

## Original Research Article

### **Influence of nitrogen and zinc on yield components and economics of**

#### **Foxtail millet (*Setaria italica*)**

**Abstract:** A field experiment was conducted during *Kharif* 2021 to study the “**Influence of nitrogen and zinc on yield components and economics of Foxtail millet (*Setaria italica*)**”, at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.3), low in organic carbon (0.57%), available N (230 kg/ha), available P (32.10 kg/ha) and available K (235 kg/ha). 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.

**Key words:** Nitrogen, Zinc, Yield, Economics

**Introduction:** Foxtail millet (*Setaria italica*) is one of the oldest cultivated millet and most economically important species of the genus *Setaria*. 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 semi-arid regions. 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 (**Munirathnam *et al.*, 2006**). 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. Crops have been reported as poor users of both available N and applied N fertilizer at the seedling stage because of the poor synchronization between the availability of N and the demand for N (**Erying, C *et al.*, 2020**), which results in the potential for significant N losses. Hence, it is very important to know how to settle the inconsistency between N availability and crop demand, and increase the N use efficiency, which could be achieved from using germplasm with higher-N uptake and utilization efficiency at early growing season. Nitrogen is the essential component of amino acids, proteins, nucleic acids, enzymes, co-enzymes and alkaloids. 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.

## 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 25° 39' 42''N latitude, 81°67'56'' 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<sup>-1</sup>), available P (32.10 kg ha<sup>-1</sup>) and available K (235 kg ha<sup>-1</sup>). 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 T<sub>1</sub>-Nitrogen 40 kg/ha + Zinc 10 kg/ha, T<sub>2</sub>-Nitrogen 40 kg/ha + Zinc 15 kg/ha, T<sub>3</sub>-Nitrogen 40 kg/ha + Zinc 20 kg/ha, T<sub>4</sub>-Nitrogen 50 kg/ha + Zinc 10 kg/ha, T<sub>5</sub>-Nitrogen 50 kg/ha + Zinc 15 kg/ha, T<sub>6</sub> -Nitrogen 50 k/ha + Zinc 20 kg/ha, T<sub>7</sub> -Nitrogen 60 kg/ha + Zinc10 kg/ha, T<sub>8</sub> -Nitrogen 60 kg/ha + Zinc 15 kg/ha, T<sub>9</sub> -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 **Gomez and Gomez, (1984)**.

## Results and Discussion

### *Effect on yield of Foxtail millet*

The highest length of ear (21.19 cm) was recored 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 by **(Divya and Maurya, 2013)**. 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., (2000)**, **Basavarajappa et al., (2002)** and **Hasan et al., (2013)**. Zinc improved the yield attributes by improving the source and sink relationship due to increased translocation of photosynthates towards reproductive system **(Sammauria and Yadav, 2010)**.

**Table 1. Effect of nitrogen and zinc on yield of Foxtail millet.**

S. No.	Treatment combination	Length of ear	Test weight	Seed yield	Straw yield
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		(cm)	(g)	(t/ha)	(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

#### *Effect on Economics of Foxatil 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 (2013)**.

**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

### 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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