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EFFECT OF FOLIAR APPLICATION OF MICRONUTRIENTS ON MORPHO-PHYSIOLOGICAL PARAMETERS FOR ENHANCING THE PRODUCTIVITY IN *BT* COTTON

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Abstract: A field experiment was conducted during *kharif* 2013 to know effect of foliar application of micronutrients on yield and yield component. The experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The results revealed that foliar application on micronutrients $MgSO_4$ 1 % + $ZnSO_4$ 0.5 % the treatment (T_7) at 70 and 90 DAS it recorded significantly higher plant height, monopodial, sympodial, total dry matter production, number of bolls per plant and seed cotton yield (2393 kg ha^{-1}) as compared to other treatments. It was on par with the treatment $FeSO_4$ 0.5 % + $ZnSO_4$ 0.5 % (T_8) and treatment $MgSO_4$ 1 % (T_3). Significantly lowest seed cotton yield (1788 kg ha^{-1}) was recorded in the treatment (T_9) control.

Key words: Cotton, Foliar spray, Micro-nutrient, Yield

I. INTRODUCTION

Cotton (*Gossypium* spp.) popularly known as "the white gold" is an important commercial fibre crop grown under diverse agro-climatic conditions around the world. It provides fibre and raw material for textile industry along with cotton seed and plays a vital role in economy of the country. In India, cotton is grown over an area of about 115.53 lakh ha with a total production of 375.00 lakh bales and productivity 552 kg ha-1 [1]. India ranks fifth in area and second in production of cotton after China. Among the cotton growing states Karnataka ranks fifth with an area of 5.78 lakh ha and eighth in production with 16.90 lakh bales of lint with an average productivity of 529 kg ha^{-1}. Cotton requires sufficient quantity of macro and micronutrients to achieve the maximum seed cotton yield. Micronutrients deficiency in cotton increases abscission of boll and finally affects the yield of cotton and are directly related to physiological process in plant and helps in increasing the production by improving the reproduction phase Dubey[3] . External supplementation of plant nutrients needs to be therefore emphasized keeping in view their role in improving yield. Essential micronutrients like Zinc, Iron, Manganese, Copper, Boron and Magnesium play an important role in physiology of cotton crop and these are being a part of enzyme system or catalyst in enzymatic reactions. They are required for plant activities such as aspiration, meristamatic development, chlorophyll formation, photosynthesis, energy system, protein and oil synthesis, gossypol, tannin and phenolic compounds development. Certain micronutrients may help to secure uniform emergence, rapid seedling growth and healthy plant stand[4].

Material and Methods

A field experiment was conducted during *kharif* season of 2013 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka. The experiment was laid out in Randomized Block Design with three replications in 5.4 x 4.5 m plot size with spacing of 90 cm x 60 cm. The trial comprised of nine treatments *viz,* T_1: foliar spray of $FeSO_4$ 0.5 % at 70 and 90 DAS, T_2: foliar spray of $ZnSO_4$ 0.5 % at 70 and 90 DAS, T_3: foliar spray of $MgSO_4$ 1 % at 70 and 90 DAS, T_4: foliar spray of $MnSO_4$ 0.5 % at 70 and 90 DAS, T_5: foliar spray of Boron 0.2 % at 70 and 90 DAS, T_6: foliar spray of $MnSO_4$ 0.5 % + $ZnSO_4$ 0.5 % each at 70 and 90 DAS,T_7: foliar spray of $MgSO_4$ 1 % + $ZnSO_4$ 0.5 % each at 70 and 90 DAS, T_8- foliar spray of $FeSO_4$ 0.5 % + $ZnSO_4$ 0.5 % each at 70 and 90 DAS and T_9- Control. Seeds were sown by hand dibbling and the recommended dose of nitrogen, P_2O_5 and K_2O were applied by top dressing (100:50:50 kg N: P_2O_5: K_2O ha^{-1}). Observations like, plant height (cm), Number of monopodial and sympodial branches, total dry matter (g), leaf area index (dm^2 $plant^{-1}$), number of bolls per plant, boll weight (g $boll^{-1}$) and yield (kg ha^{-1}) are recorded as per the standard procedure.

Results

The plant height, number of monopodial and sympodial branches per plant and total dry matter production plant differed significantly due to foliar feeding of micronutrients. The data showed that the foliar application of $MgSO_4$ 1 % + $ZnSO_4$ 0.5 % at 70 and 90 DAS (T_7) recorded significantly higher plant height (130.4 cm), monopodial and sympodial branches per plant (4.3 and 20.3, respectively), total dry matter production (224.5 g $plant^{-1}$) and leaf area index (2.75 dm^2 $plant^{-1}$) as compared to other

treatments. It was on par with the treatment (T_8) $FeSO_4$ 0.5 % + $ZnSO_4$ 0.5 %, (T_3) $MgSO_4$ 1% and (T_5) foliar spray with Boron 0.2 %. Significantly lesser plant height (122. 13 cm), monopodial branches per plant (3.33), sympodial branches per plant (15.67), total dry matter production (153.57 g $plant^{-1}$) and leaf area index (2.10 dm^2 $plant^{-1}$) were noticed in the control (T_9). These results are in conformity with findings with[9,2,7] and [6] . The reason for higher morphological parameters might be due to active participation of micronutrients in plant metabolism by activating the enzymes, increasing photosynthetic activity, efficient translocation, assimilation of photosynthates and increase in both cell division and cell elongation in apical meristem in growing parts leading to increased length of internodes.

The experimental results showed that, foliar application of $MgSO_4$ 1 % + $ZnSO_4$ 0.5 % at 70 and 90 DAS (T_7) recorded significantly higher cotton yield (2393 kg ha^{-1}), higher number of bolls per plant,(46.0) and single boll weight (6.35 g $boll^{-1}$) compare to the other treatments and was on par with the treatment (T_8) $FeSO_4$ 0.5% + $ZnSO_4$ 0.5 %, (T_3) $MgSO_4$ 1 % and (T_5) foliar spray with Boron 0.2 %. Significantly lower cotton yield (1788 kg ha^{-1}), least number of bolls per plant, (37.6) and boll weight (5.11 g $boll^{-1}$) were recorded in the control (T_9). Foliar application of these nutrients might have helped in more photosynthetic activity and better partitioning of dry matter. These results are in conformity with findings[9,8] and[5] who reported that the application of $MgSO_4$ (1.0 %) + $ZnSO_4$ (0.5 %) micronutrients significantly increased the boll weight no of bolls per plant and yield. This might be due to increased plant metabolic activity, meristematic development and energy system and protein synthesis.

Based on the experimental results, it could be concluded that, foliar application of $MgSO_4$ 1% + $ZnSO_4$ 0.5 % significantly increased the plant, number of sympodial and monopodial branches per plant, total dry matter production, number of bolls per plant, boll weight and cotton yield.

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Table 1: Effect of foliar application of micronutrients on plant height (cm) monopodial branches, sympodial branches, total dry matter (g plant^{-1}) Leaf area index, Yield (kg ha^{-1}), Number of bolls plant^{-1} and boll weight (g boll^{-1}) production in Bt cotton

Treatments		Morphological parameters					Yield and yield components		
		Plant height (cm)	Monopodial branches	Sympodial branches	Total dry matter (g plant^{-1})	Leaf area index (dm^2 plant^{-1})	No. of bolls plant^{-1}	Boll weight g plant^{-1}	Yield (kg ha^{-1})
T1	Foliar spray of $FeSO_4$ 0.5 % at 70 and 90 DAS	126.53	3.67	16.33	190.43	2.56	39.1	5.31	1954
T2	Foliar spray of $ZnSO_4$ 0.5 % at 70 and 90 DAS	127.17	3.67	17.33	191.40	2.57	41.1	5.41	2080
T3	Foliar spray of $MgSO_4$ 1% at 70 and 90 DAS	129.40	4.00	19.00	209.60	2.63	44.7	5.86	2120
T4	Foliar spray of $MnSO_4$ 0.5% at 70 and 90 DAS	125.83	3.67	16.00	177.27	2.51	37.9	5.15	1859
T5	Foliar spray of Boron 0.2% at 70 and 90 DAS	127.97	3.67	17.67	199.40	2.59	42.4	5.55	2113
T6	Foliar spray of $MnSO_4$ 0.5% + $ZnSO_4$ 0.5 % each at 70 and 90 DAS	126.43	3.67	16.33	189.43	2.55	38.5	5.19	1935
T7	Foliar spray of $MgSO_4$ 1% + $ZnSO_4$ 0.5 % each at 70 and 90 DAS	130.40	4.33	20.33	224.50	2.75	46.0	6.35	2393
T8	Foliar spray of $FeSO_4$ 0.5% + $ZnSO_4$ 0.5 % each at 70 and 90 DAS	129.63	4.23	20.00	218.13	2.72	45.6	6.06	2276
T9	Control	122.13	3.33	15.67	153.57	2.10	37.6	5.11	1788
	Mean	**127.28**	**3.81**	**17.74**	**194.86**	**2.55**	**41.4**	**5.55**	**2058**

	S.Em.±	1.05	0.30	1.09	4.32	1.55	2.4	0.20	102.2
	CD at 5%	3.08	0.87	3.19	13.87	4.54	6.9	0.58	306.5