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Influence of foliar feeding of nutrients on grwoth yield attributes and seed cotton yield of American cotton

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Abstract: Field experiments were conducted at Faridkot, Bathinda and Ludhiana during *kharif* 2011 to evaluate the effect of foliar feeding of nutrients on growth, yield and yield attributes of American cotton. The experiment was laid in randomized block design replicated thrice. There were 9 foliar treatments (*viz.,* T_1- Control, T_2-Boron@(0.1%), T_3-$ZnSO_4$@(0.5%), T_4-$MnSO_4$@(1.0%), T_5-$MgSO_4$@(1.0%), T_6-$MgSO_4$@(1.0%)+$ZnSO_4$@(0.5%), T_7-$FeSO_4$@(0.5%), T_8-$FeSO_4$@(0.5%)+ $ZnSO_4$@(0.5%) and T_9-Urea@(2%) + DAP@(2%). The results indicated highest seed cotton yield of 3517 and 2371 kg/ha with application of $MgSO_4$@(1.0%)+$ZnSO_4$@(0.5%) for Faridkot and Ludhiana, respectively. However, at Bathinda, highest seed cotton yield (3239kg/ha) was recorded with application of $FeSO_4$@0.5 per cent. The increase in yield was primarily due to improved number of bolls/ plant. Mean data for three locations indicated highest seed cotton yield of 2873kg/ha with application of $MgSO_4$@(1.0%) + $ZnSO_4$@(0.5%), as compared to other treatments. This increase in seed cotton yield over other treatments varied from 10.4 to 27.9 per cent.

***Key words*:** American cotton, bolls, monopods, sympods and seed cotton yield

Cotton being the most important *kharif* season cash crop of south western districts in Punjab occupies a significant place towards its Agrarian economy. It is highly suited as an alternate to paddy and can play a major role in the diversification. For adequate plant growth and production, although secondary and micro nutrients are needed in small quantities however, their deficiencies cause a great disturbance in the physiological and metabolic processes in the plant. Amongst the management practices for improving the seed cotton yield, foliar supplementation of plant nutrients has to be emphasized keeping in view of its importance. Moreover, since soil is supplied with the bulk of the major nutrients only through fertilizers over the years without impurities, deficiencies in both secondary and micronutrients do occur and in many cases are quite apparent requiring urgent attention to break the limits of yield barrier and to maximize crop profitability. Quantum of micronutrient deficiencies of Zn (49%), B (37%), Fe (12%), Mn (4%) and Cu (30%), respectively in Indian soils further necessitates their application (Singh, 2009). The beneficial effect of added Mg, Zn, Cu and B in influencing the growth, yield attributes and yield of hybrid cotton have also been reported by Rajakumar *et al.,* (2010).Addition of appropriate micronutrient(s) can stimulate efficient absorption of other nutrients and aid in giving a significant boost to yield. Since little information is available under site specific conditions of Punjab, hence, the present investigations were carried out to study the effect of foliar feeding of nutrients on growth, yield and yield attributing parameters of upland cotton.

The experiments were conducted during *kharif* season of year 2011 at Regional Research Stations of Faridkot and Bathinda and also at PAU Ludhiana . *Bt* hybrid MRC 6304 was sown with recommended spacing (67.5x75 cm) and fertilizer dose [150 kg N, 30 kg P_2O_5, 50kg K_2O and 25 kg $ZnSO_4$ (21%)/ha]. There were 9 foliar treatments (viz.T_1- Control, T_2-Boron@(0.1%), T_3-

$ZnSO_4$@(0.5%), T_4-$MnSO_4$@(1.0%), T_5-$MgSO_4$@(1.0%), T_6-$MgSO_4$@(1.0%) + $ZnSO_4$@(0.5%), T_7-$FeSO_4$@(0.5%), T_8-$FeSO_4$@(0.5%) + $ZnSO_4$@(0.5%) and T_9-Urea@(2%)+DAP@(2%) arranged in three replications of randomized block design. All foliar treatments were applied at flowering and boll development stages. The soil of the experimental site at Faridkot was loamy in texture, slightly alkaline (pH 8.5), normal EC (0.43 mmhos/cm), medium in O.C (0.48 %), low in available P (7.5 kg/ha) but high in available K (750 kg/ha).The soil at Bathinda was Loamy sand, pH(8.6), normal EC(0.20 mmhos/cm), OC(0.30%), P (13Kg/ha) and K (315Kg/ha). Similarly, soil at Ludhiana was loamy sand in texture, with normal reaction (pH 7.31) and EC (0.27 mmhos/cm), low in OC (0.34%) but having medium levels of P (18.4 kg/ha) and K (150.4 kg/ha).Except for low iron content at Bathinda, the soil of the experimental sites at all three test locations was medium to high for rest of the evaluated nutrient elements. Data on growth and yield attributing parameters were recorded from 5 randomly selected plants in each treatment plot while seed cotton yield (kg/ha) was calculated from whole plot. All other recommended production and protection practices were uniformly applied. Data were statistically analyzed using analysis of variance procedure (ANOVA) in GLM SAS to test the significance (SAS Institute, Inc., Cary, NC).The least significant difference (LSD) tests at P = 0.05 were employed to distinguish treatment differences.

Growth parameters : The data on growth parameters such as plant height and monopods/ plant indicated non significant differences for all the test locations (Table 1). However, sympods/ plant varied significantly only at Bathinda. Highest sympods (28.6) at Bathinda were observed with application T_9 followed T_7 (26.8), with least value for Boron@(0.1%) (21.9).Other locations though varied non significantly for this parameter but numerically least values were recorded under Control . Sankaranarayanan *et al.,* (2010) has also reported significant and positive influence of foliar application of nutrients in improving sympods per plant.

Yield attributes and seed cotton yield : The results presented in the Table 1 indicated significant differences for bolls/plant and seed cotton yield at all the test locations whereas boll weight varied non significantly. At Faridkot, application of T_6 recorded highest seed cotton yield of 3517 kg/ha though it was *at par* with T_3 (3026 kg/ha), T_5 (3339kg/ha) and T_8 (3020kg/ha) treatments but significantly better than rest of the treatments primarily due to significant improvement in boll/plant. Control treatment resulted in least seed cotton yield (2541kg/ha). The increase in seed cotton yield among various foliar treatments over that of control was in the range of 6.2– 38.4 per cent. At Ludhiana , highest seed cotton yield was observed under T_6 (2371 kg/ha) followed by (T_5) (2340kg/ha), whereas, control (1891kg/ha) recorded the lowest seed cotton yield (Table 1). The major reason for higher seed cotton yield in foliar treatments was due to improved bolls/plant than control. Boll count in case of T_6 (46.3) was significantly better than the control(35.3).Foliar application of $MgSO_4$@(1.0 %) +$ZnSo_4$@(0.5%) recorded significantly higher seed cotton yield than T_1, T_2, T_4 and T_9 treatments, but was statistically *at par* with rest of the treatments. All the treatments except T_2 and T_9 were significantly better than control. The range of increase in seed cotton yield at Ludhiana among various foliar treatments over that of control was 10.7– 25.4 per cent. Foliar sprays of $MgSO_4$ @(0.5%) at 60, 75 and 90 days after planting improved the seed cotton yield by 18 per cent over control (Sankaranarayanan *et al.*, 2010). At Bathinda, all the foliar applied treatments proved better in improving the seed cotton yield as compared to control. Highest seed cotton yield was recorded with $FeSO_4$@(0.5%) (3239kg/ha) followed by Urea@(2%)+DAP@(2%)

Table 1. Effect of foliar feeding of nutrients on growth, yield attributes and seed cotton yield of American cotton

Treatments	Growth parameters									Yield attributes			Boll weight(g)			Seed cotton yield(kg/ha)			
	Plant height(cm)			Monopods/plant			Sympods/plant			Bolls/plant									
	Fdk	Ldh	Bth	Fdk	Ldh	Bth	Fdk	Ldh	Bth	Fdk	Ldh	Bth	Fdk	Ldh	Bth	Fdk	Ldh	Bth	**Mean of 3 locations**
T_1 Control	130.0	128.9	156.3	1.0	2.7	3.4	17.3	19.9	22.4	47.6	35.3	32.3	3.8	3.9	4.6	2541	1891	2303	**2245**
T_2 Boron@ (0.1%)	136.2	131.1	151.3	1.1	2.7	3.8	23.4	21.9	21.5	56.8	39.4	31.6	4.0	4.0	4.5	2699	2095	2718	**2504**
T_3 $ZnSO_4$@ (0.5%)	134.5	131.1	152.6	1.2	2.7	3.5	20.4	25.1	23.8	59.4	41.9	36.2	3.9	4.0	4.7	3026	2322	2409	**2585**
T_4 $MnSO_4$@ (1.0%)	132.7	133.2	145.0	1.1	3.0	3.1	23.4	23.4	23.3	57.1	39.7	29.9	3.9	4.0	4.7	2741	2126	2570	**2479**
T_5 $MgSO_4$@ (1.0%)	138.9	133.9	151.3	1.3	3.0	3.4	24.3	25.7	21.7	61.0	44.4	34.5	3.8	3.9	4.6	3339	2346	2758	**2812**
T_6 $MgSO_4$@ (1.0%) + $ZnSO_4$@(0.5%)	132.2	133.5	153.0	1.3	3.1	3.4	27.7	25.9	23.3	67.3	46.3	36.3	4.1	4.2	4.7	3517	2371	2731	**2873**
T_7 $FeSO_4$@ (0.5%)	132.9	131.1	156.3	1.2	2.7	3.7	22.3	23.3	26.8	54.6	41.4	41.9	4.0	4.0	4.7	2716	2150	3239	**2701**
T_8 $FeSO_4$@ (0.5%)+ $ZnSO_4$ @(0.5%)	132.0	132.2	144.0	1.4	2.9	3.5	21.3	25.4	21.5	53.0	42.0	35.3	3.8	3.9	4.6	3020	2142	2998	**2720**
T_9 Urea @ (2%) + DAP @ (2%)	129.5	131.1	151.3	1.3	3.0	3.7	21.3	25.0	28.6	59.5	39.2	39.5	4.1	4.1	4.6	2872	2114	3012	**2666**
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	4.2	8.4	5.4	4.7	NS	NS	NS	489	231	401	-

Abbreviations viz. Fdk, Ldh and Bth indicate Faridkot, Ludhiana and Bathinda locations, respectively

(3012kg/ha) , $FeSO_4$@(0.5%) + $ZnSO_4$@(0.5%) (2998kg/ha) and $MgSO_4$@(1.0%) (2758kg/ha) with least yield of 2303kg/ha under control. The range of increase in seed cotton yield at Bathinda among various foliar treatments over that of control was 4.6– 40.6 per cent. Zakaria *et al.,* (2008) has also reported beneficial effects of zinc and magnesium sulphate in improving seed cotton yield over control. The results of present investigations are in accordance with several workers who have reported increase in seed cotton yield with foliar spray of $MgSO_4$ (Kumar and Yadav,2010), $MgSO_4$+KNO_3. Overall, mean of three locations indicate d that application of $MgSO_4$ @(1.0%) and $MgSO_4$ @(1.0%) + $ZnSO_4$@(0.5%) resulted in an increased yield by 25.2 and 27.9 per cent, respectively over the control. Application of zinc and magnesium sulphate significantly increased seed cotton yield/plant as compared with the untreated control. Shekhar *et al.,* (2013) has also reported significantly improved seed cotton yield (2506kg/ha) with foliar applications of $MgSO_4$ (1%)+KNO_3(2%) over that of control (2008kg/ha).

Overall mean of three locations for seed cotton yield highest seed cotton yield of 2873 kg/ha with application of $MgSO_4$@(1.0%)+ ZnSO4@(0.5%) closely followed by $MgSO_4$@(1.0%) while least seed cotton yield of 2245kg/ha was recorded under control. Therefore, it can be concluded from the present investigations that foliar application of either $MgSO_4$@(1.0%) or in combination of ZnSO4@(0.5%) at flowering and boll development stages is very beneficial and leads to improvement in seed cotton yield.

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