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Effect of foliar applied nutrients on soil chemical properties and nutrient uptake of baby corn (*Zea mays* L.)

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Abstract
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 chemical properties of baby corn (*Zea mays* L.). The experiment was laid out in a Randomised Complete Block Design with nine treatments replicated thrice. The higher nutrient uptake was noticed with foliar application of 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (208.09 kg N ha^{-1}, 43.60 kg P_2O_5 ha^{-1}, 227.91 kg K_2O ha^{-1}, 6.98 mg Zn kg^{-1} and 9.65 mg Iron kg^{-1}, respectively) and was on par with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (208.09 kg N ha^{-1}, 43.60 kg P_2O_5 ha^{-1}, 227.91 kg K_2O ha^{-1}, 6.98 mg Zn kg^{-1} and 9.65 mg Iron kg^{-1}, respectively) compared to other treatments.

Keywords: Baby corn, foliar nutrition, chemical properties, nutrient uptake

Introduction
Maize (*Zea mays* L.) is the third most important cereal crop next to rice and wheat in India and has the highest production potential among the cereals. For diversification in value addition and for food processing industries, recent development is of growing maize for vegetable purpose, which is commonly known as baby corn (*Zea mays* L.). The food habit in India has drastically changed over decades which has waved path for popularization of baby corn consumption and even production. Nitrogen is the most recognized plant nutrient for its presence in the structure of the protein molecule. It plays an important role in synthesis of the plant constituents through the action of different enzymes. Phosphorus requirement is high in young cells, such as shoot and root tips, where metabolism is high and cell division occurs rapidly. Root development, flower initiation, seed and fruit development is aided by phosphorus and it has been shown to reduce disease incidence in some plants and found to improve the quality of certain crops. Potassium is an important macro-nutrient and the most abundant cation in higher plants and potassium is essential for enzyme activation and enhances disease resistance. In addition to high demand for macro nutrients, micronutrients are required in relatively very small quantities for adequate plant growth and production. Micronutrient deficiency may cause great disturbance in the physiological and metabolic processes in the plant. In present Indian context, the soils are deficit in zinc and iron. Zinc plays a very important role in plant growth, in metabolic functions and also it increases protein content in plant. Iron is an essential micronutrient and plays critical role in metabolic processes such as DNA synthesis, respiration and photosynthesis. Further, many metabolic pathways are activated by iron and it is a prosthetic group constituent of many enzymes. 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. 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. 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) [5]

Materials and Methods

Smallest root within 60 minutes, if conditions are optimum and fofor 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 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. Treatments were, 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}). 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}. The soil analysis was done in laboratory of Department of Agronomy, College of Agriculture, UAS, Bengaluru.

Results

Soil was analysed for chemical properties at the experimental site and the values obtained along with the methods followed are given in Table 1. 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).
Data on soil chemical properties after harvest of baby corn as influenced by foliar application of macro and micro nutrients are presented in Table 2.

Soil pH: Among the different treatments, soil pH after harvest of the crop did not vary significantly due to foliar application of macro and micro nutrients.

Organic carbon content: Organic carbon content after harvest of the crop did not vary significantly due to foliar application of macro and micro nutrients.

Electrical Conductivity: Among the different treatments, electrical conductivity after harvest of the crop did not vary significantly due to foliar application of macro and micro nutrients.

Available Nitrogen: Significantly higher available nitrogen content after harvest of the crop was recorded with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (324.83 kg N ha^{-1}) and which has recorded on par results with application of 50% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (316.93 kg N ha^{-1}) followed by 75% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (311.23 kg N ha^{-1}), 50% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (307.80 kg N ha^{-1}), 75% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (304.03 kg N ha^{-1}) and 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (302.06 kg N ha^{-1}). Significantly lower available nitrogen content after harvest of the crop was recorded in UAS (B) package (276.36 kg N ha^{-1}).

Available phosphorus: Significantly higher available phosphorus content after harvest of the crop was recorded with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (39.03 kg P_2O_5 ha^{-1}) which has recorded on par results with application of 50% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (38.93 kg P_2O_5 ha^{-1}) followed by 50% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (38.22 kg P_2O_5 ha^{-1}), 75% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (37.65 kg P_2O_5 ha^{-1}) and 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (37.26 kg P_2O_5 ha^{-1}). Significantly lower available phosphorus content after harvest of the crop was recorded in UAS (B) package (35.90 kg P_2O_5 ha^{-1}).

Available potassium: Among the different treatments, significantly higher available potassium content after harvest of the crop was recorded with application of 75% RDF + 1.5% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (281.26 kg K_2O ha^{-1}) which has recorded on par results with application of 50% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (274.03 kg K_2O ha^{-1}) followed by 75% RDF + 1.0% 19:19:19 spray + 0.5% $ZnSO_4$ + 0.1% $FeSO_4$ (271.93 kg K_2O ha^{-1}), 75% RDF + 1.0% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (271.46 kg K_2O ha^{-1}), 75% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (269.56 kg K_2O ha^{-1}) and 50% RDF + 1.5% 19:19:19 spray + 0.2% $ZnSO_4$ + 0.1% $FeSO_4$ (266.76 kg K_2O ha^{-1}). Significantly lower available potassium content after harvest of the crop was recorded in UAS (B) package (242.43 kg K_2O ha^{-1}).

Zinc content: Zinc content after harvest of the crop did not vary significantly due to foliar application of macro and micro nutrients.

Iron content: Iron content after harvest of the crop did not vary significantly due to foliar application of macro and micro nutrients.

Table 1: Chemical properties of soil of the experimental site before sowing of the crop

Chemical properties	Methods followed	Values
pH	Buckman's zerometric pH meter (Piper, 1966) [7]	6.56
EC (dsm^{-1})	Conductometry (Jackson, 1973) [3]	0.14
Organic Carbon (%)	Walkey and Black wet oxidation method (Subbiah and Asija, 1956) [9]	0.43
Available N (kg ha^{-1})	Alkaline permanganate method (Subbiah and Asija, 1956) [9]	428.37
Available P_2O_5 (kg ha^{-1})	Olsen's method (Jackson, 1973) [3]	45.56

Available K_2O (kg ha^{-1})	Neutral normal ammonium acetate method (Jackson, 1973) [3]	243.93
Available Zinc (mg kg^{-1})	DTPA extraction method (Lindsay and Norwell, 1978) [4]	0.48
Available Iron (mg kg^{-1})	DTPA extraction method (Lindsay and Norwell, 1978) [4]	1.80

Discussion

Nitrogen and phosphorus uptake varied significantly among different treatments. The increased nitrogen and phosphorus uptake might be due to increased uptake of nitrogen which in turn increased phosphorus uptake in plants. Nitrogen being a structural component of proteins involved in various biological functions. The higher uptake of nitrogen was due to favourable influence of phosphorus on higher degree of root proliferation, anchorage and deep penetration which in turn absorb higher amount of nutrients from the rhizosphere and supply to the crop resulting in higher dry matter production. Similar findings were also observed by Parasuraman (2008) [6], Afifi *et al.* (2011) [1] and Somasundaram *et al.* (2007) [8].

Nitrogen can increase phosphorus uptake in plants by increasing root growth, by increasing the ability of roots to absorb and translocate phosphorus, and by decreasing soil pH as a result of absorption of NH_4^+ and thus increasing solubility of fertilizer phosphorus. The better performance of phosphorus uptake to the soil and foliar fertilization was due to the higher proportion of phosphorus in the foliar fertilizers, which can promote root growth inturn enhanced the utilization of soil nutrients and water by plants (Wilkinson *et al.*, 1999) [11]. Similar results were also found by Parasuraman (2008) [6] and Afifi *et al.* (2011) [1]. It is commonly viewed that increased growth requires more of both nitrogen and phosphorus, the inference being mutually synergistic effect resulted in growth stimulation and enhanced uptake of both the elements (Sumner and Farina, 1986) [10].

Table 2: Nutrient uptake by baby corn crop at harvest as influenced by foliar application of macro and micro nutrients.

Treatments	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})	Zinc (mg kg^{-1})	Iron (mg kg^{-1})
T_1	170.23	35.67	186.44	4.71	8.36
T_2	171.17	35.86	187.47	5.35	8.37
T_3	174.20	36.50	190.79	6.13	8.54
T_4	179.93	37.70	197.06	6.17	8.84
T_5	180.94	37.91	198.17	6.49	9.41
T_6	197.51	41.38	216.32	6.81	9.49
T_7	213.19	44.67	233.50	8.27	9.82
T_8	208.09	43.60	227.91	6.98	9.65
T_9	199.96	41.90	219.01	4.7	8.28
S.Em. ±	3.74	0.84	4.74	0.47	0.10
C.D. (p = 0.05)	11.24	2.52	14.23	1.42	0.32
C.V. (%)	7.52	7.64	7.25	7.87	7.23

Potassium uptake also significantly varied by the soil and foliar fertilization. The increased potassium uptake might be due to sufficient quantity of potassium present in soil and also supplied through foliar fertilizers. In addition, the higher photosynthetic activity in leaf exerted by multi-nutrients present in the foliar fertilizers indirectly lead to efficient utilization of nutrients applied to the soil. Similar findings were reported by Parasuraman (2008) [6] and Afifi *et al.* (2011) [1].

The higher uptake of zinc and iron were due to required quantity of zinc and iron available in soil and also supplied through foliar spray resulted in higher uptake of zinc and iron by baby corn plant. The findings are in conformity with the work of Farshid (2011) [2] in maize crop.

References

1. Afifi MHM, Khalifa RKM, Camilia Y. Urea foliar application as a partial substitution of soil-applied nitrogen fertilization for some maize cultivars grown in newly cultivated soil. Australian J Basic Appl. Sci. 2011; 5(7):826-832.
2. Farshid A. Zinc and boron content by maize leaves from soil and foliar application of zinc sulphate and boric acid in zinc and boron deficient soils. Middle-East J. Sci. Res. 2011; 7(4):610-618.
3. Jackson MK. Soil chemical analysis. Prentice-Hall. Inc. Engle Wood Cliffs, New Jersey, 1973.
4. Lindsay WL, Norwell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Amer. J. 1978; 42:421-428.
5. Manasa LP, Devaranavadagi SB. Effect of foliar application of micronutrients on growth, yield and nutrient uptake of maize. Karnataka J Agric. Sci. 2015; 28(4):474-476.
6. Parasuraman P. Studies on integrated nutrient requirement of hybrid maize (*Zea mays* L.) under irrigated conditions. Madras Agric. J. 2008; 92(1):89-94.
7. Piper CS. Soil and Plant Analysis, Academic Press, New York, 1966, 236.
8. Somasundaram E, Mohmed MA, Thirukkmaran K, Chandrashekaran R, Vaijyapuri K. Biochemical changes, nitrogen flux and yield of crops due to organic sources of nutrients under maize based cropping system. J. Applied Sci. Res. 2007; 3(12):1724-1729.
9. Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. Curr. Sci. 1956; 25(8):259-260.
10. Sumner ME, Farina MPW. Phosphorus interactions with other nutrients and lime in field cropping systems. *Adv. Soil Sci.* 1986; 5:201-236.
11. Wilkinson SR, Grunes DL, Sumner ME. Nutrient interactions in soil and plant nutrition. In: Handbook of Soil Sci., Ed. CRC Press: Boca Raton, 1999, 89-112.