Response of Sweet Dorglw to VA MYCORRMIZA Inoculation and Two Methods of Applying Boron

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ABSTARCT

Two fields experiments were carried out at Sabahia Agricultural Research Station at Alexandria Governorate during 2001 and 2002 seasons to investigate the effect of soil and foliar application at two rates of boron and their interaction or and with VA mycorrhizal fungi on sweet sorghum plants. Results indicated that seed inoculation with VA mycorrhizal fungi insignificantly affect total chlorophyll, LAI at age 60 days from sowing, NAR, plant height. no. of internodes, stalk diameter, T.S.S., sucrose percentage, all yield components (ton/fed) (plant, stalk. forage and baggas), juice and syrup extraction %, whereas LAI at age 81 from sowins days juice and syrup yields (ton/fed) and N,P,K. and B contents were significantly increased during the two successive seasons of the study. Boron application gave the same trend of all mentioned characters with exception- T.S.S., and sucrose percentage were significantly increased. Moreover, foliar spray gave the better results than soil application on these trails,an opposite trend obtained in N, P,K. and B contents which the soil application was the most beneficial. Interaction between inoculated seed with VA mycorrhiza and B application gave a positive effect but not significant on all characters in this study, except generally the nutritional status N,P,K and B contents. Finally, both of boron treatments or VAM inoculation alone or their combination pronounced the growth, yields, yield quality and nutritional status of sweet sorghum plants. The results sometimes gave a significant effect. It could be concluded that the highest syrup yield (ton/fed) and sugar percentage was obtained by foliar application of boron at the lower rate (0.05%) in mycorrhizal plants.

INTRODUCTION

Sugar production in Egypt does not meet the consumption of the progressively increased population. Therefore, more research work must be focused on increasing the productivity of sugar crops. Among the important sugar crops, sweet sorghum which might replace sugar cane in syrup production and this will deviate channel all the cane produced into sugar manufacture. Another, main advantage of growing sweet sorghum is that it can be used also in sugar production,

The increase of sucrose percentage and syrup production could be achieved by the application of appropriate agrotechnique, mean while, biofertilizer as vesicular arbuscular mycorrhizal (VAM) and micronutrients as boron.

VAM are considered as being beneficial to plant growth, especially where root systems are restricted and soil nutrient status is low. The favorable effect of VAM on plant growth in P-deficient soils is believed to mainly due to enhanced uptake and translocation of P by external hyphae. Inoculation with VA

mycorrhiza enhanced the plant growth (Ikram, et al 1994). Reda (2001) and Zahana-Afaf, et al (2003) found a positive effect of VA mycorrhiza on shoot dry weight and plant height of flax compared with uninoculated treatments.

Seed inoculated with VA mycorrhizal may increased N, P and k uptake, whereas El-Ghandour, et a1 (1996), Koreish, et al (1998) and Massoud, (1999) found that VAM significantly increased N and P uptake. The K concentration in shoots of mycorrhiza1 plants was higher than that of non-mycorrhizal plants (Mala and Thongchai, 1995 and Beyene,et al 1996).

Regarding the effect of VA mycorrhizal fungi on yield and yield components, (EL-Ghandour et al 1996, Reda, 2001 and Zahana-Afaf, et al 2003) found that inoculated seeds with mycorrhizal fungi significantly increased yield and their components compared to those without inoculation.

Boron plays a role in carbohydrate metabolism and influences the protein and nucleic acid ones. Boron deficiency upset the synthesis, transformation and migration of carbohydrates, formation of reproductive organs, fertilization and fruit bearing (Roy, et al 1981).

Many of workers found that B soil on sprinkler, application to increased total chlorophyll, leaf area, N.A.R., plant height, total soluble solids and sucrose percentage (Beshiet, et al 1992, Aly, et al 1995 and Grewal, et al 1998 on chlorophyll), (Plesnicar, et al 1997 on leaf area),(Jiang, et al 1994 on plant height),(Omran. Samya et al 2002 on T.S.S), (Aly, et al 1995, Mahmoud, 1999 and Omran-Samya, et al 2002 on sucrose percentage).

Boron also increased N, P,K and B concentrations, Jiang, et al (1994) and Wei and Zuo, (1996) found that B promoted the absorption of nitrogen. Misra, et al (1991) showed that B increased P concentration in seed coat by 24.5%, Li, et al (1996) found that K concentration decreased by B deficiency and Mandal, (1994), Wroble, (1997) and Omran-Samya, et al (2002) found that B increased B content in the plants.

Regard the effect of boron on yield and yield components, Jiang, et al (1995), Wei and Zuo, (1996) and Omran-Samya, et al (2002) found that foliar application of boron increased the yield.

MATERIALS AND METHODS

Two field trials were established in the Sabahia Agricultural Research Station Farm at Alexandria during 2001 and 2002 seasons. Collier variety was sown on Jun 10th in both seasons. A split plot design with three replication was used. Each experiment included 10 treatments which were the combination of two inoculation treatments with (VAM) vesicular-arbuscula mycorrhiza(+M)and uninoculated(-M) as main plot and five boron rates 0, (0.25 and 0.50kg/fed) as soil application, (0.05 and 0.10%) as foliar application in the form of borax as sub plot. Each sub plot area was 15m^2 (5 ridges) each 5 m long and 60 cm apart, and 20cm between plants, approximately 2-3 seeds in each hill. The inoculum used in this experiment was propagated on maize plant grown in

glasshouse for 12 weeks. The seed inoculation was done before sowing (150 g mixture of maize root with adhering soil / hill), Menge and Timmer, (1982). Borax as soil application was applied before the first irrigation (21 days after sowing), while foliar application was applied at 45 and 60 days from sowing. Some physical and chemical properties of soil were analyzed according to Chapman and Pratt (1961) and the description was given in Table (1). Other cultural agronomic practices were carried out as recommended. A random sample of 10 plants was taken from the second ridge of each plot after 60, 81 and at dough-ripe stage (102 days from planting) to determined leaf area and dry weight of leaf.

Al 102 days from sowing, the plants were ready for harvest. The two middle ridges were weighted for determining the following characters.

1. Physiological characters:

1-1.Total chlorophyll was determined using chlorophyll meter (SPAD 501).

1-2. Leaf area index (L.A.I).

1-3. Net assimilation rate (N.A.R) ug/cm^2 /day as described by the equation.

2. Some agronomic and technological characters

2-1. Plant height (m).

2-2. Number of internodes.

2-3. Stalk diameter (m.m).

2-4.Total soluble solids (T.S.S) using the hand refractometer.

2-5. Sucrose percentage was determined according to the procedure out line by A.O.A.C. (1990).

3. Macro element (N, P and K) and microelement (B) in juice:

3-1.Nitrogen percentage measured according to the improved macro Kjeldahle method (A.O.A.C., 1990).

3-2.Phosphorus percentage was calculated calorimetrically using spectra photometer according to Chapman And Pratt (1961).

3-3.Potassium percentage was determined using flame photometer according to Brown and Lilliand (1964).

3-4 Boron was determined according to Chapman and Pratt (1961).

4. Yield components (ton/fed) and extraction percentage of juice and syrup:

4-1. Plant weight. 4-2. Stalk weight. 4-3.Forage weight.

4-4. Juice weight. 4-5. Baggas weight. 4-6. Syrup weight.

4-7. Extraction % of juice and syrup were calculated according to the following formula:

$$-\text{Juice extraction percentage} = \frac{\text{Juice yield (ton/fed)}}{\text{Fresh weigth of stalk (ton/fed)}} \times 100$$

$$-\text{Syrup extraction percentage} = \frac{\text{Syrup yield (ton/fed)}}{\text{Fresh weigth of stalk (ton/fed)}} \times 100$$

Analysis of variance was carried out according to Sendecor and Cochran (1976) and means were compared by least significant difference (LSD) at 0.05 level was used.

Table 1. Physical and chemical soil properties of the experiment field before sowing.

Soil properties	Values
A. Physical properties:	
Clay%	41.1
Silt %	43,5
Sand%	14.1
Textural class	Silt clay clay
EC d sm^{-1}	4.52
$CaCO_3$ %	7.50
O.M.%	1.30
PH(soil paste)	7.80
B. Chemical properties:	
Cation in meq /L (soil paste)	
Ca^{+2}	18.2
Mg^{+2}	10.5
Na^{+1}	15.0
K^{+1}	1.37
Anion in meq /L (soil paste)	
$CO3^{-2}$	0.00
$HCO3^{-1}$	2.57
CL^{-1}	28.1
$SO4^{-2}$	14.4
Available element (ppm)	
B	0.50

RESULTS AND DISCUSSION

1- Some physiological characters:

NSR refers to the rate of increase of dry matter per leaf area unit per time unit. It has special interest as it is a resultant of the excess C gained from

photosynthesis over that lost by respiration.

Results in Table (2) showed that seed inoculation with VA mycorrhizal fungi increased insignificantly total chlorophyll content, NAR, LAI and LAI at 60 days, while was significantly at 81 days from sowing in 2001 and 2002 seasons.

Data in Table (2) showed that inoculated seed with mycorrhizal fungi insignificantly increased NSR compared with those without inoculation in both samples i.e. 81 and 102 days from sowing in both seasons of the study.

In at growth stage same table data showed that total chlorophyll and NAR was insignificantly increased, while it was significantly on LAI with increasing boron rates at 60 and 81 days under studied seasons. Foliar spray was more favorable effect than soil application by boron on NSR (ug/cm^2/days). In this connection, Aly, et al (1995).

This increase in total chlorophyll may be attributed to that B increased photosynthetic oxygen evaluation per unit, leaf area and proton gradient across the thylakoid membrane (Plesnicar, et al 1997). Similar these results are in conformity with the results were obtained by Aly, et al (1995) and Grewal, et al (1998).The increase of LAI could be attributed to the effect of these treatments in increasing both size and number of cell in the leaf. In this connection, Tisdale and Nelson (1975) stated that boron influenced the rate of cell division and development. These results are in agreements with Plesnicar, et al (1997) and Omran, Samya et al (2002).

VAM x boron interaction effect insignificant on total chlorophyll, LAI and NAR at growth stages in both studied seasons of the study.

2- Some agronomic and the technological characters:

Data in Table (3) showed that, inoculation with mycorrhizal fungi insignificantly increased plant height, number of internodes, stalk diameter, total soluble solids in both seasons with sucrose percentage it was significantly increased in the second season. Similar trend was obtained by Reda(2001) and Zahana, Afaf et al (2003).

The data presented data in Table (3) showed that the increase of boron rate did not significantly increased the plant height, number of internodes and stalk diameter in 2001 and 2002 seasons. On the other hand, the excess of B rate significantly increased total soluble solids and sucrose percentage where, Tisdale and Nelson (1975) stated that B regulate the translocation of sugar from leaves to the storage organs. In general, foliar spray gave the highest values than soil application. The obtained results are in harmony with those of Tarig, et al (1993) who found that root diameter and length of sugar beet increased with B application.

Jiang, et al (1994) found that application of B increased the plant height. Also, Bondok (1996) found that B increased sugar yields and root quality (sucrose %, total soluble solids and purity).

Both inoculation with VAM and B application together exhibited an insignificant increase in all studied characters .

3- Nutritional status (N, P, K% and B (mg/L)):

Data in Table (4) indicated that seed inoculation with mycorrhizal fungi increased N, P and K percentage and B (mg/L) in the two seasons compared to untreated ones. Favorable effect on the N status was explained by Mosse, et al (1976) and Smith, et al (1979) on the basis of improvement for nitrogenous activity rather than improvements in the uptake of either nitrate or ammonium ions from soil. The favorable effect of VAM on P content is believed to mainly due to enhanced uptake and translocation of P by external hyphae, also relatively higher uptake rate of K by mycorrhizal fungi were attributed to lower rates of efflux but high influx rates as well as higher vascuolar poll size (Rygiewicz and Bledsoe, (1984)). Such results agree with those obtained by Beyene, et al, 1996, EL-Ghandour, et al 1996, Barsoom, 1998, Massoud, 1999 and Reda, 2001.

Data also obviously showed that N, P, K percentage and B mg/L in juice of sugar sorghum plants increased with increasing levels of B either as foliar spray or soil application. It is also noticed that, B as soil application gave the best results than foliar spray on all studied elements. This increase in N,P,K% and B mg/L may be attributed to B promoted the absorption of nitrogen (Wei and Zuo, 1996), and with the B- induced increase in K uptake could cause a subsequent stimulation of the H^+ - ATpase (proton pump) and lead to the observed hyper polarization of root cell membranes or that B may stimulate the proton pump, with the subsequent hyper polarization resulting in an increase driving force for K influx (Schon, et al, 1990 and Ferrol, et al 1993).

As for interaction between VAM accompanied with B application gave superiority effect than B alone on all these elements.

Seed inoculation with VA mycorrhizal fungi accompanied with B as soil application at (0.5 Kg/fed) gave the best result than other treatments on N, P, K and B contents.

Better yield components were generally, obtained due to the physiological and biochemical effects of N,P and K on growth behavior (EL-Laboudi, et al 2000) so, the increase these elements by B and VAM improved the growth and this reflected in higher yield per plant and per feddan.

4- Yield components (ton/fed) and extraction percentage of juice and syrup:

The data in Table (5) revealed that seed inoculation with mycorrhizal insignificantly increased the yield of plants, stalk, forage, baggas and extraction this showed that VAM and B act independently on all characters under study percentage of juice and syrup in 2001 and 2002 seasons. The increase in the yield production was mostly due to plant growth regulators produced by mycorrhizal bacteria and due, to a less extent, to N- fixation (Mosse *et al.*, 1981).

Whereas, juice and syrup amounts (ton/fed) were significantly increased by inoculation with VA mycorrhizal fungi compared with untreated plants. Also Besada *et al.*, (1991) illustrated that inoculation with VAM, either single on with

N2- fixing bacteria, improved barley growth and yield when compared with the control treatment.

Regarding the effect of B application the same table show that, in general the increase of B rates at two methods of application in significantly increased the yield of plants, stalk, forage and baggas (ton/fed) in the first season and the same trend was obtained in the second season. On the other side, boron as foliar or soil application significantly increased syrup and juice yield (ton/fed).

Data also found that B application as foliar or soil application increased extraction percentage of juice and syrup in two seasons of the study.

The interaction between VA mycorrhiza and B application as soil or foliar had no significant effect on all studied characters during both seasons of the study.

It can be see concluded that foliar spray of boron at the lower rate 0.05% accompanied with inoculation with VAM gave the most superior effect than the other studied factors on N%, P %, K% and ppm of sweet sorghum syrup.

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Table 2. Interaction some physiological characters as affected by VA mycorrhizal fungi and boron fertilizer.

Treatments (T)	Total chlor.		L. A. I.				N. A. R. (ug / cm /day)			
	60 day		60 days		81 days		81 days		102 days	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Non mycorrhizal plants (- M)										
Control	33.6	33.2	2.29	2.14	4.01	3.78	0.094	0.065	0.142	0.206
B1 (S)	38.1	36.7	2.33	2.37	4.51	4.10	0.108	0.088	0.179	0.227
B2 (S)	41.2	38.8	2.48	2.48	4.75	4.75	0.199	0.130	0.173	0.229
Mean	39.7	37.8	2.42	2.43	4.63	4.43	0.154	0.109	0.176	0.228
B1 (F)	42.2	40.0	2.80	2.64	5.12	5.21	0.463	0.252	0.265	0.271
B2 (F)	43.1	42.2	2.84	2.82	5.29	5.35	0.364	0.477	0.270	0.318
Mean	42.7	41.2	2.82	2.73	5.21	5.20	0.414	0.365	0.268	0.295
All means	38.7	37.4	2.52	2.43	4.62	4.50	0.221	0.180	0.195	0.243
Mycorrhizal plants (+ M)										
Control	42.0	37.8	2.38	2.42	4.97	4.64	0.201	0.150	0.201	0.256
B1 (S)	42.2	39.8	2.63	2.62	5.26	5.20	0.290	0.233	0.227	0.267
B2 (S)	42.2	39.0	2.51	2.58	5.13	5.10	0.266	0.205	0.218	0.258
Mean	42.2	39.4	2.57	2.60	5.20	5.15	0.278	0.219	0.223	0.263
B1 (F)	43.9	44.1	3.24	3.18	5.47	5.54	0.445	0.458	0.298	0.464
B2 (F)	43.4	43.6	3.00	2.97	5.39	5.48	0.516	0.530	0.292	0.331
Mean	43.6	43.9	3.12	3.07	5.43	5.51	0.481	0.494	0.295	0.398
All means	42.6	40.4	2.69	2.70	5.20	5.10	0.320	0.288	0.240	0.306
L. S. D. at 0.05 level :										
Mycorrhiza (M)	N. S	N. S	N. S	N. S	0.25	0.15	N. S	N. S	N. S	N. S
Treatments (T)	N. S	N. S	0.47	0.40	0.51	0.25	N. S	N. S	N. S	N. S
M × T	N. S	N. S	N. S	N. S	N. S	N. S	N. S	N. S	N. S	N. S

L A I = Leaf area index. B (S) = Soil application.
N A R = Net a simulation rate. B (F) = Foliar application.

ble 3. Some agronomic and technological characters as interaction affected by VA mycorrhizal fungi and boron fertilizer.

eatmens (T)	Plant height (m)		No.of internods		Staik diameter (m.m)		Total Soluble Solids (T.S.S)		Sucrose %	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Non mycorrhizal plants(-M)										
Control	2.03	1.97	15.3	14.5	2.57	2.43	15.0	15.3	5.85	5.92
B1(S)	2.11	2.01	15.4	14.9	2.64	2.54	15.7	15.7	6.20	6.67
B2(S)	2.17	2.12	16.0	15.6	2.60	2.66	16.0	15.7	6.28	6.79
Mean	2.14	2.06	15.7	15.7	2.62	2.60	15.8	15.7	6.24	6.73
B1(F)	2.33	2.22	17.2	16.3	2.81	2.68	17.0	17.3	7.41	7.64
B2(F)	2.45	2.38	17.3	17.0	2.85	2.67	17.3	17.7	7.82	7.95
Mean	2.39	2.25	17.3	16.7	2.83	2.68	17.2	17.5	7.62	7.80
All means	2.22	2.13	16.2	15.7	2.69	2.60	16.2	16.3	6.71	6.99
Mycorrhizal plants(+M)										
Control	2.24	2.10	16.3	15.9	2.61	2.51	15.7	15.7	6.55	6.79
B1 (S)	2.30	2.20	17.0	16.1	2.77	2.66	16.3	16.7	6.93	7.36
B2 (S)	2.23	2.15	16.7	15.9	2.65	2.51	16.0	16.3	6.89	6.89
Mean	2.26	2.17	16.8	16.0	2.71	2.58	16.2	16.5	6.91	6.89
B1 (F)	2.58	2.48	18.3	17.9	2.91	2.72	17.7	18.0	8.05	8.55
B2 (F)	2.55	2.39	18.0	17.5	2.87	2.51	17.3	18.0	7.84	8.35
Mean	2.56	2.43	18.2	17.7	2.89	2.62	17.5	18.0	7.95	8.45
All means	2.38	2.26	17.3	16.7	2.76	2.58	16.6	16.9	7.25	7.59
L. S. D. at 0.05 level :										
Mycorrhiza (M)	N. S	N . S	N . S	N . S	N . S	N . S	N . S	N . S	N . S	0.16
Treatments (T)	N. S	N . S	N . S	N . S	N . S	N . S	1.33	1.05	1.06	0.99
M × T	N. S	N . S	N . S	N . S	N . S	N . S	N . S	N . S	N . S	N. S

(S) = Soil application. B (F) =Foliar application.

Table 4. Nutritional status of syrup (% N,P,K and B ppm) as interaction affected by V A mycorrhizal fungi and boron fertilizer.

Treatments (T)	%N		%p		%K		B (ppm)	
	2001	2002	2001	2002	2001	2002	2001	2002
Non mycorrhizal plants (-M)								
Control	0.38	0.40	0.07	0.09	0.60	0.59	5.52	5.80
B1(S) B2(S)	0.54	0.56	0.13	0.14	0.72	0.73	6.82	6.91
	0.57	0.57	0.15	0.17	0.78	0.79	7.22	7.40
Mean	0.55	0.57	0.14	0.16	0.75	0.76	7.02	7.15
B1(F) B2(F)	0.44	0.43	0.10	0.11	0.63	0.63	6.33	6.51
	0.48	0.49	0.13	0.14	0.69	0.71	6.92	6.92
Mean	0.46	0.46	0.12	0.13	0.66	0.67	6.63	6.70
All Means	0.47	0.49	0.11	0.13	0.67	0.69	6.56	6.70
Mycorrhizal plants (+M)								
Control	0.42	0.44	0.14	0.15	0.65	0.66	6.21	6.02
B1(S) B2(S)	0.66	0.68	0.21	0.21	0.88	0.87	8.62	8.60
	0.60	0.64	0.18	0.19	0.85	0.84	7.90	8.02
Mean	0.63	0.66	0.20	0.20	0.87	0.85	8.26	8.30
B1(F) B2(F)	0.60	0.61	0.19	0.20	0.81	0.83	7.60	7.71
	0.53	0.55	0.16	0.17	0.77	0.76	7.00	7.32
Mean	0.57	0.58	0.18	0.19	0.79	0.80	7.30	7.50
All Means	0.56	0.58	0.17	0.18	0.77	0.79	7.48	7.60
L.S.D.at 0.05 Level:								
Mycorrhiza(M)	0.011	0.011	0.004	N. S	0.007	0.004	0.014	0.098
Treatments(T)	0.020	0.015	0.008	0.006	0.011	0.013	0.170	0.140
M × T	N . S	0.020	N. S	0.008	0.016	0.018	0.237	0.198

B (S) = Soil application. **B (F) = Foliar application.**

Table 5. Yield components (ton / fed) and extractions % of juice and syrup as affected by V A mycorrhizal fungi and boron fertilizer.

Treatments (T)	Yield components (ton / fed)												Extractions %			
	Plant Weight		Stalk Weight		Forage Weight		Juice Weight		Baggas Weight		Syrup Weight		Juice		Syrup	
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002
Non mycorrhizal plants (- M)																
Control	20.7	19.9	12.0	11.2	8.73	8.73	2.52	2.43	9.50	8.80	0.50	0.49	21.1	22.0	4.18	4.39
B1 (S)	21.1	20.3	12.0	11.6	9.07	8.83	2.66	2.48	9.35	9.08	0.52	0.50	22.7	21.5	4.41	4.29
B2 (S)	22.1	20.4	12.7	12.5	9.41	7.93	2.09	2.79	9.79	9.68	0.56	0.56	23.0	22.4	4.47	4.47
Mean	21.6	20.4	12.4	12.0	9.24	8.38	2.38	2.64	9.57	9.38	0.54	0.53	22.8	22.0	4.44	4.38
B1 (F)	23.3	22.4	14.1	13.7	9.29	8.73	3.29	3.16	10.8	10.6	0.65	0.63	23.5	23.3	4.64	4.66
B2 (F)	24.1	23.3	14.3	13.9	9.86	9.04	3.36	3.24	10.9	10.7	0.66	0.65	23.5	23.7	4.62	4.74
Mean	23.7	22.8	14.2	13.8	9.58	8.88	3.33	3.20	10.8	10.7	0.66	0.64	23.5	23.5	4.63	4.70
All means	22.3	21.3	12.9	12.6	9.27	8.65	2.78	2.82	10.1	9.77	0.58	0.57	22.8	22.6	4.46	4.51
Mycorrhizal plants (+ M)																
Control	21.4	20.9	12.7	12.1	8.73	8.73	2.82	2.77	9.87	9.36	0.55	0.55	22.4	23.1	4.35	4.63
B1 (S)	23.5	20.8	13.8	13.4	9.63	8.39	3.17	3.08	10.7	10.3	0.64	0.62	22.9	23.2	4.59	4.64
B2 (S)	22.9	21.8	13.5	12.8	9.41	8.95	3.05	2.96	10.4	9.85	0.60	0.59	22.8	24.7	4.46	4.94
Mean	23.2	21.3	13.6	13.1	9.52	8.67	3.11	3.02	10.6	10.1	0.62	0.61	22.8	24.0	4.52	4.79
B1 (F)	25.3	24.5	15.1	14.9	10.2	9.52	3.63	3.45	11.4	11.5	0.71	0.69	24.1	23.6	4.72	4.72
B2 (F)	24.7	24.0	14.7	14.6	9.97	9.69	3.47	3.32	11.3	11.3	0.69	0.66	23.6	28.4	4.69	5.68
Mean	25.0	24.2	14.9	14.7	10.1	9.47	3.55	3.38	11.4	11.4	0.70	0.68	23.8	26.0	4.70	5.20
All means	23.6	22.4	14.0	13.6	9.59	9.06	3.23	3.12	10.7	10.5	0.64	0.62	23.2	24.6	4.56	4.92
L.S.D at 0.05 level :																
Mycorrhiza(M)	N.S	N.S	N.S	N.S	N.S	N.S	0.23	0.25	N.S	N.S	0.04	0.05	N.S	N.S	N.S	N.S
Treatments (T)	N.S	N.S	N.S	N.S	N.S	N.S	0.48	0.48	N.S	N.S	0.10	0.10	N.S	N.S	N.S	N.S
M × T	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

B (S) = Soil application. B (F) =Foliar application.

الملخص العربي

استجابة الذرة السكرية للمعاملة بفطر الميكوريزا وإضافة بالبورون بطريقتين

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أقيمت تجربتان حقليتين بمحطة بحوث الصباحية محافظة الاسكندرية خلال موسمي ٢٠٠١ -٢٠٠٢ وذلك لدراسة تأثير الإضافة الأرضية أو الرش الورقي بالبورون بمعدلين سواء بصورة منفردة أو مخلطة بالسماد الحيوي المحضر معمليا الميكوريزا على بعض صفات النمو والمحصول وكذلك الحالة الغذائية لنبات الذرة السكرية.

وكانت النتائج المتحصل عليها ما يلي:-

تلقيح تقاوى الذرة السكرية بفطر الميكوريزا لم يكن له تأثير معنوي على كل من الكلوروفيل الكلي فى الاوراق ودليل مساحة الاوراق فى عمر ٦٠ يوم من الزراعة ومعدل التمثيل الغذائي وارتفاع النبات وعدد العقل وقطر الساق ونسبة المواد الصلبة الذائبة الكلية ونسبه السكروز فى العصير وكذلك محصول النبات والسيقان والأوراق والمصاص (طن/فدان) ونسبة استخلاص العصير ونسبة استخلاص الشراب بينما زاد معنويا دليل مساحة الأوراق عند عمر ٨١ يوم من الزراعة ومحصول العصير والشراب (طن/فدان) وكذلك النسبة المئوية للنتروجين والفوسفور والبوتاسيوم والبورون محسوبًا بالمليجرام / لتر فكان التأثير الايجابي معنويا خلال موسمي الزراعة .

-امـا بالنسبة للبورون سواء بالاضافة الارضية او الرش الورقي فقد اعطى نفس الاتجاه السابق في كل الصفات التي ذكرت ما عدا المواد الصلبة الذائبة الكلية ونسبة السكروز فقد زادوا زيادة معنوية . -الاضافة الورقية كان لها أثر ايجابي افضل من الاضافة الارضية على الصفات السابقة بينما كانت الاضافة الارضية هي الافضل بالنسبة للعناصر (نيتروجين - فوسفور - بوتاسيوم - بورون)- التداخل بين تلقيح البذرة بالميكوريزا واضافة البورون قد اعطى تاثير ايجابي ولكنه غير معنوي على كل الصفات التي درست عموما ماعدا الحالة الغذائية فقد أعطت تاثير إيجابي ومعنوي.

-أخيرا كل من المعاملة بالبورون أو التلقيح بالميكوريزا منفردين أو في صورة مختلطة زادت كل من صفات النمو والمحصول ومكوناته وكذلك الحالة الغذائية في نبات الذرة السكرية وكان التأثير في بعض هذه الصفات معنويا .

ومن المهم ملاحظة أن الحصول على أعلى محصول عصير وأحسن نسبة سكر يكون عن طريق الإضافة الورقية بالبورون عند ٠,٠٥ % في النباتات الملقحة بالميكوريزا .