

Original Research Article

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Quality Studies and Yield as Influenced by Zinc Fertilization in Baby Corn (*Zea mays* L.)

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ABSTRACT

A Field experiment was conducted at College farm, College of Agriculture, Rajendranagar, PJTSAU, Hyderabad to study the effect of zinc fertilization on quality and yield of baby corn during *kharif* season 2016. The results revealed that soil application of $ZnSO_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $ZnSO_4 @ 0.2\%$ at 25 DAS and at 40 DAS recorded significantly higher crude protein content and crude protein yield in plant, husk and corn over control (no zinc). Again, superior quality of acid detergent fibre and neutral detergent fibre was recorded with soil application of $ZnSO_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $ZnSO_4 @ 0.2\%$ at 25 DAS and at 40 DAS. Superior fibre quality was observed with increase in level of zinc fertilization over control no zinc application. Significantly higher corn yield, dry matter yield and green fodder yield was observed with soil application of $ZnSO_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $ZnSO_4 @ 0.2\%$ at 25 DAS and at 40 DAS over control (no zinc). The profound increase in probably due to the involvement of zinc in auxin metabolism, which led to higher hormonal activity and growth performance. The results of the study concluded that there was significant results observed in quality and yield of baby corn with soil application of $ZnSO_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $ZnSO_4 @ 0.2\%$ at 25 DAS and at 40 DAS over control (no zinc) application.

Keywords

Quality, Yield, Zinc fertilization, Baby corn.

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Introduction

Recently cultivation of baby corn has started and gaining popularity in peri-urban areas due its export potential besides huge employment generation. Being a short duration crop (50-60 days) it can be sown and harvested 3 to 4 times in a year. Baby corn is the dehusked young cobs harvested within 2-3 days of silk emergence and are consumed as vegetable

due to its sweet flavour. Baby corn has high contents of folate as well as vitamin 'B' and also good source of several other nutrients. The earliness facilitates crop diversification, increase overall cropping intensity in a year and increases profitability. The lack of knowledge on production technology seems to be the major constraints for popularization

among the growers. One third of the world population is reported at the risk of malnutrition due to inadequate dietary intake of zinc (Cakmak, 2009). About 50 % of Indian soils are deficient in zinc causing low level of zinc and yield losses in fodder crops and affecting the health of the livestock (Singh, 2011).

According to the recent survey, zinc deficiency in human nutrition is the most wide spread nutritional disorder, next to iron, vitamin 'A' and iodine. Zinc has a key role as a structural constituent or regulatory co-factor of a wide range of enzymes and proteins in many important biochemical pathways and these are mainly concerned with carbohydrate metabolism, both in photosynthesis and in the conversion of sugars to starch, protein metabolism, auxin metabolism, pollen formation, maintenance of integrity of biological membranes and resistance to infection by certain pathogens (Alloway, 2008). Zinc fertilization are used to increase micronutrient in edible parts to reduce the micro nutrient deficiency in human populations.

Materials and Methods

Field experiment was carried at College Farm, College of Agriculture, Rajendranagar, Hyderabad, Telangana State, during *khari* season, 2016. The experimental site is geographically situated at 17⁰19' N latitude, 78⁰ 28' E longitude and at an altitude of 542.3 m above sea level which falls under Southern Telangana Agro-climatic region. The experiment was laid out in a randomized block design consisting of twelve treatments and replicated thrice. The treatments consisted are, T₁: Control (No zinc), T₂: Foliar spray of ZnSO₄ @ 0.2% at 25 DAS, T₃: Foliar spray of ZnSO₄ @ 0.2% at 40 DAS, T₄: Foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS, T₅: Soil application of ZnSO₄ @

12.5 kg ha⁻¹, T₆: T₅ + Foliar spray of ZnSO₄ @ 0.2% at 25 DAS, T₇: T₅ + Foliar spray of ZnSO₄ @ 0.2% at 40 DAS, T₈: T₅ + Foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS, T₉: Soil application of ZnSO₄ @ 25 kg ha⁻¹, T₁₀: T₉ + Foliar spray of ZnSO₄ @ 0.2% at 25 DAS, T₁₁: T₉ + Foliar spray of ZnSO₄ @ 0.2% at 40 DAS, T₁₂: T₉ + Foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS.

Baby corn variety, VL-1 was used by adopting a spacing of 40 cm x 20 cm. The recommended dose of 150:60:50 NPK kg ha⁻¹ was applied to all treatments. Nitrogen was applied in two splits per treatment i.e. half as basal and half at 30 days after sowing in form of urea. Phosphorus, potassium and zinc were applied in the form of single super phosphate, muriate of potash and zinc sulphate respectively. The experimental site was sandy clay loam and observed fertility status was low in organic carbon and available zinc as well as available nitrogen, medium in available phosphorus and high in potassium.

The collected samples from each treatment i.e. plant, husk and corn were oven dried 70 °C for 48 hours, powdered and analyzed for quality studies. The total nitrogen content in plant, husk and corn samples was estimated by Micro Kjehldal method (Subbaiah and Asija, 1956). The protein content in plant, husk and corn samples was obtained by multiplying with the conversion factor 6.25 (Raghuramulu *et al.*, 1983) and expressed in percentage. Crude protein content of plant, husk and corn samples was multiplied with dry matter yield of plant, husk and corn and it is expressed in kg ha⁻¹. Crude protein yield was estimated by using the formula,

$$\text{Crude protein yield (kg ha}^{-1}\text{)} = \frac{\text{Crude protein (\%)} \times \text{Dry matter yield (kg ha}^{-1}\text{)}}{100}$$

Similarly, Acid detergent fibre (%) and Neutral detergent fibre (%) was determined using heat stable amylase according to the procedure of Van Soest and Wine (1967) and expressed in percentage and were calculated by using the formula,

$$\text{Fibre (\%)} = \frac{\text{Weight of silica crucible with contents before ashing} - \text{Weight of silica crucible with contents after ashing}}{\text{Weight of sample}} \times 100$$

At harvest, the corn yield (kg ha^{-1}), dry matter yield (kg ha^{-1}) and green fodder yield (t ha^{-1}) were recorded. Data were statistically analyzed as suggested by Panse and Sukhatme (1978).

Results and Discussion

Data on various quality parameters in baby corn was presented in Table 1. It was resulted that significantly higher crude protein content in plant (9.75%), in husk (8.44%) and in corn (13.31%) with soil application of $\text{ZnSO}_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $\text{ZnSO}_4 @ 0.2\%$ at 25 DAS and at 40 DAS over control no zinc application which showed crude protein content in plant (7.69%), in husk (6.69%) and in corn (11.31%).

Similar increase in protein content with application of zinc was also reported by Tahir *et al.*, (2016). Therefore, Significantly higher crude protein yield in plant (1057 kg ha^{-1}), in husk (415 kg ha^{-1}) and in corn (217 kg ha^{-1}) was recorded with soil application of $\text{ZnSO}_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $\text{ZnSO}_4 @ 0.2\%$ at 25 DAS and at 40 DAS whereas lower crude protein yield in plant (594 kg ha^{-1}), in husk (239 kg ha^{-1}) and in corn (143 kg ha^{-1}) observed with control no zinc application. Increase in protein content might be due to increase in protein concentration in plant which is an integral part of protein synthesis

(Balai *et al.*, 2011). Zinc is involved in protein synthesis and biosynthesis of Indole 3-acetic acid, a growth hormone, involved in cell division and cell elongation. Similar increase with zinc application was also reported by Arya and Singh (2000), Ghodpage *et al.*, (2008) and Mahdi *et al.*, (2012).

In Table 2, Crop supplied with soil application of $\text{ZnSO}_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $\text{ZnSO}_4 @ 0.2\%$ at 25 DAS and at 40 DAS recorded superior quality of acid detergent fibre (43.15%) and neutral detergent fibre (58.65%) over control no zinc application (46.98% acid detergent fibre and 65.00% neutral detergent fibre).

Reduction in acid detergent fibre (ADF) and neutral detergent fibre (NDF) content due to recommended dose of fertilizer along with higher levels of zinc treatments. Acid detergent fibre represents concentration of cellulose + lignin + silica, which impart physical strength to plant and not easily digestible in animals (Maynard and Loosli, 1969).

Sheta *et al.*, (2010) also reported that reduction in acid detergent fibre and neutral detergent fibre content with higher fertilizer levels. Neutral detergent fibre includes cell wall constitutes comprising of acid detergent fibre as well as relatively easily digestible fibre compounds such as hemi cellulose, lignified N compounds. It imparts bulk and improves digestibility in animals.

Lower fibre content with soil application of $\text{ZnSO}_4 @ 25 \text{ kg ha}^{-1}$ + foliar spray of $\text{ZnSO}_4 @ 0.2\%$ at 25 DAS and at 40 DAS might be due to higher zinc content which is showed higher palatability. Application of zinc reduces the fibre and soluble carbohydrate content in fodders thereby increases digestibility (Alloway, 2008).

Table.1 Crude protein content (%) and crude protein yield (kg ha⁻¹) as influenced by zinc fertilization

Treatments	Crude protein content			Crude protein yield		
	Plant	Husk	Corn	Plant	Husk	Corn
T₁ : Control (No zinc)	7.69	6.69	11.31	594	239	143
T₂ : Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	8.06	6.88	11.75	716	278	158
T₃ : Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	8.13	6.94	11.88	717	283	147
T₄ : Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	8.31	7.13	12.13	772	295	151
T₅ : Soil application of ZnSO ₄ @ 12.5 kg ha ⁻¹	8.56	7.38	12.31	787	319	166
T₆ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	8.81	7.50	12.44	846	331	165
T₇ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	8.94	7.50	12.50	858	324	182
T₈ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	9.19	7.69	12.69	935	345	178
T₉ : Soil application of ZnSO ₄ @ 25 kg ha ⁻¹	9.38	7.88	12.94	951	353	197
T₁₀ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	9.56	8.06	13.06	960	383	196
T₁₁ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	9.56	8.13	13.13	1016	385	206
T₁₂ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	9.75	8.44	13.31	1057	415	217
SEm ±	0.18	0.20	0.21	43	22	7
CD (P=0.05)	0.52	0.60	0.61	125	65	21

Table.2 ADF (%), NDF (%), corn yield (kg ha⁻¹), dry matter yield (kg ha⁻¹) and green fodder yield (t ha⁻¹) as Influenced by zinc fertilization

Treatments	ADF	NDF	Corn yield	Dry matter yield	Green fodder yield
T₁ : Control (No zinc)	46.98	65.00	1261	7742	22.38
T₂ : Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	46.13	64.20	1349	8876	23.10
T₃ : Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	46.57	64.60	1240	8820	23.33
T₄ : Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	46.74	63.85	1245	9280	23.66
T₅ : Soil application of ZnSO ₄ @ 12.5 kg ha ⁻¹	45.05	62.35	1351	9164	24.57
T₆ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	44.48	63.15	1326	9586	24.73
T₇ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	44.31	62.15	1459	9611	25.81
T₈ : T₅ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	44.69	61.95	1404	10166	25.92
T₉ : Soil application of ZnSO ₄ @ 25 kg ha ⁻¹	43.43	59.45	1522	10125	27.06
T₁₀ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS	43.52	60.55	1500	10007	26.48
T₁₁ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 40 DAS	43.47	60.80	1566	10649	27.48
T₁₂ : T₉ + Foliar spray of ZnSO ₄ @ 0.2% at 25 DAS and at 40 DAS	43.15	58.65	1630	10855	27.76
SEm ±	2.47	2.90	44	538	0.70
CD (P=0.05)	NS	NS	130	1577	2.04

In Table 2, Significantly higher corn yield (1630 kg ha⁻¹), dry matter yield (10855 kg ha⁻¹) and green fodder yield (27.76 kg ha⁻¹) was recorded with soil application of ZnSO₄ @ 25 kg ha⁻¹ + Foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS over control no zinc treatment. Zinc treatment either by soil or foliar application led to an increase in the corn yield by 0.4% to 31.4% and in the green fodder yield by 3.1% to 24.0% over control no zinc application. Increase in corn yield might be due to favourable influence of applied zinc on physiological and metabolic process of the plants, which ultimately enhanced corn yield. Similar results were also founded by Ghodpage *et al.*, (2008). Higher dry matter production in soil application of ZnSO₄ @ 25 kg ha⁻¹ + foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS might be due to synchronized and optimum release of nutrients under this treatment. Dry matter yield related to productivity contributes an important factor in source-sink relationship. Increase in green fodder yield might be due to the enhanced translocation of photosynthates with applied zinc, which resulted in higher production of green fodder in the respective levels of nutrient. Similar results of significantly higher fodder yield with Zn application was also reported by Mahdi *et al.*, (2012), Balwinder kumar *et al.*, (2013) and Mona (2015).

It is concluded that among different zinc fertilization treatments studied in baby corn, soil application of ZnSO₄ @ 25 kg ha⁻¹ + foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS recorded significantly higher crude protein content and crude protein yield over control no zinc application. Similarly, superior quality of acid detergent fibre and neutral detergent fibre was also reported with soil application of ZnSO₄ @ 25 kg ha⁻¹ + foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS which is showed higher palatability. Significantly higher corn yield,

dry matter yield and green fodder yield resulted with soil application of ZnSO₄ @ 25 kg ha⁻¹ + foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS over control no zinc application. The present experimental study suggested that soil application of ZnSO₄ @ 25 kg ha⁻¹ + foliar spray of ZnSO₄ @ 0.2% at 25 DAS and at 40 DAS is better for improving quality of baby corn and also corn yield, dry matter yield and green fodder yield.

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