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Foliar Nutrition: A Novel Technology to Increase Growth and Yield in Baby Corn (*Zea mays* L.)

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A B S T R A C T

A field experiment was conducted at Zonal Agricultural Research Station, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bengaluru during *kharif* 2016 to study the effect of foliar application of macro and micro nutrients on growth and yield attributes of baby corn (*Zea mays* L.). The experiment was laid out in a Randomised Complete Block Design with nine treatments replicated thrice. Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ recorded significantly higher baby corn and green fodder yield (244.05 q ha^{-1} and 85.16 t ha^{-1}, respectively) and was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (212.37 q ha^{-1} and 76.82 t ha^{-1}, respectively). This was attributed by enhanced growth parameters *viz.*, plant height (144.91 cm), total dry matter (152.28 g $plant^{-1}$), Absolute growth rate (1.79 g day^{-1}), Crop growth rate (1.77 g^{-2} day^{-1}), Net assimilation rate (5.56 g dm^{-2} day^{-1}), Leaf area index (6.84), Leaf area duration (78.53 days) and yield attributes like number of cobs $plant^{-1}$ (3.67), length of babies (10.90 cm), girth of babies (4.07 cm) and weight of babies (23.87 g cob^{-1}).

Introduction

Baby corn is an unfertilized, young and immature cob harvested for vegetable purpose during silk emergence and the left out green material serves as quality green fodder for cattle. Chinese are using young cobs as vegetable for generations and it has spread to other Asian counties due to change in tradition and culture and also invasion of westernized lifestyle. The food habit in India has drastically changed over decades which has waved path for popularization of baby corn consumption and even production. At present, baby corn has shown immense potential for cooking and canning industry. Thailand, Japan and Europe are the major importers of canned cob and it has good future too. Baby corn has short growth period, thus the crop can fit very well in the cropping system. The adaptation range of this crop is wide and does not need intensive cultivation as compared to other crops.

The availability of macro and micronutrients added to the soil are affected by soil environmental factors leading to various losses. Foliar application is a particular technique to supply macro and micro-nutrients which avoids wastage or loss of nutrients which enhances nutrient use efficiency and reduces the cost of cultivation. Again foliar application of nutrients will be an added advantage in rapid absorption. The foliar nutrition can prevent soil nutrient overloading and lower the risk of environmental threats. During the foliar nutrition, nutrient efficiency can reach up to 85 per cent whereas application of fertilizers through soil has only 30-60 per cent of efficiency depending on nutrient type.

Foliar feeding was stimulated by Tukey and Wittwer during 1950's at Michigan State University, using radioactive isotopes of known plant nutrients which were absorbed by plant foliage and translocated throughout the plant (Dorneanu *et al.,* 2011). There are mainly two advantages of foliar application of fertilizers over soil application *viz.,* about more than 90 per cent fertilizers are utilized by the plant when applied in foliar form and about 95 per cent of the foliar fed nutrients are translocated. After supplying nutrients through foliar spray are found in the smallest root within 60 minutes, if conditions are optimum and foliar fertilizer use efficiency in sandy loam soils is upto 20 times more effective when compared to soil applied fertilizers. (Manasa and Devaranavadagi, 2015) Keeping these things in view studies were conducted to study the effect of foliar application of macro and micro nutrients on growth and yield attributes of baby corn (*Zea mays* L.)

Materials and Methods

The field experiment was carried out to study the response of baby corn (*Zea mays* L.) for foliar application of macro and micro nutrients on growth, yield and quality during *kharif* season of 2016. The material used and the techniques adopted during the course of this investigation are described in this chapter. The experiment was conducted at Zonal Agricultural Research Station (ZARS), Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bengaluru which is situated at 13º 05' North latitude and 77º 34' East longitude and at an altitude of 924 m above mean sea level which comes under eastern dry zone (ACZ-V) of Karnataka. The soils of the experimental site are red sandy clay loam. Composite soil samples were taken at random from upper 30 cm layer and were analyzed for physico-chemical properties. The soil reaction was neutral (6.56), medium in available nitrogen (428.37 kg ha^{-1}), available phosphorus (45.56 kg P_2O_5 ha^{-1}), available potassium (243.93 kg K_2O ha^{-1}), low in zinc (0.48 ppm) and iron (1.80 ppm).

Treatment details

T_1: 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$

T_2: 50% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$

T_3: 50% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$

T_4: 50% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$

T_5: 75% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$

T_6: 75% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$

T_7: 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$

T_8: 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$

T_9: UAS (B) package (150:75:40 kg N: P_2O_5: K_2O ha^{-1})

Note: Nitrogen in RDF has been applied in two splits, one at the time of sowing (50 %) and other at 30 DAS (50 %), respectively.

19:19:19 foliar spray was given at 20 and 40 DAS, $ZnSO_4$ and $FeSO_4$ spray was given at 30 DAS. Quantity of spray solution used was 500 litres ha^{-1}. For all plots FYM was applied @ 10 t ha^{-1}.

Observations on growth parameters

The various growth parameters such as plant height, number of leaves $plant^{-1}$, leaf area $plant^{-1}$, absolute growth rate, crop growth rate, net assimilation rate, leaf area index, leaf area duration, dry matter production were recorded at different growth stages of baby corn crop.

Plant height

The plant height (cm) was recorded from five randomly selected and labelled plants.

Plant height was taken from the base of the plant to tip of the newly opened leaf. The mean plant height was worked out and expressed in centimeter.

Number of leaves

Total number of fully opened green leaves of five plants was counted and their average was taken as the number of leaves $plant^{-1}$.

Leaf area

The green leaves from the selected plants were fed to the leaf area meter and expressed as cm^2 $plant^{-1}$ (Model Li-300 from Licor Co Nebraska)

Absolute growth rate

Absolute growth rate (AGR) refers to the total growth of a plant per unit time. For various growth periods it was worked out from the below mentioned formula of Watson (1952) and expressed in g day^{-1}.

$$AGR = W_2\text{-}W_1/\ t_2\text{-}t_1$$

Where,

W_2 = Dry matter production $plant^{-1}$ (g) at t_2
W_1 = Dry matter production $plant^{-1}$ (g) at t_1
t_1 and t_2 = time intervals

Crop growth rate

Crop growth rate (CGR) for various growth periods was worked out from the below given formula of Watson (1952) and expressed in g^{-2} day^{-1}.

$$CGR = W2\text{-}W1/t2\text{-}t1 \times P$$

Where,

W_2 = Dry matter production $plant^{-1}$ (g) at t_2
W_1 = Dry matter production $plant^{-1}$ (g) at t_1
t_1 and t_2 = time intervals
P = land area (cm^2)

Net assimilation rate

Net assimilation rate (NAR) is defined as the rate of increase of dry weight per unit of leaf area. NAR for various growth periods was worked out from the below given formula of Gregory (1926) and expressed in g dm^{-2} day^{-1}.

$$NAR = W2\text{-}W1/t2\text{-}t1 \times LogeL2\text{-}LogeL1\ /L2\text{-}L1$$

Where,

W_2 = Dry matter production $plant^{-1}$ (g) at t_2
W_1 = Dry matter production $plant^{-1}$ (g) at t_1
t_1 and t_2 = time intervals
L_1 = LAI at time t_1
L_2 = LAI at time t_2

Leaf area index

Leaf area index (LAI) is defined as an assimilatory surface per unit area of land (Sestak *et al.,* 1971).

Leaf area index was worked out at 15, 30, 45 days after sowing and at harvest by dividing the leaf area plant^{-1} by land area occupied by the plant.

$$LAI = \frac{\text{Leaf area plant}^{-1}\ (cm^2)}{\text{Land area plant}^{-1}\ (cm^2)}$$

Leaf area duration

Leaf area duration (LAD) is the integration of leaf area index over a growth period (Watson, 1952). For various growth periods LAD was worked out from the formula of Powar *et al.,* (1967) and expressed in days.

$$LAD = \frac{L1 + L2}{2} \times (t2-t1)$$

Where,

L_1 = LAI at time t_1

L_2 = LAI at time t_2

$t_2 - t_1$ = Time interval between crop growth period in days

Dry matter production and accumulation

Total dry matter production in leaf and stem was recorded at 15, 30, 45 DAS and at harvest from five randomly selected plants in each plot.

Samples were dried at 65^{o} C to attain constant weight and average dry weight was calculated and expressed in grams per plant.

Observation on yield parameters

Length of husked and de husked baby corn

Length of baby corn was measured by using linear scale from base to tip of the baby and expressed in centimeter.

Girth of husked and de husked baby corn

Circumference of the husked and dehusked baby corn was measured using thread and expressed in centimeter.

Weight of husked and de husked baby corn

Freshly harvested husked baby corn mean weight was recorded and expressed in grams. In the similar way fresh weight of dehusked baby corn was also recorded. De husked baby corn were sun dried and later dried in hot air oven at 65 °C till to get constant weight. The mean dry weight of a baby corn was taken and expressed in grams.

Husked and dehusked baby corn yield

Husked and dehusked baby corn yield from net plot was converted into quintals per hectare.

Green fodder yield

Green fodder yield from net plot was converted into tonnes per hectare.

Statistical analysis and interpretation of data

The experimental data collected on growth, yield and quality components of plant were subjected to Fisher's method of "Analysis of Variance" (ANOVA) as outlined by Panse and Sukhatme (1967). Wherever, F- test was significant, for comparison among the treatment means, an appropriate value of critical difference (C.D.) was worked out. If F-test found non-significant, against C.D. values NS (Non-Significant) was indicated. All the data were analyzed and the results were presented and discussed at a probability level of five per cent. Correlation matrix was worked out between growth, yield and quality parameters (Gomez and Gomez, 1984).

Results and Discussion

Plant height

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher plant height (Table 1) at harvest (144.91 cm) and was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (134.31 cm). Significantly lower plant height was recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (116.07 cm). Significant variation in the plant height is due to in time availability of the needed nutrients to the plant at the important growth stages and application of zinc has led to production of IAA resulting in increased plant height (Manasa and Devaranavadagi, 2015). Nitrogen and zinc also helped in more leaf area as a consequence more assimilates were produced and increased the plant height (Jasim Iqbal *et al.,* 2016). These results are in conformity with Asghar *et al.,* (2011), Mahmoud (2001) and Parasuraman (2008). Generally, P has positive significant interaction with N absorption and plant growth (Sumner *et al.,* 1986).

Number of leaves

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ recorded significantly higher number of leaves plant^{-1} (Table 1) at harvest (11.47) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (11.20). Significantly lower number of leaves plant^{-1} were recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (10.13). The synergistic effect of both nitrogen and zinc helps in rapid growth and development of plants as they help in photosynthesis and various plant biochemical processes which responds towards growth (Jasim Iqbal *et al.,* 2016).

Leaf area

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ recorded significantly higher leaf area (Table 1) at harvest (9229.37 cm^2 plant^{-1}) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (8627.11 cm^2 plant^{-1}). Significantly lower leaf area was recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (7223.37 cm^2 plant^{-1}). The higher leaf area was due to the increased plant height resulted into more number of nodes per plant leading to more number of leaves per plant. The results on leaf area index across the crop growth stages differed significantly. The formation of optimum photosynthetic stage for longer period was through timely supply of nutrients by foliar nutrition. On the other side, the improved photosynthetic capacity was highly influenced by the foliar fertilization of major nutrients *viz.,* nitrogen, phosphorus and potassium including the micronutrients (Watson, 1952).

Absolute growth rate

Among the different treatments, (Table 2) application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher absolute growth rate (1.79 g day^{-1} at 45 days-harvest). However, application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ recorded on par results with the above treatment (1.73 g day^{-1} at 45 days-harvest). Significantly lower absolute growth rate was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (1.06 g day^{-1} at 45 days-harvest).

Crop growth rate

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher crop growth rate (Table 2) *i.e.*, 1.77 g m^{-2} day^{-1} at 45 days-harvest which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (1.55 g m^{-2} day^{-1} at 45 days-harvest). Significantly lower crop growth rate was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (0.86 g m^{-2} day^{-1} at 45 days-harvest).

Net assimilation rate

Significantly higher net assimilation rate (Table 2) was recorded with application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (5.56 g^{-1} dm^{-2} leaf area^{-1} day^{-1} at 45 days-harvest) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (5.41 g^{-1} dm^{-2} leaf area^{-1}day^{-1} at 45 days-harvest). Significantly lower net assimilation rate was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (2.69 g^{-1} dm^{-2} leaf area^{-1}day^{-1} at 45 days-harvest).

Leaf area index

At harvest (Table 2), application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher leaf area index (6.84) and was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (6.39). Significantly lower leaf area index was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (5.35).

Leaf area duration

At 45 DAS - at harvest (Table 2), application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher leaf area duration (78.53 days). Significantly lower leaf area duration was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (60.75 days).

The higher growth indices were resultant of higher growth parameters *viz.*, plant height, number of leaves, leaf area and dry matter accumulation in various parts. Production of photosynthates and their translocation to sink depends upon availability of mineral nutrients like potassium, whose availability has increased the zinc uptake also. Most of the photosynthetic pathways are dependent on enzymes and co-enzymes, which are synthesized by mineral nutrients such as nitrogen, phosphorus and potassium activated by zinc. Nitrogen is an integral part of chlorophyll and a component of protoplasm protein, nucleic acid and plays a vital role in vegetative and reproductive phase of crop growth. The differences in the growth parameters could be attributed to rapid cell division and elongation through the effect of nitrogen. The results are in conformity with Roopashree (2013).

Dry matter production and accumulation

Dry matter accumulation in leaves

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher dry matter accumulation in leaves (Table 3) at harvest (67.11 g plant^{-1}) and which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (65.50 g $plant^{-1}$). Significantly lower dry matter accumulation in leaves were recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (53.58 g $plant^{-1}$).

Dry matter accumulation in stem

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher dry matter accumulation in stem (Table 3) at harvest (85.17 g $plant^{-1}$) and which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (83.13 g $plant^{-1}$).

Significantly lower dry matter accumulation in stem were recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (68.01 g $plant^{-1}$).

Total dry matter accumulation

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ has recorded significantly higher total dry matter accumulation (Table 3) at harvest (152.28 g $plant^{-1}$).

Significantly lower total dry matter accumulation was recorded at harvest with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (121.59 g $plant^{-1}$).

Increased dry matter production is due to balanced amount of macro and micro nutrients through foliar fertilization which resulted in better crop growth and photosynthetic activity which led to better supply of photosynthates ultimately resulted in higher dry matter production per plant. Potassium in the foliar fertilizers had helped in osmotic regulation and increased metabolic activity of plants through synergistic effect with zinc. Additional nitrogen from the foliar fertilizer besides split application influenced the vegetative growth in plant and reduced the fertilizer loss resulted in higher dry matter production per plant. The results are in conformity with the findings of Parasuraman (2008), Thavaprakaash *et al.*, (2006) and Abdou El- Nour (2002).

The foliar spray given at different crop growth stages might have closely synchronised to the nutrient requirements leading to better absorption, translocation and assimilation of nitrogen and potassium by plants leading to significant increase in dry matter yield. The results are also in line with the findings of Afifi *et al.*, (2011).

Length of husked and de husked baby corn

Significantly higher length of cob (Table 4) with husk was recorded application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (25.72 cm) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (24.67 cm). Significantly lower length of cob with husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (21.68 cm).

Among the different treatments, application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (10.90 cm) recorded significantly higher length of cob without husk (Table 4). However, application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (10.47 cm) recorded on par results with the above treatment.

Significantly lower length of cob with husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (9.27 cm).

Table.1 Plant height, number of leaves and leaf area of baby corn at harvest as influenced by foliar nutrition

Treatments	Plant height (cm)	Number of Leaves plant^{-1}	Leaf area (cm^2 plant^{-1})
T_1	116.07	10.13	7223.37
T_2	119.85	10.20	7345.39
T_3	121.81	10.33	7503.91
T_4	124.37	10.40	7603.06
T_5	127.75	10.67	7786.66
T_6	133.02	10.73	7991.37
T_7	144.91	11.47	9229.37
T_8	134.31	11.20	8627.11
T_9	133.97	10.80	8145.83
S.Em. ±	3.60	0.22	332.78
C.D. (p = 0.05)	10.80	0.65	998.36
C.V. (%)	8.21	7.44	9.43

Table.2 Absolute growth rate, crop growth rate, net assimilation rate, leaf area index and leaf area duration of baby corn at harvest as influenced by foliar nutrition

Treatments	Absolute growth rate (g day^{-1})	Crop growth rate (g m^{-2} day^{-1})	Net assimilation rate (g^{-1} dm^{-2} leaf area^{-1} day^{-1})	Leaf area index	Leaf area duration (days)
T_1	1.06	0.86	2.69	5.35	60.75
T_2	1.10	0.93	2.81	5.44	61.58
T_3	1.20	1.08	3.21	5.56	63.90
T_4	1.39	1.25	4.15	5.63	64.50
T_5	1.47	1.32	4.65	5.77	66.53
T_6	1.52	1.37	4.58	5.92	67.43
T_7	1.79	1.77	5.56	6.84	78.53
T_8	1.73	1.55	5.41	6.39	72.53
T_9	1.57	1.41	4.68	6.03	68.48
S.Em. ±	0.19	0.17	0.23	0.26	1.86
C.D. (p = 0.05)	0.57	0.51	0.70	0.80	5.59
C.V. (%)	7.72	8.81	9.48	8.97	10.69

Table.3 Dry matter in leaves, dry matter in stem and total dry matter of baby corn at harvest as influenced by foliar nutrition

Treatments	Dry matter in leaves (g plant^{-1})	Dry matter in stem (g plant^{-1})	Total dry matter (g plant^{-1})
T_1	53.58	68.01	121.59
T_2	53.88	68.38	122.26
T_3	54.83	69.59	124.42
T_4	56.64	71.88	128.52
T_5	56.96	72.28	129.24
T_6	62.17	78.90	141.07
T_7	67.11	85.17	152.28
T_8	65.50	83.13	148.63
T_9	62.95	79.88	142.83
S.Em. ±	1.36	1.74	7.20
C.D. (p = 0.05)	4.08	5.20	21.59
C.V. (%)	9.28	9.27	8.12

Table.4 Length of cob, girth of cob, fresh weight of cob, dry weight of cob of baby corn at harvest as influenced by foliar nutrition

Treatments	Length of cob (cm)		Girth of cob (cm)		Fresh weight of cob (g cob^{-1})		Dry weight of cob (g cob^{-1})	
	with husk	without husk	with husk	without husk	with husk	without husk	with husk	without husk
T_1	21.68	9.27	69.75	16.10	69.75	16.10	13.04	5.03
T_2	22.63	9.30	74.78	16.73	74.78	16.73	13.88	5.23
T_3	23.17	9.37	76.58	17.40	76.58	17.40	13.73	5.44
T_4	23.58	9.47	80.77	17.73	80.77	17.73	16.25	5.54
T_5	23.92	9.83	83.67	17.80	83.67	17.80	16.84	5.56
T_6	24.30	9.97	85.95	20.17	85.95	20.17	18.88	6.30
T_7	25.72	10.90	93.87	23.87	93.87	23.87	20.61	7.46
T_8	24.67	10.47	91.02	21.40	91.02	21.40	19.54	6.69
T_9	24.58	10.37	87.08	21.23	87.08	21.23	18.95	6.64
S.Em. ±	0.37	0.17	1.29	0.84	1.29	0.84	0.48	0.27
C.D. (p = 0.05)	1.11	0.51	3.85	2.52	3.85	2.52	1.46	0.80
C.V. (%)	6.54	5.83	6.54	5.83	8.84	8.25	8.68	8.11

Table.5 Dry matter in leaves, dry matter in stem and total dry matter of baby corn at harvest as influenced by foliar nutrition

Treatments	Baby corn yield (q ha^{-1})		Green fodder yield (t ha^{-1})
	with husk	without husk	
T_1	124.64	26.83	124.64
T_2	127.64	27.89	127.64
T_3	150.76	32.48	150.76
T_4	156.18	33.23	156.18
T_5	171.90	40.33	171.90
T_6	174.17	42.80	174.17
T_7	244.05	60.30	244.05
T_8	212.37	49.54	212.37
T_9	189.28	48.08	189.28
S.Em. ±	15.95	3.68	15.95
C.D. (p = 0.05)	47.83	11.04	47.83
C.V. (%)	9.48	8.88	9.48

Girth of husked and de husked baby corn

Significantly higher girth of cob with husk (Table 4) was recorded application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (8.00 cm) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (7.76 cm). Significantly lower girth of cob with husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (6.96 cm).

Among the different treatments, application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (4.07 cm) recorded significantly higher girth of cob without husk (Table 4) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (4.00 cm). Significantly lower girth of cob without husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (3.38 cm).

The improvement in length and girth of cob was due to additive effect of macro and micro nutrients. The results obtained are in conformity with Roopashree (2013).

Weight of husked and de husked baby corn

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ recorded (Table 4) significantly higher fresh weight and dry weight of cob with husk (93.87 g cob^{-1} and 20.61 g cob^{-1}, respectively) and which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (91.02 g cob^{-1} and 19.54 g cob^{-1}, respectively). Significantly lower fresh weight and dry weight of cob with husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (69.75 g cob^{-1} and 16.10 g cob^{-1}, respectively).

Among the different treatments, application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (Table 4) recorded significantly higher fresh weight and dry weight of cob without husk (23.87 g cob^{-1} and 7.46 g cob^{-1}, respectively) which was on par with application of 75% RDF + 1.5%

19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (21.40 g cob^{-1} and 6.69 g cob^{-1}, respectively). Significantly lower fresh weight of cob without husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (16.10 g cob^{-1} and 5.03g cob^{-1}, respectively).

The fresh and dry weight of cobs varied due to genetic potential of hybrid and differential application of macro and micro nutrients resulted in higher cob length and cob girth resulted in higher fresh weight of cob. The results are also in line with the findings of Afifi *et al.*, (2011).

The higher cob weight of baby corn crop was due to the positive influence exerted by potassium on the weight of cob, since it involved in the transportation of carbohydrates to the sink that is babies. In addition to that, presence of phosphorus in the foliar fertilizers enhanced better absorption of nitrogen by the plant. The presence of zinc in the foliar fertilizer which is necessary for protein synthesis ensuring the quality, uniform maturity and better absorption of nitrogen by the plant leading to increased photosynthesis and increased weight of cob. The results are in conformation with work done by Manja Naik (2012) and Manasa and Devaranavadagi (2015).

Husked and dehusked baby corn yield

Application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (Table 5) recorded significantly higher baby corn yield with husk and without husk (244.05 q ha^{-1} and 60.30 q ha^{-1}, respectively) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (212.37 q ha^{-1} and 49.54 q ha^{-1}, respectively). Significantly lower baby corn yield with husk and without husk was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (124.64 q ha^{-1} and 26.83 q ha^{-1}, respectively). Significantly higher cob yield was mainly attributed to the significantly higher cob length, cob girth, number of cobs and fresh weight of cob. Substantial improvement in yield and yield attributing parameters were observed in baby corn treated with foliar spray of $ZnSO_4$ at 9 leaf stage as per Tariq *et al.*, (2014). These results are also in line with the work of Saeed and Mohammad (2012), Asghar *et al.*, (2011), Potarzyki and Grzebisz (2009), Parasuraman (2008), Dorneanu *et al.*, (2011), Mahmoud (2001) and Afifi *et al.*, (2011).

Green fodder yield

Significantly higher green fodder yield was recorded with application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (85.16 t ha^{-1}) which was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (76.82 t ha^{-1}). Significantly lower green fodder yield was recorded with application of 50% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (57.18 t ha^{-1}).

Higher growth parameters *viz*., plant height, number of leaves and leaf area index led to higher total dry matter production per plant which attributed to higher green fodder yield over other treatments. The results are in line with Asghar *et al.*, (2011) and Parasuraman (2008).

Improved yield and growth attributes might be interpreted as the manifestation of higher nutrient uptake by the plants. Increase in dry matter production per unit area is a first step in achieving higher yield. Dry matter production at different growth stages of any crop is an important pre requisite for higher yields as it signifies photosynthetic ability of the crop (Asghar *et al.*, 2011).

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