



Effect of foliar nutrition on growth and yield of cotton (*Gossypium herbaceum*) MCU 5

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In India, Cotton (*Gossypium herbaceum* L.) is one of the most important commercial crops and is generally known as white gold which accounts for one fourth of the global fibre production. At a global level around 60 million people are involved in cotton cultivation, yarn processing, textiles and trading. Among the cotton cultivating countries, India stood second in its production during the year of 2018–19. India has a major area under cotton cultivation however production per unit area is lower than the average productivity of USA (955 kg/ha) and China (1764 kg/ha). In India, 62% of cotton cultivation is under rainfed condition. In Tamil Nadu, the production of cotton is only 0.6 million bales in an area of 0.2 million hectare (Mohammed *et al.* 2020). The lower productivity in cotton is mainly due to the poor soil fertility and improper nutrient management practices. The reasons for reduced productivity are due to low soil fertility with less availability of micro and macro nutrients which lead to physiological disorders like leaf reddening and boll shedding (Shivamurthy and Biradar 2014).

In lower soil fertility conditions, the productivity can be improved by means of foliar fertilisation (Rajendran *et al.* 2010). External supplementation of plant nutrients under poor soil fertility conditions is needed for improving the yield per unit area. Indian soils have the defect of micro nutrients like zinc (49%), boron (37%) and manganese (4%) as reported by Singh (2009). Only inadequate findings are available on the application of micronutrients through foliar nutrition and their influence on growth and yield of cotton. The present study was conducted with foliar application of different micro nutrients along with recommended dose of fertiliser.

This study was carried out at Agricultural College and Research Institute, Kudumiyannmalai, Pudukkottai district

of Tamil Nadu (10°24'N, 78°40'E, 119 m amsl) during the rainy (*kharif*) season of 2020 and 2021. The experiment was laid out in Randomised Complete Block Design (RCBD) with three replications with a plot size of 5.4 m × 6.0 m and adopted the plant spacing of 90 cm × 60 cm. The experiment comprised of seven foliar treatments, viz. T₁, Control; T₂, Boron 0.1% 3 foliar sprays, T₃, MgSO₄ 1.0% 3 foliar sprays, T₄, ZnSO₄ 0.5% 3 foliar sprays; T₅, Boron 0.1% + ZnSO₄ 0.5% 3 foliar sprays; T₆, Boron 0.1% + MgSO₄ 1.0% 3 foliar sprays and; T₇, MgSO₄ 1.0% + ZnSO₄ 0.5% 3 foliar sprays. The experimental field was sandy clay loam in texture with low in available nitrogen (229.0 kg/ha), high in available phosphorus (24.0 kg/ha) and medium in available potassium (233.0 kg/ha) with pH 7.5, EC 0.16/dSm and organic carbon 0.40%. Cotton MCU 5 was used as a test variety for this experiment. Acid delinted seeds were sown during the first fortnight of June by hand dibbling of two seeds per hill. Cotton crop was fertilised with 80:40:40 kg NPK per hectare as per the package of practices given in Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu crop production guide.

All the recommended doses of phosphorus and 50% of potassium were applied as basal. Nitrogen was applied in three equal splits respectively at basal, 40 DAS and 60 DAS. The remaining half dose of potassium was applied at the time of flowering. Foliar nutrition treatments were imposed during the growth stages of flowering, squaring and boll development. Crop growth and yield observations were made respectively from each treatment plot. Other crop management practices were followed homogeneously for all the treatments.

RESULTS AND DISCUSSION

Growth parameters: The growth characters are differed considerably due to the foliar nutrition treatments (Table 1). The two years data exhibited that the application MgSO₄ 1.0% + ZnSO₄ 0.5% as foliar application of three times recorded noticeably higher plant height (127.2 cm), no. of monopodia per plant (3.2), number of sympodia per plant

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Table 1 Influence of foliar nutrition on growth parameters of cotton MCU 5

Treatment	Plant height (cm)			No. of monopodia/plant			No. of sympodia/plant			DMP (kg/ha)		
	2020	2021	pooled	2020	2021	pooled	2020	2021	pooled	2020	2021	pooled
T ₁	102.9	100.7	101.8	1.29	1.23	1.26	8.8	8.4	8.6	3552	3346	3449
T ₂	109.8	106.2	108.0	1.54	1.46	1.50	12.2	11.6	11.9	3860	3636	3748
T ₃	114.2	112.4	113.3	2.01	1.91	1.96	14.2	13.6	13.9	3992	3760	3876
T ₄	115.3	113.1	114.2	2.03	1.93	1.98	14.4	13.7	14.0	4108	3868	3988
T ₅	120.8	118.6	119.7	2.46	2.34	2.40	16.4	15.6	16.0	4312	4060	4186
T ₆	123.6	121.2	122.4	2.67	2.54	2.60	17.2	16.4	16.8	4361	4107	4234
T ₇	128.4	126.0	127.2	3.28	3.12	3.20	18.9	17.9	18.4	4674	4402	4538
SE.d	1.7	1.6	1.5	0.1	0.1	0.1	0.54	0.58	0.67	61.3	57.6	59.2
CD (P=0.05)	3.9	3.7	3.6	0.3	0.2	0.4	1.2	1.3	1.4	129	121	124

Refer to the methodology for treatment details. DMP, Dry matter production.

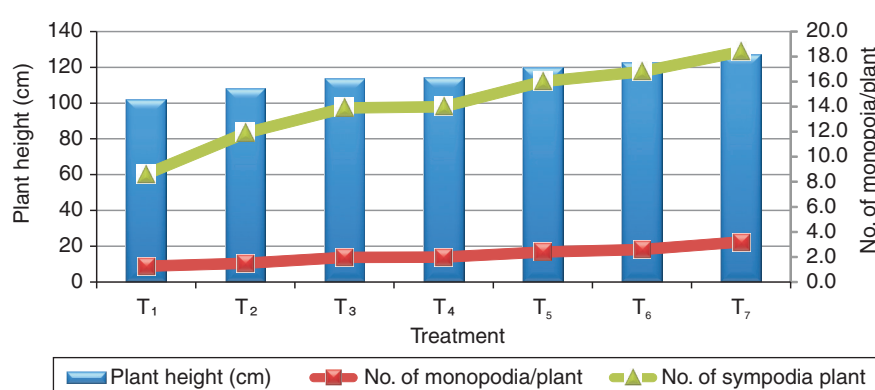


Fig 1 Influence of foliar nutrition on plant height, no. of monopodia/plant and sympodia/plant.

(18.4) and dry matter production (4538 kg/ha) as compared to other foliar treatments. Significantly lesser plant height (101.8 cm), no. of monopodia per plant (1.26), no. of sympodia per plant (8.6) and total dry matter production (3449 kg/ha) were noticed in control (Fig 1).

Increase in growth components at foliar application of MgSO_4 1.0% + ZnSO_4 0.5% is possibly due to the

foliar nutrition of micro nutrients (magnesium) which led to enhanced photosynthetic activity and enzymatic reactions in the plant. Similar results are reported by Sankaranarayanan *et al.* (2010).

Yield parameters and seed cotton yield: The data on various yield attributes showed substantial differences on number of bolls/plant, single boll weight and number of fruiting points/plant (Table 2, Fig 2). Among the foliar application treatments, application of MgSO_4 1.0% + ZnSO_4 0.5% as foliar sprays

three time respectively at flowering, squaring and boll development stages recorded distinctly higher number of bolls/plant (37.0, 35.8 and 36.4 respectively during 2020, 2021 and pooled mean). Conspicuously lower number bolls/plant (34.5, 35.8 and 36.49 during 2010, 2011 and pooled, respectively) were recorded in control treatment. Also the application of MgSO_4 1.0% + ZnSO_4 0.5% as

Table 2 Yield and its attributes as influenced by different foliar sprays in cotton

Treatment	No. of bolls/plant			Single boll weight (g/boll)			No. of fruiting points/plant			Seed cotton yield (kg/ha)		
	2020	2021	pooled	2020	2021	pooled	2020	2021	pooled	2020	2021	pooled
T ₁	19.9	18.7	19.3	4.63	4.41	4.52	41.9	39.5	40.7	1619	1526	1572
T ₂	25.4	23.8	24.6	4.91	4.67	4.79	44.5	41.9	43.2	1759	1658	1709
T ₃	28.4	27.8	28.1	5.16	4.91	5.03	46.7	44.0	45.3	1819	1715	1767
T ₄	29.9	28.5	29.2	5.20	4.95	5.07	47.1	44.4	45.7	1872	1764	1818
T ₅	33.2	32.0	32.6	5.44	5.18	5.31	49.3	46.5	47.9	1965	1852	1908
T ₆	33.8	32.4	33.1	5.57	5.30	5.43	50.4	47.5	49.0	1987	1873	1930
T ₇	37.0	35.8	36.4	5.78	5.50	5.64	52.4	49.4	50.9	2130	2008	2069
SE.d	0.96	1.1	1.1	0.09	0.10	0.10	0.91	1.02	0.98	49.7	51.2	52.3
CD (P=0.05)	2.1	2.5	2.4	0.19	0.22	0.21	1.9	2.1	2.2	104.5	107.2	106.4

Refer to the methodology for treatment details.

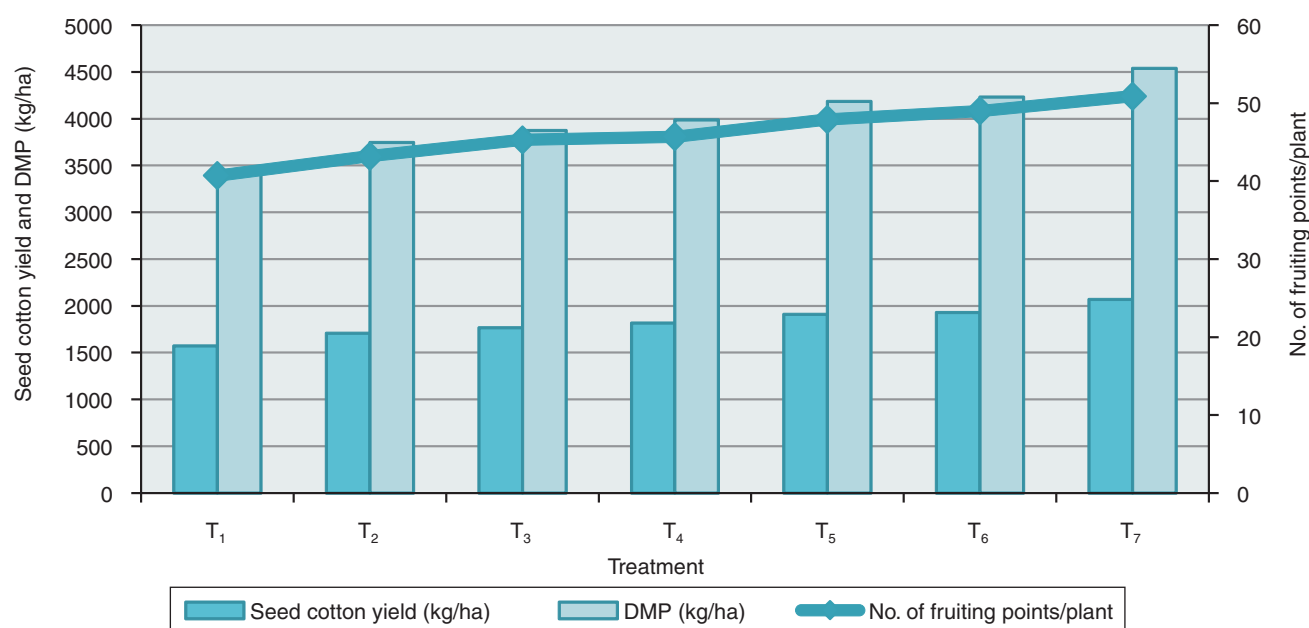


Fig 2 Influence of foliar nutrition on DMP, no. of fruiting points/plant and seed cotton yield. DMP, Dry matter production. Refer to the methodology for treatment details.

foliar sprays three times respectively at flowering recorded conspicuously higher single boll weight (5.64 g/boll) and number of fruiting points/plant (50.9) during squaring and boll development stages. Foliar application of MgSO_4 and ZnSO_4 might have impacted in the enhanced photosynthetic activity and better dry matter partitioning (Aladakatti *et al.* 2011). These results are in conformity with the findings of Blaise *et al.* (2009) and Hosmath (2011).

From the two years of experimental studies, it was found that the significant effect was aroused on seed cotton yield due to foliar application of micronutrients (Table 2). According to the two years of experimental results, it could be revealed that, the application of MgSO_4 1.0% + ZnSO_4 0.5% as foliar sprays three time respectively at flowering, squaring and boll development stages recoded distinctly higher seed cotton yield (SCY) of 2069 kg/ha. El Shazly (2020) found a significant increase in seed cotton yield with respect to the foliar nutrition of magnesium and zinc individually as well as foliar nutrition in combination. Foliar spray of zinc and magnesium increased maximum SCY per plant as compared to absolute control (Zakaria *et al.* 2008). Foliar sprays of MgSO_4 0.5% three times at squaring, flowering and boll formation stages augmented the SCY by 18% in comparison to control (Sankaranarayanan *et al.* 2010). The results are in line with the findings of Shivamurthy *et al.* (2015).

The foliar application of 1.0% magnesium sulphate along with 1% zinc sulphate increased the single boll weight by 46.9% and SCY by 24.0% as compared to control. The increase in seed cotton yield may be due to reduction in boll shedding and increased boll weight. Distinctly lower SCY of 1572 kg/ha was observed in control. Similar results were reported by Yaseen *et al.* (2013) and Santhosh *et al.* (2015).

SUMMARY

From the experimental results, it is inferred that cotton crop responds well to the foliar nutrition with zinc and magnesium. Application of these nutrients through foliar spray might be the feasible option to control the yield barrier under rainfed condition. Further the study found that foliar spraying of MgSO_4 1.0% along with 0.5% of ZnSO_4 three times respectively at squaring, flowering and boll formation stages markedly improved the plant growth and seed cotton yield. Thus, these treatments may be recommended for enhancing the rainfed cotton yield but location specificity verification is required before recommendation

REFERENCES

- Aladakatti Y R, Hallikeri S S, Nandagavi R A, Naveen N E, Hugar A Y and Blaise D. 2011. Yield and fibre qualities of hybrid cotton (*Gossypium hirsutum* L.) as influenced by soil and foliar application of potassium. *Karnataka Journal of Agricultural Sciences* 24(2): 133–36.
- Blaise D, Singh J V and Bonde A N. 2009. Response of rainfed cotton (*Gossypium hirsutum* L.) to foliar application of potassium. *Indian Journal of Agronomy* 54(4): 444–48.
- EL-Shazly M W. 2020. Effect of foliar feeding with some chelated nutrients on productivity and quality of Egyptian cotton cultivar Giza 86. *Journal of Plant Production* 11(11): 1145–51.
- Hosmath J A. 2011. 'Evaluation of Bt cotton genotypes and nutrient management to control leaf reddening'. PhD Thesis, University of Agricultural Sciences, Dharwad (India).
- Mohammed Ashraf, Ragavan and Naziya Begam. 2020. Influence of *in situ* soil moisture conservation practices with pusa hydrogel on physiological parameters of rainfed cotton. *International Journal of Bio-resource and Stress Management* 11(6): 548–57.
- Rajendran K, Mohamed Amanullah M and Vaiyapuri K. 2010. Foliar nutrition in cotton: A review. *Agricultural Reviews* 31(2): 120–26.

- Sankaranarayanan K, Praharaj P, Nalayini K K, Bandyopadhyay and Gopalakrishnan N. 2010. Effect of magnesium, zinc, iron and boron application on yield and quality of cotton (*Gossypium hirsutum*). *Indian Journal of Agricultural Sciences* **80**: 699–703.
- Santhosh U N, Rao S, Desai B K, Halepyati A S and Koppalkar B G. 2015. Effect of nutrient management practices on leaf reddening of Bt cotton (*Gossypium hirsutum* L.) under irrigated conditions. *Journal of Cotton Research and Development* **29**(1): 71–75.
- Shivamurthy D and Biradar D P. 2014. Effect of foliar nutrition on growth, yield attributes and seed cotton yield of Bt cotton. *Karnataka Journal of Agricultural Sciences* **27**(1): 5–8.
- Shivamurthy D, Biradar D P and Aladakatti Y R. 2015. Evaluation of intra hirsutum bt cotton hybrids under integrated nutrient management. *International Journal of Agricultural and Statistical Sciences* **11**(1): 105–09.
- Singh M V. 2009. Micronutrient nutritional problems in soils of India and improvement for human and animal health. *Indian Journal of Fertilizers* **5**(4): 11–26.
- Yaseen Muhammad, Wazir Ahmed and Muhammad Shahbaz. 2013. Role of foliar feeding of micronutrients in yield maximisation of cotton in Punjab. *Turkish Journal Agriculture and Forestry* **37**: 420–26.
- Zakaria M, Sawan Mahmoud H, Mahmoud El-Guibali and Amal H. 2008. Influence of potassium fertilisation and foliar application of zinc and phosphorus on growth, yield components, yield and fibre properties of Egyptian cotton (*Gossypium barbadense* L.). *Journal of Plant Ecology* **1**: 259–70.