



Influence of Nitrogen and Zinc on Growth and Yield of Baby Corn (*Zea mays* L.)

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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

An experiment was conducted during the *Rabi* season of 2020 at Fodder Production Farm of Livestock Research Station (Sri Venkateswara Veterinary University), Lam Farm, Guntur. A.P, to find out the effect of basal application of Nitrogen and Zinc on growth and yield of Baby corn (*Zea mays* L.). The experiment was laid out in Randomized Block Design with 9 treatments and each treatment replicated thrice. Treatments consisted of combination of three levels of Nitrogen (80, 100 and 120kg/ha) and three levels of Zinc (10, 20 and 30 kg/ha). It was observed that application of 100 kg Nitrogen /ha + 30 kg Zinc/ha, was found the best treatment for obtaining growth and yield attributes such as Plant height (178.46 cm), Plant dry weight (105.58 g), No. of leaves per plant (12.00), Leaf area index (3.07), No. of cobs per plant (4.19), Length of cob (20.72 cm), Length of the corn (9.06 cm), Girth of the cob (7.34 cm), Corn girth (3.42), Cob yield (16026.53 kg/ha) and Corn yield (2597.47 kg/ha in Krishna zone of Andhra Pradesh, India.

Keywords: *Baby corn; nitrogen; zinc; growth; yield.*

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1. INTRODUCTION

Maize (*Zea mays L.*) is one of the most versatile emerging crop having wider adaptability under varied agro-climatic conditions. Globally, Maize is known as Queen of Cereals because of its high genetic yield potential among the Cereals, used for various purposes including grain, feed, fodder, table purpose and industrial products. It is cultivated on nearly 150 million hectares in about 160 countries having wider diversity of soil, climate, biodiversity and management practices which contributes 36% (782 MT) in the global grain production [1].

Baby corn is a short duration crop, with potential option for raising farmer's income being a high value crop. This crop may open new alternatives since, it fits well in the cropping systems and grows year-round in a wide range of climatic conditions. Production technologies of baby corn differ from maize thus, development and standardization of location specific agro-techniques are required before popularization among the farmers, [2].

The productivity of baby corn entirely depends on the extent of successful completion of crop growth for exploiting their full genetic potential and properly integrated with environmental conditions in which it is grown. However, the role of balanced and adequate nutrition is recognized as one of the important factors in realizing the maximum yield of baby corn. Role of nutrients for effective progression of plant ontogeny and crop yield as well as in quality improvement of crop has been well recognized. Besides the major primary nutrients, N, P, K, secondary nutrients like Sulphur and Micro-nutrients like Zn have been recognized as essential inputs for sustaining the Baby corn productivity and in enhancement of its quality [3].

Nitrogen (N) is a vital plant nutrient and a major determining factor required for maize production [4] which is a component of protein, nucleic acids and when N is sub optimal, growth is reduced. Its availability in sufficient quantity throughout the growing season is essential for optimum Maize growth [5]. Nitrogen as a major constituent of cell plays a vital role in cell division and elongation by virtue of being an essential part of diverse type of metabolically active compound like amino acids, proteins, nucleic acids, porphyrins, flavins, purines and pyrimidine nucleotides, enzymes, co-enzymes and alkaloids. Therefore, it is a vitally associated with the activity of every living cell. Thus, greater

availability of Nitrogen at higher fertilizer doses might have improved protein synthesis and photosynthesis leading thereby to rapid cell division and enlargement which is ultimately resulted in to vigorous plant growth [6].

(Zn) is essential for several enzymes that regulate various metabolic activities in plants. It is also vital for oxidation processes in plant cells and helps in transformation of carbohydrates and sugar in plants; enhances cell division and elongation; plays an important role in photosynthesis and nitrogen metabolism which ultimately increased the growth of the maize. [7]. It helps in formation of chlorophyll and some carbohydrates, conversion of starches to sugars and its presence in plant tissues help the plant to withstand in cold temperatures too. Zinc deficiency at soils may not only reduces the crop production but also causes deficiency of Zn in human diet [8]. In Asia about 2.50 billion people were estimated to be suffering highly from zinc deficiencies, specifically between the age group of 0 to 5 years [9]. Zinc fertilization are used to increase micro nutrient in edible part to reduce the micro nutrient deficiency in human populations. Among field crops, Maize is highly susceptible to zinc deficiency and it can be used as an indicator plant for zinc deficiency. Maize occupies the third rank in demand for zinc next to rice and wheat, respectively [10]. Therefore, keeping the above facts in view, the present experiment entitled "Influence of Nitrogen and Zinc on Growth and Yield of Baby corn (*Zea mays L.*)" has been proposed for study.

2. MATERIALS AND METHODS

The field experiment was conducted during the *Rabi* season of 2020 at Fodder Production Farm of, Livestock Research Station, Sri Venkateswara Veterinary University, Lam Farm, Guntur-522034, Andhra Pradesh, India, which has a tropical climate with maximum and minimum temperature of 31.37 and 15.82 °C, respectively. The soil of experimental field was Black Clayey in texture, with pH 8.50 and EC(0.45/dms), Organic Carbon (0.42%), available Nitrogen (288 kg ha⁻¹), available P₂O₅ (174 kg ha⁻¹) available K₂O (418 kg ha⁻¹) and available Zn (0.57 kg ha⁻¹). The experiment comprised with 9 treatments, each replicated thrice. The treatment combinations are mentioned in Table 1.

The ridges and furrows were opened at 45 cm distance. Healthy seeds of Baby corn variety G-

5414 of Syngenta Pty. Ltd., were sown on 24th November 2020 by dibbling two seeds manually per hill on one side of the ridge by keeping 15 cm intra row spacing at a depth of 3-4 cm. Nutrients were applied as per treatment description and the source of N, P, K, Zinc were Urea, Single Super Phosphate (SSP), Muriate of Potash (MOP) and Zinc Sulphate respectively. Full doses of all the nutrients were applied as basal during sowing. To calculate the leaf area index (L.A.I.), five leaves were selected at random from the sample plants. The leaf area of these sample leaves was measured with a Leaf Area Meter (LI-COR-3100C of LI-COR®, USA). The area covered by the leaf was determined and the total area of leaves per plant was calculated by counting the leaves per plant and multiplying it by average leaf area. Then the leaf area index (LAI) was calculated by following formula LAI= Leaf area/Ground area. The first harvesting of baby corns cobs was carried out 58 days after sowing (21.01.2021) and subsequently harvested in 2 pickings. The cobs were harvested from an area of one meter squared, treatment wise and weighed with and without husk where after the obtained values were converted to per hectare and recorded as kg/ha.

Table 1. Treatment combinations

Tr. No	Treatment Combinations
T ₁	80 kg Nitrogen /ha + 10 kg ZnSo ₄ /ha
T ₂	80 kg Nitrogen /ha + 20 kg ZnSo ₄ /ha
T ₃	80 kg Nitrogen /ha + 30 kg ZnSo ₄ /ha
T ₄	100 kg Nitrogen /ha + 10 kg ZnSo ₄ /ha
T ₅	100 kg Nitrogen /ha + 20 kg ZnSo ₄ /ha
T ₆	100 kg Nitrogen/ha + 30 kg ZnSo ₄ /ha
T ₇	120 kg Nitrogen/ha + 10 kg ZnSo ₄ /ha
T ₈	120 kg Nitrogen/ha + 20 kg ZnSo ₄ /ha
T ₉	120 kg Nitrogen/ha + 30 kg ZnSo ₄ /ha

The experiment data was analyzed as per the methods of "Analysis of Variance technique [11]. The significance and non-significance of the treatment effect was judged with the help of "F table" (variance ratio).

3. RESULTS AND DISCUSSION

Application of Nitrogen and Zinc showed substantial effect on different growth and yield attributes of baby corn. Data regarding growth parameters is presented in Table 2.

3.1 Growth Parameters

The maximum Plant height was recorded (178.46 cm) under T₆ (Nitrogen 100 kg/ha + Zinc 30

kg/ha) and minimum Plant height was recorded (121.32) under T₁ (Nitrogen 80 kg/ha + Zinc 10 kg/ha). That there was wide variation found in plant height recorded at final harvesting stage of Baby corn as affected by different treatments. Nitrogen increases photosynthetic activity and helps in maintaining higher auxin level which could have resulted in better plant height. Similar findings were reported by Bhaladhare *et al.* [12]. Significant increase in plant height due to Zinc fertilization has a positive effect on the physiological process, plant metabolism and plant growth [13]. Zinc is essential in the formation of auxins, which might help with growth regulation and stem elongation. Similar observation was noticed by Kumar and Bohra [7], Amutham *et al.* [14].

The maximum No. of leaves were recorded (12.00) under T₆ (Nitrogen 100 kg/ha + Zinc 30 kg/ha) and minimum No. of leaves were recorded (9.13) in T₁ (Nitrogen 80 kg/ha + Zinc 10 kg/ha). Nitrogen is indispensable for increasing crop production as a constituent of protoplasm and chlorophyll and is associated with the activity of every living cell. The increase in No. of Leaves/plant may be due to application of Nitrogen and zinc which were promoted rapid vegetative growth and help the plant to produce chlorophyll which gives the plant their green colour [2]. These results were in conformity with Bhaladhare *et al.* [12].

The maximum Plant Dry weight was recorded (105.58 g) under T₆ (Nitrogen 100 kg/ha + Zinc 30 kg/ha) and minimum Plant Dry weight was recorded (79.22 g) in T₁ (Nitrogen 80 kg/ha + Zinc 10 kg/ha). Total dry matter production is related with plant height and leaf area. It has been documented that Zn plays important role in synthesis of various enzymes like carbonic anhydrase, glutamic acid dehydrogenase, lactic acid dehydrogenase and some peptidases [15]. Zinc is also considered to be a precursor for auxin synthesis, involved in nitrogen metabolism and several oxidation reduction reactions, stability of RNA and starch formation. Thus, its adequate supply results in higher dry matter production, ultimately growth and development of plants. Similar results were found by Ashoka *et al.*, [16].

The maximum Leaf area index was recorded (3.07) under T₆ (Nitrogen 100 kg/ha + Zinc 30 kg/ha) and minimum Leaf area index was recorded (1.57) in T₁ (Nitrogen 80 kg/ha + Zinc 10 kg/ha). In fact, increase in leaf area index

Table 2. Effect of application of nitrogen and zinc on growth attributes of baby corn (*Zea mays* L.)

Tr. No.	Treatments	Plant height (cm)	Number of leaves	Plant dry weight (g)	Leaf Area Index
T ₁	80 kg/ha Nitrogen + 10kg/ha Zinc	121.32	9.13	79.22	1.57
T ₂	80 kg/ha Nitrogen + 20kg/ha Zinc	140.03	9.40	83.52	1.68
T ₃	80 kg/ha Nitrogen + 30kg/ha Zinc	151.02	9.87	92.42	2.27
T ₄	100 kg/ha Nitrogen + 10kg/ha Zinc	147.23	9.73	91.51	2.18
T ₅	100 kg/ha Nitrogen + 20kg/ha Zinc	161.55	10.33	102.39	2.53
T ₆	100 kg/ha Nitrogen + 30kg/ha Zinc	178.46	12.00	105.58	3.07
T ₇	120 kg/ha Nitrogen + 10kg/ha Zinc	155.00	10.00	100.61	2.39
T ₈	120 kg/ha Nitrogen + 20kg/ha Zinc	167.99	11.53	103.35	2.90
T ₉	120 kg/ha Nitrogen + 30kg/ha Zinc	177.08	11.73	104.81	2.97
	<i>F test</i>	S	S	S	S
	<i>S. Em</i> (±)	1.27	0.19	0.49	0.05
	<i>CD (P=0.05)</i>	3.82	0.57	1.46	0.14

Table 3. Effect of application of nitrogen and zinc on yield attributes & yield of baby corn

Tr. No.	Treatments	No. of cobs / plant	Length of cob (cm)	Length of corn (cm)	Girth of cob (cm)	Girth of corn (cm)	Cob weight with husk (g)	Cob weight without husk (g)	Cob yield (kg/ha)	Corn yield (kg/ha)
T ₁	80 kg/ha Nitrogen + 10kg/ha Zinc	4.10	15.89	7.10	5.98	2.35	39.37	9.32	13900.03	1932.03
T ₂	80 kg/ha Nitrogen + 20kg/ha Zinc	3.87	16.52	7.43	6.13	2.51	40.69	9.49	14000.03	2073.33
T ₃	80 kg/ha Nitrogen + 30kg/ha Zinc	4.07	17.19	7.97	6.41	2.72	42.21	10.17	14685.17	2367.20
T ₄	100 kg/ha Nitrogen + 10kg/ha Zinc	4.17	16.90	7.67	6.27	2.47	41.64	9.73	14670.43	2309.63
T ₅	100 kg/ha Nitrogen + 20kg/ha Zinc	4.07	18.52	8.20	6.69	3.07	44.44	11.31	15073.93	2474.03
T ₆	100 kg/ha Nitrogen + 30kg/ha Zinc	4.19	20.72	9.06	7.34	3.42	48.49	11.87	16026.53	2597.47
T ₇	120 kg/ha Nitrogen + 10kg/ha Zinc	3.93	17.91	8.13	6.55	2.89	45.40	10.51	14814.83	2396.07
T ₈	120 kg/ha Nitrogen + 20kg/ha Zinc	3.53	19.78	8.43	7.08	3.24	46.24	11.47	15519.83	2536.33
T ₉	120 kg/ha Nitrogen + 30kg/ha Zinc	4.03	20.64	8.92	7.23	3.32	47.29	11.56	15926.20	2570.37
	<i>F test</i>	NS	S	S	S	S	S	S	S	S
	<i>S. Em</i> (±)	0.14	0.06	0.08	0.09	0.06	0.45	0.12	166.05	20.58
	<i>CD (P=0.05)</i>	-	0.17	0.25	0.28	0.18	1.34	0.35	497.83	61.71

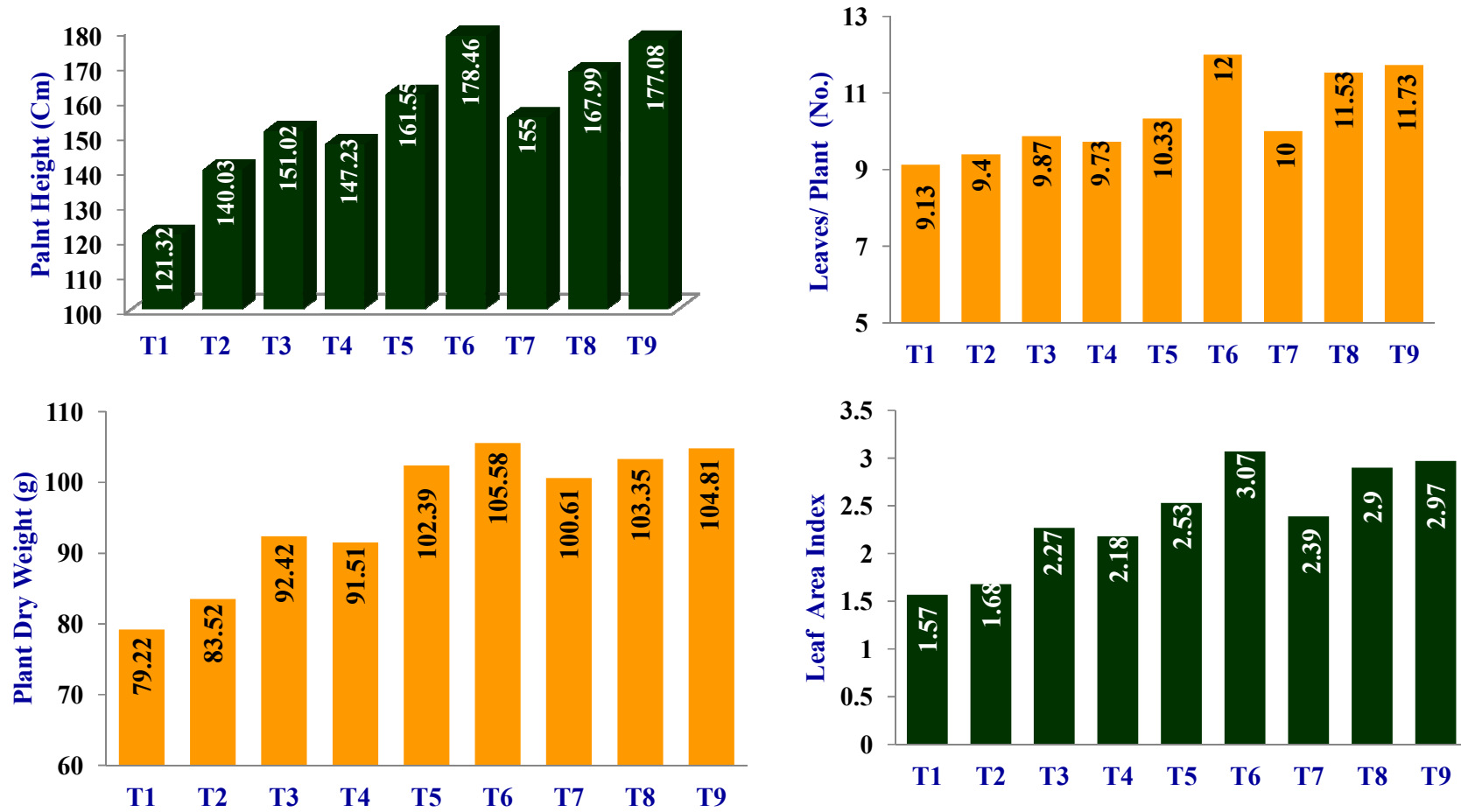


Fig. 1. Effect of application of Nitrogen and Zinc on growth attributes of Baby corn (*Zea mays. L*)

with Nitrogen fertilization could be attributed to a more fact that more protein synthesis at higher Nitrogen rates induced vegetative growth which resulted in increase of photosynthetic surface that stimulated more leaf length, width and leaf blade size and Jeet *et al.*, [17] also reported similar findings. The increase in LAI might be due to significant increase in leaf expansion, higher rate of cell division and cell enlargement and there by improved quality of vegetative growth due to zinc fertilization. Comparable results were also reported by Mahdi *et al.*, [18] and Kumar and Bohra [7].

3.2 Yield Parameters

The analyzed data regarding the yield attributes were presented in Table. 3. A significant effect in yield parameters (except Number of cobs/plant) were observed with T₆ where plants received Nitrogen 100 kg/ha + Zinc 30 kg/ha. The maximum Length of the cob 20.72 cm, Length of the corn 9.06 cm, Girth of the cob 7.34 cm, Girth of the corn 3.42 cm, Cob weight with husk 48.49 g., Cob weight without husk 11.87 g., Cob yield 16026.53 (kg/ha), corn yield 2597.47 (kg/ha) were recorded in T₆. Yield is an ultimate end product of many yield contributing components, physiological and morphological processes taking place in plants during growth and development. Zinc fertilization has beneficial effect on physiological process, plant metabolism and plant growth, which leads to higher yield. Increase in cob and corn yield with application of zinc was also reported by Kumar and Bohra [7], Chand *et al.* [19]. A faster growth under influence of higher level of nitrogen fertilization might have played a significant role in reducing competition for photosynthates and nutrients with other plants, resulting in healthy plants, resulting in high number of yield attributes. In most cereals, greater assimilating surface at reproductive developments results in improved green cob formation because of adequate production of metabolites and their translocation towards cob [20]. The findings of the present investigation are in line with Bindhani et al. [20].

4. CONCLUSION

From the above results of the present study, it could be concluded that, basal application of 100 kg. N/ha along with 30 Kg. Zn/ha will be beneficial to obtain higher yield of baby corn at black clay loamy soils of Andhra Pradesh. Findings of one season may not be revealing

the magnitude of different components therefore, the trail must be continued in order to reach valid conclusion.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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