RESPONSE OF DRIP IRRIGATION AND MICRONUTRIENT MIXTURE ON YIELD, QUALITY AND NUTRIENT UPTAKE IN SWEET CORN (*Zea mays* L. SACCHARATA STURT.)

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ABSTRACT

A field experiment was conducted during rabi 2010-11 at Tribal Research cum Training Centre, Anand Agricultural University, Devgadh Baria, Dist. Dahod (Gujarat) to evaluate the effect of four irrigation treatments [Surface irrigation (0.8 IW/CPE ratio); 0.6 ADFPE (drip); 0.8 ADFPE (drip) and 1.0 ADFPE (drip)] and three levels of micronutrient mixture [0, 10 and 20 kg/ha] on yield, quality, nutrient uptake by sweet corn (Zea mays L. saccharata. Sturt.) cv.'Madhuri' and also the availability of micronutrient content in the soil. Results revealed that applying of irrigation scheduling at 0.8 IW/CPE ratio (5 irrigations of 50 mm depth) recorded higher green cob yield (15124 kg/ha) and stover yield (20910 kg/ha) of good quality and increased the micronutrient uptake by plant and content in soil. Application of irrigation water by drip irrigation at 1.0 ADFPE at alternate day was the next best treatment. Similarly, application of 20 kg micronutrient mixture per ha recorded the increased the higher green cob yield (15452 kg/ha) and stover yield (19831 kg/ha) of good quality and micronutrient uptake by plant and content in soil over no application of micronutrient mixture.

KEY WORDS: Drip irrigation, micronutrient mixture, sweet corn

INTRODUCTION

Sweet corn is popular vegetable and ranks second in farm values and fourth in commercial values among all commercial crops in India. Due to rising in demand, the sweet corn is able to increase the farm income. The productivity potential of sweet corn is higher than wheat and nutritive status superior to rice on account of which it will no larger a 'coarse grain' but a 'nutritious grain' (Batra, 2002). Sweet corn has good nutritional values. Nutritional quality of fresh sweet corn is based on moisture (70-78 %) and total solids (12-20 %). It possessed Carbohydrates (81.00 %), protein (13.00 %), lipid (3.50 %) and total sugar content (15-20 %) (Anonymous, 2003).Technological innovations are to be exploited to achieve the objective of better quality of product. In this regard, drip irrigation is one of the best alternate in delivering water to the plant. Increasing trend of intensive cultivation due to increasing in availability of irrigation facilities, introduction of high yielding varieties and heavy usage of high analysis fertilizers, micronutrients deficiencies were observed in these areas so it's application becomes necessary now a days. Keeping all this in view, the present investigation was planned.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2010-11 at Tribal Research cum Training Centre, Anand Agricultural University, Devgadh Baria, Dist. Dahod. Geographically, Devgadh Baria is located at 22˚-42' N Latitude, 73˚-54' E Longitude with an elevation of 104 m above mean sea level. The experimental site was sandy loam in texture having low in organic carbon (0.33%), available nitrogen (210.25 kg/ha), medium in phosphorus (51.54 kg/ha) and zinc (0.93 mg/kg), high in available potassium (352.00 kg/ha), iron (17.71 mg/kg), manganese (15.80 mg/kg) and copper (1.79 mg/kg) contents with pH 7.4. Twelve treatment combinations comprising of four levels of irrigation viz. I_1: Surface irrigation (0.8 IW/CPE ratio with depth of irrigation 50 mm), I_2: 0.6 ADFPE (through drip), I_3: 0.8 ADFPE (through drip), I_4: 1.0 ADFPE (through drip) and three levels of micronutrient mixture viz. M_0: without micronutrient mixture, M_1: 10 kg micronutrient mixture per ha and M_2: 20 kg micronutrient mixture per ha [Micronutrient mixture will be prepared as per Government of Gujarat notified Grade-V (Fe-2.0%, Mn-0.5%, Zn-5.0%, Cu-0.2% and B-0.5%) and applied through soil application as basal] were tried in split plot design with four replications. In drip irrigation treatments, irrigation given at alternate days based on fraction of pan evaporation of two days. Drip system should be laid out as one lateral at alternate row of sweet corn at 90 cm apart with 4 lph dripper placed at a distance of 60 cm and system operated at 1.2 kg/cm^2 pressure. Sweet corn variety 'Madhuri' was sown on 1 November, 2010. The row to row spacing 45 cm and plant to plant spacing 20 cm was maintained. After field preparation, a basal dose of 60 kg N and 60 kg P_2O_5 per ha was applied and remaining half amount (60 kg N per ha) was top dressed to sweet corn row only in two equal splits at knee height and tasseling stages. The first irrigation was given just after sowing the crop and then light irrigation was given after a week to facilitate germination and establishment of seedlings and then after drip irrigation was started at 10 DAS in drip irrigation treatments. There is no any pest or diseases occurred during crop period. The green cob was picked four times in three days interval after 16 January, 2011. The yield data of the crop was recorded at all picking and plant samples were collected before harvesting of crop. Soil sample after harvesting of sweet corn were measured with collecting of individual plot sample at 15 cm depth. One soil sample of each plot was air dried, processed to pass through 2 mm sieve and analyzed for availability of different micronutrients through Atomic Absorption Spectrophotometry method described by Lindsay and Norvell (1978).

RESULTS AND DISCUSSION

Effect on yield and quality

Higher green cob yield (15124 kg/ha) and stover yield (20910 kg/ha) was recorded under the treatment I_1 (0.8 IW/CPE ratio) followed by treatment I_4 (1.0 ADFPE) (Table 1 and Figure 1). The probable reason may be behind that higher frequencies of irrigation did not cause water stress at any stage of the crop providing favorable conditions for crop growth resulting in increased green cob and stover yields. Similar results were also reported by Mughalkhod *et al.* (2011) and Patil *et al.* (2011). Maximum moisture content at harvest in grains (74.02 %) and significantly higher total soluble sugar (19.85 %) and total soluble solids (16.50 ^{0}Brix) were recorded under I_4 treatment (1.0 ADFPE). This might be due to better availability of soil moisture in the root zone through more frequent irrigation (Anonymous, 2010).

Significantly Higher green cob yield (15452 kg/ha) and stover yield (19831 kg/ha) (Table 1) was recorded under the treatment M_2 (20 kg micronutrient mixture per ha). The reason might be due to multi-micronutrients supplementation could be the results of

balanced nutrition of the crop (Patel *et al.*, 2003). Moisture content at harvest in grains did not show significant effect on application of micronutrient mixture. Significantly highest total soluble sugar (19.57 %) and total soluble solids (16.35 ^{0}Brix) was recorded with application of 20 kg micronutrient mixture per ha. Increasing the micronutrient mixture levels may stimulate and activating the biochemical process in plant, which improving the quality. These findings are close in conformity with Bakry *et al.* (2009).

Effect on micronutrient uptake

Significantly highest Fe (1614.71 mg/kg), Mn (654.48 mg/kg), Zn (255.60 mg/kg) and Cu (89.03 mg/kg) uptake (Table 2) were recorded under the treatment I_1 (0.8 IW/CPE ratio) and it was at par with I_4 treatment (1.0 ADFPE), while the lowest nutrient uptake were recorded under the I_2 (0.6 ADFPE). The reason might be due to reduced uptake of micronutrient from the soil was attributed to water stress because water stress can immobilize the micronutrient available in soil. Similar results were also reported by Oktem (2008).

Each successive increase in micronutrient mixture level from 0 to 20 kg micronutrient mixture per ha, increase the Fe, Mn, Zn and Cu uptake by plant was observed. Treatment M_2 (20 kg micronutrient mixture per ha) recorded significantly highest Fe (1682.37 mg/kg), Mn (693.99 mg/kg), Zn (262.43 mg/kg) and Cu (92.33 mg/kg) uptake by plant Supplementation of multi-micronutrients could be the results of balanced nutrition of the crop and though the better utilization of all micronutrients, which in turn results in to increase in micronutrient uptake. Similar results were also reported by Patel *et al.* (2003) and Patel *et al.* (2009).

Effect on available micronutrient in soil

Significantly higher values of available Fe (10.61 mg/kg), Mn (13.63 mg/kg) and Zn (0.73 mg/kg) in soil (Table 2) were observed under I_4 (1.0 ADFPE), which clearly indicated the water plays a significant role in their mobilization. Available copper in soil failed to show any significant effect.

Application of micronutrient mixture brought out significant changes in availability of iron, manganese, zinc and copper in soil. Treatment M_2 (20 kg micronutrient mixture per ha) recorded significantly higher Fe (10.07 mg/kg), Mn (13.10 mg/kg), Zn (0.69 mg/kg) and Cu (1.36 mg/kg) status in soil, clearly indicated the beneficial effects of addition of micronutrient mixture.

CONCLUSION

Overall results suggested that applying of irrigation scheduling at 0.8 IW/CPE ratio (5 irrigations of 50 mm depth) followed by drip irrigation at 1.0 ADFPE at alternate day with drip system with an application of 20 kg micronutrient mixture per ha recorded higher yield, quality and micronutrient uptake by plant and content in soil.

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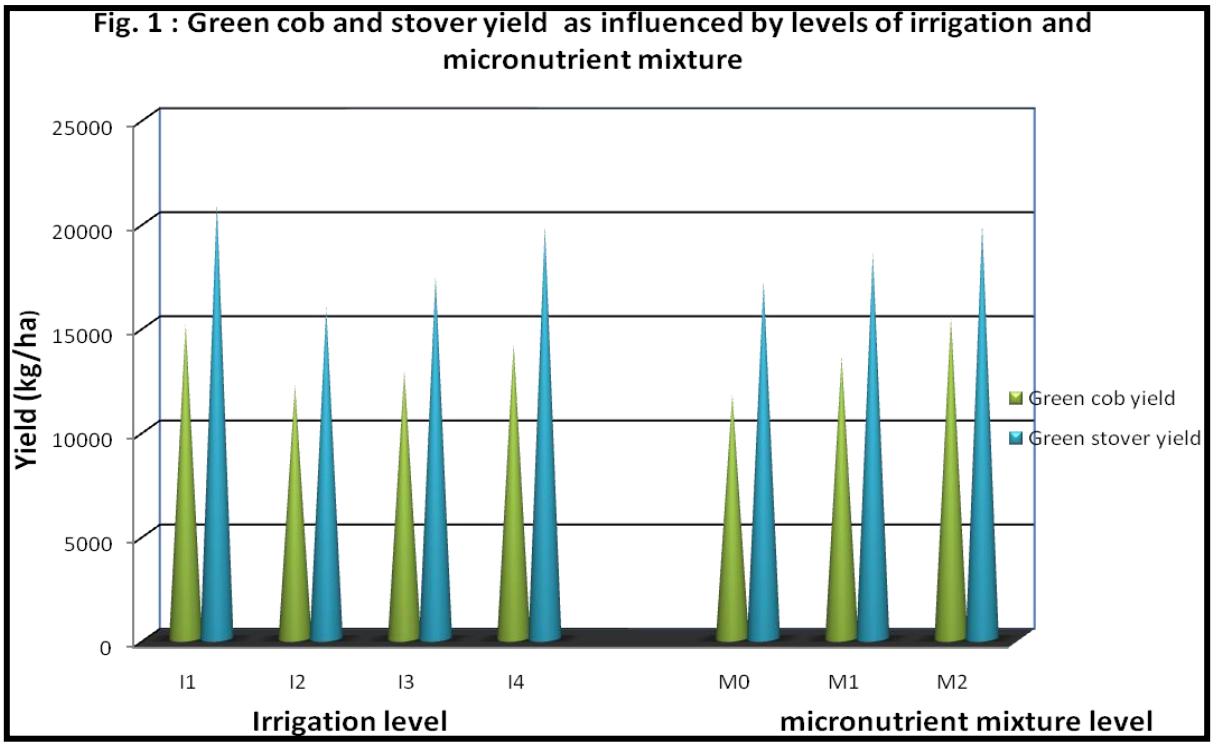
Table 1: Effect of different irrigation and micronutrient mixture levels on yield and quality of sweet corn

Treatment	Yield (Kg/ha)		Moisture Content at Harvest (%)	Total Soluble Sugar (%)	Total Soluble Solids (°Brix)
	Green Cob	Green Stover			
Main plot: Irrigation Level (I)					
I_1	15124	20910	72.15	18.23	14.97
I_2	12177	15887	72.71	18.67	15.59
I_3	12863	17390	73.69	19.25	16.11
I_4	14149	19800	74.02	19.85	16.50
S. Em.±	376	495	0.44	0.13	0.11
CD at 5%	1204	1583	1.39	0.42	0.37
Sub Plot: Micronutrient Mixture Level (M)					
M_0	11722	17141	72.70	18.50	15.16
M_1	13559	18519	73.07	18.92	15.87
M_2	15452	19831	73.65	19.57	16.35
S. Em.±	294	421	0.34	0.11	0.10
CD at 5%	858	1227	NS	0.32	0.29

Table 2: Effect of different irrigation and micronutrient mixture levels on micronutrient uptake by plant and available micronutrient in soil

Treatment	Micronutrient Uptake by Plant (mg/kg)				Available Micronutrient in Soil (mg/kg)			
	Fe	Mn	Zn	Cu	Fe	Mn	Zn	Cu
Main plot: Irrigation Level (I)								
I_1	1614.71	654.48	255.60	89.03	8.83	12.15	0.60	1.29
I_2	1321.16	530.73	205.81	71.98	9.19	11.75	0.64	1.32
I_3	1393.90	567.31	218.40	76.12	9.93	13.19	0.68	1.35
I_4	1542.27	629.60	240.69	84.62	10.61	13.63	0.73	1.34
S. Em.±	36.20	17.62	5.83	2.11	0.06	0.10	0.01	0.02
CD at 5%	115.82	56.36	18.67	6.75	0.20	0.32	0.02	NS
Sub Plot: Micronutrient Mixture Level (M)								
M_0	1257.22	508.11	198.23	68.72	9.19	12.28	0.63	1.29
M_1	1467.97	594.64	229.72	80.27	9.66	12.66	0.67	1.33
M_2	1682.37	683.99	262.43	92.33	10.07	13.10	0.69	1.36
S. Em.±	33.13	14.41	4.96	1.80	0.07	0.09	0.00	0.00
CD at 5%	96.71	42.05	14.47	5.26	0.22	0.25	0.01	0.01



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