DOI: 10.15740/HAS/AU/12.TECHSEAR(4)2017/1024-1027 *Agriculture Update*
Volume **12** | TECHSEAR-4 | 2017 | 1024-1027
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RESEARCH ARTICLE :

Studies on effect of micro nutrients application on morpho physiological traits in sweet corn

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ARTICLE CHRONICLE :
Received :
11.07.2017;
Accepted :
26.07.2017

KEY WORDS :
Effect of micronutrients, Application, Morpho physiological trait, Sweet corn

SUMMARY : A field experiment was conducted at Wheat and Maize Research Unit, VNMKV, Parbhani during *Kharif* 2016 to study the effect of micronutrients (Mg, Zn and B) on morphological and physiological characters in sweet corn.The effect of 10 treatments *viz.*, control (T_1), RDF (120:60:50 kg NPK ha^{-1}) (T_2), RDF + 3 Content, through soil (Mg + Zn + B) (20 kg, 20 kg, 5 kg ha^{-1}), respectively (T_3), RDF + Mg (20 kg ha^{-1}) soil application at the time of sowing (T_4), RDF + Zn (20 kg ha^{-1}) soil application at the time of sowing (T_5), RDF + B (5 kg ha^{-1}) soil application at the time of sowing (T_6), RDF + foliar application at 30 and 45 DAS of Mg + Zn + B @ 1% (T_7), RDF+ foliar application of Mg at 30 and 45 DAS @ 1% (T_8), RDF + foliar application of Zn at 35 and 45 DAS @ 1% (T_9) and RDF + foliar application of B at 30 and 45 DAS @ 1% (T_{10}) were evaluated for morpho-physiological traits.Results revealed that for chlorophyll content (SPAD) and leaf area at flowering and maturity, treatment T_7 (RDF+ Mg SO_4 + Zn SO_4 + B spraying @ 1% at 30 and 45 DAS) (64.87) found significantly superior over rest of the treatments. Further, similar treatment was also found significantly superior over rest of treatments, in respect of cob yield $plot^{-1}$ (41.93 kg) and cob yield ha^{-1} (436.80 q) and at par with treatment T_8 (RDF+ Foliar application of Mg @ 1% at 30 and 45 DAS) (36.42 kg $plot^{-1}$ and 379.39 q ha^{-1} cob yield) and significantly superior over rest of the treatments.

How to cite this article : Salunke, V.D., Mundhe, A.G., Kokate, R.M. and Bhangare, R.V. (2017). Studies on effect of micro nutrients application on morpho physiological traits in sweet corn. *Agric. Update*, **12** (TECHSEAR-4): 1024-1027; **DOI: 10.15740/HAS/AU/12.TECHSEAR (4)2017/1024-1027.**

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BACKGROUND AND OBJECTIVES

Sweet corn (*Zea mays* L.) is the world's most widely cultivated food crop providing ample food calories and protein for more than one thousand million human beings in the world. Maize (*Zea mays* L.) is one of the most versatile emerging crops having wide adaptability under varied agro-climatic conditions. Maize has been usually considered as poor man's crop and is occupying the place in rich communities due to its multifarious uses as industrial, food and feed crop.

Micronutrient requirements of the maize (*Zea mays* L.) crops are relatively small and ranges between their deficiencies and toxicities in plants and soils are rather narrow. Maize is a plant with a high productivity potential, which requires a much larger amount of nutrients during its growth and development compared to other cereal crops. It is also characterized by the specific

dynamics of nutrient absorption, which requires the manufacturer to provide such a method of application of mineral fertilizers that completely meets the demand for particular nutrients according to the rhythm of maize growth.

Micronutrient play an active role in the plant metabolic process starting from cell development to respiration, photosynthesis, chlorophyll formation, enzyme activity, hormones synthesis, nitrogen fixation etc. The micronutrients are going to play a major protective role in bringing stability and sustainability in food production. The role of macro and micronutrients is crucial in yields. Nitrogen is a primary constituent of proteins and thus, all enzymes (Raun and Johnson, 1999). P is involved in almost all biochemical pathways as a component part of energy carrier compounds, ATP and ADP (Khalil, 2003). Six micronutrients *i.e.* Mn, Fe, Cu, Zn, B and Mo are known to be required for all higher plants (Welch, 1995). These have been well documented to be involved in photosynthesis, N- fixation, respiration and other biochemical pathways (Marschner and Romheld, 1991).

Therefore, in present field experiment an attempt was made to study the effect of micronutrients (Mg, Zn and B) on morphological and physiological characters.

RESOURCES AND METHODS

The experiment was laid out in Randomized Block Design (RBD) with three replications and ten treatments *viz.*, Control (T_1), RDF (120:60:50 kg NPK ha^{-1}) (T_2), RDF + 3 Content, through soil (Mg + Zn + B) (20 kg, 20 kg, 5 kg ha^{-1}), respectively (T_3), RDF + Mg (20 kg ha^{-1}) soil application at the time of sowing (T_4), RDF + Zn (20 kg ha^{-1}) soil application at the time of sowing (T_5), RDF + B (5 kg ha^{-1}) soil application at the time of sowing (T_6), RDF + foliar application at 30 and 45 DAS of Mg + Zn + B @ 1% (T_7), RDF+ foliar application of Mg at 30 and 45 DAS @ 1% (T_8), RDF + foliar application of Zn at 35 and 45 DAS @ 1% (T_9) and RDF + foliar application of B at 30 and 45 DAS @ 1% (T_{10}).

Plot size of individual treatment was gross 3.60 m x 4.00 m and net 2.40 m x 3.60 m. seed were sown at experimental farm of Wheat and Maize Research Unit, VNMKV, Parbhani following spacing of 60 cm x 20 cm during *Kharif* 2016 after receiving the sufficient rainfall. Only one healthy seedling was maintained. Data on morpho- physiological parameter such as plant height and leaf area were recorded at flowering and harvesting stage. Days to 50 % tasselling and 50 % silking were recorded from the date of sowing in all treatments similarly chlorophyll content in leaves was recorded at flowering stage.

The result obtained were statistically analyzed and appropriately interpreted as per the methods described in "Statistical method for Agricultural Workers" by Panse and Sukhatme (1985). Appropriate standard error (S.E.) critical differences (C.D.) at 5 per cent levels were worked out for interpretation of result.

OBSERVATIONS AND ANALYSIS

Results pertaining to morpho-physiological traits presented in Table 1 revealed that plant height increased continuously upto the physiological maturity and reached (173.07 cm) at harvesting. The rate of increase in plant height was increasing upto the flowering.The data also indicated that there was constant increase in plant height with the commencement of growth flowering to harvesting. It was also noted that the effect of only NPK was found less as compared to combination of micronutrients along with recommended chemical fertilizer. In present study plant height (cm) at flowering (157.07) and harvesting (173.73) were found non-significant. These results accordance with Kamble and londe (2008) observed that application of zinc and boron resulted in increase in the plant height.

The cob height (cm) at flowering (104.55) and harvesting (119.55) were found non-significant. It is revealed from the data that plants grown under dose of fertilizers level (NPK) supported with micronutrients have showed beneficial effects to earliness in harvesting in maize. Data pertaining to the leaf area were recorded at flowering and harvesting stage. There was increase in leaf area of plant in preceding growth stages. It is apparent from the data that significantly highest leaf area was attained by plants under treatment T_7 (RDF+ Mg SO_4 + Zn SO_4+ B @ 1% spraying 30 and 45 DAS) at both growth stages and at par with treatment T_8 (RDF +Mg @ 20 kg ha^{-1} 1% spraying at 30 and 45 DAS) and significantly superior over rest of the treatments. Considering the concentration of NPK and the source of micronutrients application in combination gave highest leaf area than control. It might have accelerated the metabolic and physiological activity of plant and put up more growth by assimilating more amounts of major nutrients and ultimately increased the leaf area $plant^{-1}$ in

present investigation. It was predicted that the leaf area was increased with recommended dose of NPK along with micronutrients at both crop growth stages. Similar results were reported by Hussain *et al.* (2005) and Asif *et al.* (2013).

As regards to chlorophyll content(SPAD) (Table 1 and Fig. 1) treatment T_7 (RDF+ Mg SO_4 + Zn SO_4 + B spraying @1% at 30 and 45 DAS)(64.87) recorded significantly higher chlorophyll content and was at par with T_8 (RDF +Mg @ 20 kg ha^{-1} 1% spraying at 30 and 45 DAS) (64.19 SPAD at flowering), T_9 (RDF+ Zn @ 20 kg ha^{-1} 1% spraying at 30 and 45 DAS) (63.36 SPAD) and T_{10} (RDF + Foliar application of B at 30 and 45 DAS @ 1%) (63.09 SPAD) and T_3 (RDF + 3 content, through soil) (Mg + Zn + B) and significantly superior over rest of the treatment. Similar findings for chlorophyll index were recorded by Chaab *et al.* (2010) and Panwar *et al.* (2011).

Table 1: Influence of different treatments on morpho-physiological traits in sweet corn

Treatments	Initial plant count m^{-2} (%)	Final plant count m^{-2} (%)	Days to 50% pollen shedding	Days to silking	Plant height (cm)		Cob height (cm)		Leaf area (dm^2)		Chlorophyll content (SPAD) at flowering	Cob yield	
					At flowering	At harvesting	At flowering	At harvesting	At flowering	At harvesting		Kg. $plot^{-1}$	Qt.ha^{-1}
T_1 : Control	79.00	79.00	49.67	59.67	144.03	169.36	93.18	112.95	50.56	48.37	54.68	17.38	181.02
T_2 : RDF (120:60:50 kg NPK ha^{-1})	79.67	79.33	50.00	62.33	144.48	171.14	93.50	113.17	51.33	49.68	61.65	18.75	195.27
T_3 : RDF +3 Content, through soil (Mg + Zn + B) (20 kg, 20kg, 5kg ha^{-1}) respectively.	79.33	79.00	51.33	62.33	155.58	172.92	96.02	115.95	54.69	52.98	62.88	31.72	330.39
T_4 : RDF + Mg (20kg ha^{-1}) soil application at the time of sowing	79.67	79.33	52.01	61.33	151.21	172.25	95.36	115.36	53.93	51.84	62.32	28.32	295.03
T_5 : RDF+Zn (20kg ha^{-1}) soil application at the time of sowing	79.33	79.00	50.00	60.33	149.76	171.43	95.20	114.20	53.22	51.12	62.18	26.49	275.92
T_6 : RDF + B (5kg ha^{-1}) soil application at the time of sowing	79.33	79.00	52.67	63.33	149.66	170.87	94.30	113.63	52.49	50.98	61.95	22.24	231.67
T_7: RDF + foliar application at 30 and 45 DAS of Mg + Zn + B @ 1%	80.00	79.67	51.01	65.01	157.07	174.73	104.55	119.55	57.17	56.45	64.87	41.93	436.80
T_8 : RDF+ foliar application of Mg at 30 and 45 DAS @ 1%	79.33	79.00	51.00	62.02	156.93	174.43	99.95	118.62	56.86	55.36	64.19	36.42	379.39
T_9 : RDF + foliar application of Zn at 30 and 45 DAS @ 1%	79.33	79.00	50.67	63.00	156.57	172.24	98.00	117.92	55.85	54.55	63.36	33.48	348.71
T_{10} : RDF + foliar application of B at 30 and 45 DAS @ 1%	79.67	79.00	51.32	60.33	156.54	170.87	97.08	116.75	55.32	53.54	63.09	32.36	337.12
S.E.±	0.316	0.411	0.985	1.006	3.827	2.165	4.136	1.110	0.323	0.340	0.727	2.274	23.70
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	0.998	1.010	2.159	6.747	70.31
C.V %	0.689	0.900	3.356	2.953	4.356	2.185	7.40	6.14	1.035	1.124	2.029	13.63	13.63
GM.	79.50	79.13	50.86	59.03	152.18	171.60	96.71	115.81	54.14	52.48	62.11	28.90	301.13

NS= Non-significant

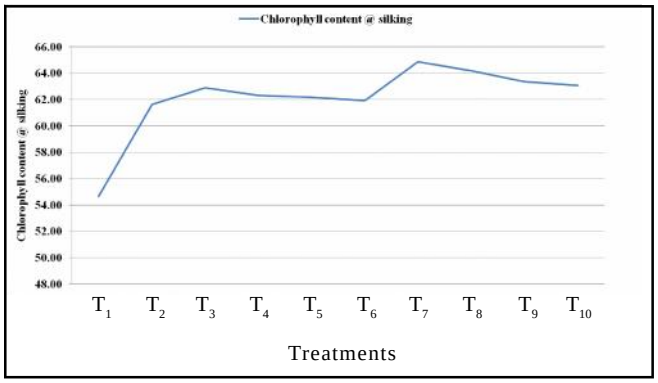

Fig. 1: Influence of different treatments on mean chlorophyll content at silking (SPAD)

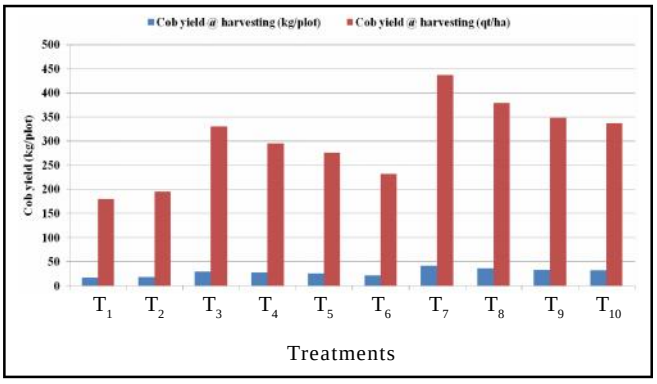

Fig. 2: Influences of different treatments on mean cob yield (kg plot^{1}) and (q ha^{-1}) at harvesting

Further, results indicated that, the maximum cob yield (41.93 kg plot^{-1}) and cob yield (436.80q ha^{-1}) was found in $T_{7.}$ Treatment T_7 (RDF+ Mg SO_4+ Zn SO_4+ B @ 1% spraying at 30 and 45 DAS) was found significantly superior over rest of treatments, in respect of cob yield (41.93 kg plot^{-1}) and cob yield (436.80 q ha^{-1}) and at par with treatment T_8 (RDF+ Foliar application of Mg @ 1% at 30 and 45 DAS) (36.42 kg plot^{-1} and 379.39 q ha^{-1} cob yield) and significantly superior over rest of the treatments (Fig. 2), these results are confined by Ziaeiann *and* Malakouti (2001) and Soleimani (2006).

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