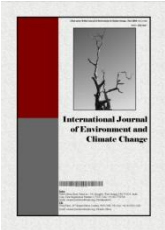

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Influence of Nitrogen and Zinc on Yield Components and Economics of Foxtail Millet (*Setaria italica*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Foxtail millet crop has interesting characteristic features *i.e.,* fairly tolerant to drought, and can escape terminal drought because of early maturity. Foxtail millet is comparable to that of super cereals like rice and wheat due to its capacity to withstand drought, adaptable to adverse climatic condition and input management.
Objectives: Effect of nitrogen and zinc on yield attributes and economics of foxtail millet.
Methods: With the goal of studying the effect of nitrogen and zinc on yield and economics of foxtail millet (*Setaria italica*) One variety of Foxtail millet i.e., DHFt 109-3 was used with different doses of Nitrogen at 40, 50, 60 kg/ha and Zinc at 10, 15, 20 kg/ha was used. There were 9 treatments each replicated thrice. The result showed that the yield parameters *viz,* length of Ear (21.19 cm), seed yield (2.11 t/ha), test weight (3.36 g) straw yield (5.48 t/ha), gross return (73,850.00 INR/ha), net return (51,508.00 INR/ha), B:C ratio (2.30) were recorded superior with application of nitrogen at 60 kg/ha along with zinc 20 kg/ha.
Conclusion: Maximum Gross returns (73,850.00 INR/ha), Net return (51,508.00 INR/ha), B:C ratio (2.30) was obtained with application of 60 N kg/ha + 20 kg Zn/ha.

Keywords: Nitrogen; zinc; yield; economics.

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1. INTRODUCTION

Foxtail millet is one of the oldest cultivated small millets both for food and fodder. It ranks second in the total world production of millets and it continues to have an important place in world agriculture providing food for millions of people in arid and semiarid regions [1]. It is native to China, regarded as an elite drought-tolerant crop. Andhra Pradesh, Karnataka and Tamil Nadu are the major foxtail millet growing states in India contributing about 79% of the total area [2]. It has excellent nutritional profile and is miles ahead of rice and wheat in terms of protein, fiber, minerals and vitamins. It has good nutritive value as it is rich in proteins (12.3 g), carbohydrates (60.9 g), fat (4.3 g), crude fiber (8.0 g), Minerals (3.3 g), calcium (3.1 g), Iron (2.8 g), Thiamine (50 mg), Energy 331 kcal per 100 g. The grain is a good source of Beta-carotene, which is the precursor of vitamin A.

Nitrogen is considered to be an important role in building units of proteins in the plant system, seedling stage, as an important period of crop growth, determines the developing of crop production and final grain yield. Nitrogen is considered to be an important nutrient for growth and development of plants. It plays an important role in building units of proteins in the plant system Thus, N nutrition not only influence productivity but also quality M. Uma Maheswar Reddy [3]. Nitrogen is the major nutrient required by the millets which positively increases the growth, yield attributes and finally improve the yield [4].

Zinc plays a key role in plants with enzymes and proteins involved in carbohydrate metabolism, proteins synthesis, gene expression, auxin (growth regulator) metabolism, pollen formation, maintenance of biological membranes, protection against photo- oxidative damage and heat stress, and resistance to infection by certain pathogens. Zinc deficiency in plants retards photosynthesis and nitrogen metabolism, reduces flowering and fruit development, prolongs growth periods (resulting in delayed maturity), decreases yield and quality, and results in sub- optimal nutrient-use efficiency. The results from a large number of on- farm follow- up trails comparing soil test-based balanced nutrition with farmer's inputs showed that balanced plant nutrient management significantly increases crop productivity and enhances grain and straw quality of crops. Zinc is an essential trace element for the growth and development of plants, humans and animals. Zinc deficiency is one of the most important reasons affecting human health. The growth and immune system of humans can be impaired by Zn deficiency [5].

2. MATERIALS AND METHODS

The experiment was conducted during the Kharif season 2021, at Crop Research Farm in the Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.) which is located at 25o 39' 42''N latitude, 81o67'56" E longitude and 98 m altitude above the mean sea level (MSL). This area is situated on the right side of the Yamuna River by the side of Prayagraj- Rewa road about 12 km from the city. The soil of experimental field was sandy loam, pH of soil (pH 7.3), low in organic carbon (0.57%), available N (230 kg ha-1), available P (32.10 kg ha-1) and available K (235 kg ha-1). The experiment involving with one variety of Foxtail millet DHFt 109-3 which was laid out in randomized block design with nine treatments replicated thrice. The treatments consist of different combinations of nitrogen and zinc doses in T1-Nitrogen 40 kg/ha + Zinc 10 kg/ha, T2 - Nitrogen 40 kg/ha + Zinc 15 kg/ha, T3 -Nitrogen 40 kg/ha + Zinc 20 kg/ha, T4 -Nitrogen 50 kg/ha + Zinc 10 kg/ha, T5 -Nitrogen 50 kg/ha + Zinc 15 kg/ha, T6 -Nitrogen 50 k/ha + Zinc 20 kg/ha, T7 - Nitrogen 60 kg/ha + Zinc10 kg/ha, T8 -Nitrogen 60 kg/ha + Zinc 15 kg/ha, T9 -Nitrogen 60 kg/ha + Zinc 20 kg/ha. Observations on yield and yield attributes of Foxtail millet were recorded and their significance was tested by the variance ratio (F-value) at 5% level [6].

3. RESULTS AND DISCUSSION

3.1 Effect on Yield of Foxtail Millet

The highest length of ear (21.19 cm) was recorded in the treatment 9 (Nitrogen 60 kg/ha + Zinc 20 kg/ha) however, treatment 8 (Nitrogen at 60 kg/ha + Zinc at 15 kg/ha), is statistically at par with treatment 9 (Nitrogen at 60 kg/ha + Zinc at 20 kg/ha). The maximum test weight (3.36 g), Seed yield (2.11 t/ha), Straw yield (5.48 t/ha) was recorded in treatment 9 (Nitrogen at 60 kg/ha + Zinc at 20 kg/ha), however, treatment 8 (Nitrogen at 60 kg/ha + Zinc at 15 kg/ha), treatment 7 (Nitrogen at 60 kg/ha + Zinc at 10 kg/ha), are statistically par to treatment 9 (Nitrogen at 60 kg/ha + Zinc at 20 kg/ha). The increase in

thousand grain weight due to higher nitrogen levels might be due to efficient dry matter partitioning and better translocation to the sink, leading to the formation of large sized grains due to adequate availability of nutrients at the time of grain filling. This ultimately resulted in higher test weight. This is in the accordance with the results reported Divya and Maurya [7].

Nitrogen is a component of porphyrins of chloroplasts and hence increased nitrogen fertilization increased the growth and yield of crop due to maximum photosynthates production. This resulted in enhanced morphological characters i.e., plant height, leaf area and dry matter accumulation which was reflected in higher straw yield. These findings are in support of Kalaghatagi et al. [8], Basavarajappa et al. [9] and Hasan et al. [10]. Zinc improved the yield attributes by improving the source and sink relationship due to increased translocation of photosynthates towards reproductive system [11].

3.2 Effect on Economics of Foxtail Millet

The maximum gross return (73,850.00 INR/ha), net return (51,850.00 INR/ha), benefit cost ratio (2.30) was recorded in the treatment 9 (Nitrogen at 60 kg/ha + Zinc at 20 kg/ha), while treatment 1 (Nitrogen 40 kg/ha + Zinc 10 kg/ha) was recorded the lowest gross return (61,600.00 INR/ha), net return (40,178.00 INR/ha) and benefit cost ratio (1.87). This could be due to the manifestation of higher grain and straw yields fetching of higher net returns at increased level of nitrogen. The similar results are reported by Divya and Maurya [7].

Fig. 1. At the time of sowing

Fig. 2. At the time of readings

Fig. 3. At the time of harvesting

Fig. 4. Research board

Table 1. Effect of nitrogen and zinc on yield of foxtail millet

S. no.	Treatment combination	Length of ear (cm)	Test weight (g)	Seed yield (t/ha)	Straw yield (t/ha)
1.	Nitrogen 40 kg/ha + Zinc 10 kg/ha	16.43	3.15	1.83	3.73
2.	Nitrogen 40 kg/ha + Zinc 15 kg/ha	17.03	3.03	1.76	3.92
3.	Nitrogen 40 kg/ha + Zinc 20 kg/ha	16.65	3.00	1.84	4.02
4.	Nitrogen 50 kg/ha + Zinc 10 kg/ha	17.19	3.07	1.90	4.11
5.	Nitrogen 50 kg/ha + Zinc 15 kg/ha	17.91	3.05	1.92	4.46
6.	Nitrogen 50 kg/ha + Zinc 20 kg/ha	18.37	3.10	1.93	4.70
7.	Nitrogen 60 kg/ha + Zinc 10 kg/ha	19.63	3.19	2.00	5.24
8.	Nitrogen 60 kg/ha + Zinc 15 kg/ha	19.97	3.31	2.06	5.42
9.	Nitrogen 60 kg/ha + Zinc 20 kg/ha	21.19	3.36	2.11	5.48
	SEm±	0.44	0.06	0.02	0.15
	CD (P = 0.05)	1.35	0.20	0.84	0.45
	F test	S	S	S	S

Table 2. Effect of nitrogen and zinc on economics of foxtail millet

S. no.	Treatment combination	Gross return (INR/ha)	Net return (INR/ha)	Benefit cost ratio
1.	Nitrogen 40 kg/ha + Zinc 10 kg/ha	61,600.00	40,178.00	1.87
2.	Nitrogen 40 kg/ha + Zinc 15 kg/ha	64,050.00	42,230.00	1.93
3.	Nitrogen 40 kg/ha + Zinc 20 kg/ha	64,400.00	42,178.00	1.89
4.	Nitrogen 50 kg/ha + Zinc 10 kg/ha	66,500.00	45,018.00	2.09
5.	Nitrogen 50 kg/ha + Zinc 15 kg/ha	67,200.00	45,318.00	2.07
6.	Nitrogen 50 kg/ha + Zinc 20 kg/ha	67,550.00	45,268.00	2.03
7.	Nitrogen 60 kg/ha + Zinc 10 kg/ha	70,000.00	48,458.00	2.24
8.	Nitrogen 60 kg/ha + Zinc 15 kg/ha	72,000.00	50,158.00	2.28
9.	Nitrogen 60 kg/ha + Zinc 20 kg/ha	73,850.00	51,508.00	2.30

**Economics not subjected to data analysis*

4. CONCLUSION

It was concluded that application of Nitrogen 60 kg/ha along with Zinc 20 kg/ha in Foxtail millet recorded maximum seed yield (2.11 t/ha), gross return (73,850.00 INR/ha), net return (51,508.00 INR/ha) and Benefit cost ratio (2.30). These findings are based on one season therefore, further trails may be required for further confirmation.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ramesh G, Ch. Pulla Rao, Dr. PVN Prasad, Dr. PRK Prasad. Effect of integrated nutrient management on growth, yield and economics of foxtail millet. Journal of Pharmacognosy and Phytochemistry. 2019;8(4):3115-3117.
2. Jaison M, Kiran Pilli, Harish SG, Chikkaramappa T. Response of foxtail millet to application of zinc and boron in Alfisols of Karnataka. International Journal of Chemical Studies.2018;6(6):2658-2661.
3. Reddy MUM, Roja M, Reddy MD, Barman S. Effect of nitrogen and phosphorus management on growth and yield of foxtail millet [*Setaria italica* L.] during summer season in Odisha, India. Indian Journal of Agricultural Research. 2020;54(2):242-246.
4. Prasad SK, Samota A, Singh MK, Verma SK. Cultivars and nitrogen levels influence on yield attributes, yield and protein content of pearl millet under semi-arid condition of vindhyan region. The Ecoscan. 2014;6:47-50.
5. Munirathnam P, Sambasiva A, Sawadhkar Sm. Evaluation of foxtail millet varieties under low fertility conditions. Agric. Sci. Digest. 2006;26(3):197-199.
6. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd Ed., Wiley and Sons, Inc. New York, USA; 1984.
7. Divya S, Maurya BM. Response of kodo millet (*Paspalum scrobiculatum*) to varying levels of nitrogen under rainfed condition. International Journal of Scientific Research. 2013;2(8):10-11.
8. Kalaghatagi S, Jirali DI, Walia SY, Nagod MS. Response of foxtail millet (*Setaria italica*) to nitrogen and phosphorous under rainfed conditions of northern dry zone of karnataka. Annals of Arid Zone. 2000; 39(2):169-171.
9. Basavarajappa R, Prabhakar AS, Halikatti SI. Effect of tillage, organics, nitrogen and their interaction on yield attributes and yields of foxtail millet (*Setaria italica*) under shallow alfisols during rainy season. Indian Journal of Agronomy. 2002;47(3):390-397.
10. Hasan MS, Rashid MH, Rahman QA, Almamun MH. Influence of seed rates and levels of NPK fertilizers on dry matter accumulations and yield performance of foxtail millet (*Setaria italica* L. Beauv.). Bangladesh Journal of Agricultural Research. 2013;38(4):689-704.
11. Sammauria R, Yadav RS. Response of pearl millet (*Pennisetum glaucum*) to residual fertility under rainfed conditions of arid region of Rajasthan. Indian J. Dryland Agric. Res. & Dev. 2010;25(1):53-60.

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