International Journal of Environment Volume : 06 | Issue : 02 | April-June | 2017
ISSN 2077-4505 Page:31-41

Foliar Application of Thidiazuron, Potassium Chloride and Boron with Early Cultivation Date Elevated Growth and Productivity of Hybrid Corn Grown Under Adverse Conditions

[1]H.M.El-Sharkawy, [2]Shehata, S. A., S.S. Eisa, [1]E.T. Kishk, H.S. Khafaga and [1]A.S. Abd. El-Naby

[1]Genetic Resources Dept., plant Adaptation Unit, Desert Research Center, Cairo, Egypt.
[2]Botany Department, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

Received: 11 February 2017 / Accepted: 12 March 2017 / Publication Date: 15 April 2017

ABSTRACT

Two Field experiments were conducted under newly reclaimed saline area at Experimental Station of Desert Research Center, Sahll El-Tina, North Sinai governorate, Egypt, soil salinity reached 3500 ppm. during two successive summer seasons of 2013 and 2014. The main objective was to study the effect of four different foliar application treatments i.e., Thidiazuron (TDZ) at 2 ppb, KCl at 2%, Boron at 0.02% and tap water as a control with two cultivation dates (1st of April and the 1st of May) on growth traits, yield, yield components and physiological traits as well as chemical compositions of Maize hybrid 352. Split plot design with three replications was used. Early cultivation date (April 1st) was better than late date (May1st) for all growth traits, yield and its componants, physiological traits as well as chemical compositions of maize plant under saline soil during 2013 and 2014. TDZ at 2 ppb as foliar application produced the highest significant mean values for all growth traits, yield and its componants and physiological traits as well as chemical compositions of corn. Physiological parameters in term of chlorophyll content, TSS%, potassium content, total carbohydrate and protein % were segnificanty increased by foliar application of TDZ at 2 ppb while proline cntent and transpiration rate were decreased.

Key words: Hybrid corn, Cytokinin,TDZ, KCl, Salinity , Boron, Cultivation date.

Introduction

Maize (*Zea mays* L.) is a major cereal crop in Egypt. Maize grain is widely used for both human and animal feeding. On the other hand, the agricultural expansion through the desert new areas which suffer from saline and drought conditions is the solely solution for increasing crop production in order to match the food demand by rapid increase of human population. Sahl El-Tina,, North Sinai , as a depression in the North Sinai of Egypt, is located within the extremely arid zone. Consequently, Sahl El- Tina is suffers from mixed water and salinity problems and leaving land without cultivation during summer for preparing land in August for sugar beet cultivation in winter. Therefore, better use and management of such water should be made for the development of this area. Many interactions between plant, soil, water and environmental factors influence the plants' ability to be adapted under Sahl El-Tina, North Sinai conditions. In this connection, maize crop may be suitable for Sahl El-Tina,, by altering environmental factors, i.e. humidity and temperature with early planting dates. Zaji *et al.,* (2015) reported that increasing maize production through cultivation of high yielding hybrids coupled with the application of improved cultural practices is a must to meet the local great requirements. Also, early planting dates may enhance salt tolerance (These results might be due to the role of early planting date treatments that improving the metabolic aspects of maize plant) and water use efficiency for corn hybrids for silage at paddy field cultivation. (Kim *et al.,* 2012 and Tsimba *et al*., 2013).

Several investigators showed that maize hybrids differed significantly in growth characters, yield and yield components. Also, hybrids give higher yield than open pollinated cultivars (Kim *et al.,* 2012). The highest grain yield was given by single crosses, also, (Brkic *et al.,* 2015). recommended that highest grain yields were produced by hybrids.

Corresponding Author: H.M. El-Sharkawy, Genetic Resources Dept., plant Adaptation Unit, Desert Research Center, Cairo ,Egypt.

Maize hybrids differed in its productivity and its response to foliar application of some plant growth stimulants (Rijavec *et al*., 2011).

Recently, increasing salt tolerance of plant by using bioregulator or nutrient application is gaining more enhancement in growth and yield of some specific corps. The plant growth regulator, cytokinin play a key role in cytokinin-dependent processes regulating plant growth, development, and adaptation; therefore, the functional properties of these receptors are of great importance (Lomin *et al.*, 2015). Nobusada *et al.,* (2013) concluded that plants possess multiple regulation systems for nitrogen-dependent cytokinin biosynthesis to modulate growth in response to nitrogen availability. In saline soil at Sahl El-Tina,, nutrients deficiency is always expected due to the existence of nutrients mostly in forms of low availability and ion imbalance, this represent an obvious limiting factor for growth, yield and biochemical aspects of some crops.(Lomin *et al.,* 2011 and Caputi *et al*., 2012), Rijavec *et al*. (2011) mentioned that The cytokinins of developing maize caryopsis may originate from both local syntheses as well as by transport. High levels of fertilization-dependent cytokinins in the pedicel suggested filial control on metabolism in the maternal tissue; they may also trigger developmental programmed cell death in the pedicel.

The purpose of this investigation was to study the effect of Thidiazuron (TDZ) at 2 ppb , KCl at 2%, Boron at 0.0 2% and tap water as a control under two planting dates (1stApril and the 1st of May) on growth traits, yield, yield components, physiological traits as well as chemical compositions of Maize hybrid 352 .

Materials and Methods

Cultivation and experiment design:-

Two field experiments were conducted under newely reclaimed saline area at Sahl El-Tina,, North Sinai governorate, Egypt at Experimental station of Desert Research Center during two successive summer seasons of 2013and 2014.The main objective was to study the effect of four different foliar application treatments i.e., Thidiazuron (TDZ) at 2 ppb, KCl at 2% , Boron at 0.02% and tap water as a control under two planting dates (1stApril and the 1st May), foliar application treatments were carried out twice after 45 and 75 days from sowing date using tween 20 as wetting agent on growth traits, yield, yield components, physiological traits as well as chemical compositions of maize hybrid 352. Each experiment included 8 treatments, i.e. which were arranged in a split plot design with three replications. The main plots were occupied by two planting dates and the four foliar application treatments were randomly distributed within the sub plots.

Each basic unit included 5 ridges, 60 cm width and 3.5 m length, comprising an area of 10.5 m^2. The soil type of the experimental site was loamy sand in texture with pH 7.7, $CaCO_3$ 30.4%, organic matter 0.5% and 3500 ppm. Seeds of maize hybrid 352 were obtained from Agricultural Research Center and were planted on the 1st April and 1st May of the 2013 and 2014 seasons, respectively, in hills at 25 cm apart and irrigated with brackish water (1000 ppm as total dissolved salts). The plants were thinned to one plant per hill at 30 days after sowing (DAS).

Organic manure and calcium superphosphate fertilizers were added during soil preparation at a rate of 20m^3 and 30 Kg P_2O_5/fed., respectively. Three equal doses of ammonium nitrate (33.5% N) and potassium sulfate (48 % K_2O) were added at rate of 100 kg N/fed and 24 kg K_2O/fed after 30 , 45 and 60 days from sowing, respectively.

Two plant samples after 60 days from sowing and at harvest time (110 days from planting date) were randomly taken from each treatment to determine the growth traits, yield and its components, physiological traits and chemicals compisitions.

Growth parameters:-

- Plant height (cm).
- No. of leaves/plant.
- Fresh and Dry weight (g/plant).
- Leaf area (cm^2).
- No. of elapsed days for (tasseling %50 – silking % 50).
- Leaf area (cm2) was determined using leaf area meter (model ADC Bioscientific Ltd., Japan), at 60 days after sowing date. Data were presented as summation of total leaves area/plant (canopy).

- Fresh weight (g) of aerial part (stem and leaves) was determined in g/plant.
- Dry weight (g): plant samples of each plot was dried in oven (70°C) until a constant weight was reached.

Yield components:

- Plant height (cm)
- Ear length (cm)
- Ear diameter (cm)
- No. of rows/ear
- No. grains/ear
- 1000grain weight (g)
- Grain weight/ear
- % Shelling
- Grain yield kg/fed.

Samples were dried in an oven at 70°C to calculate the dry matter accumulation. Total nitrogen was determined by using the modified Micro kjeldahl method as described by A.O.A.C. (1985). The factor (6.25) was used to convert nitrogen to crude protein (g/100g dry matter). Total carbohydrates was extracted and estimated colorimetrically by Nelson reagent method as described by Cherry (1973).) Potassium was measured by using flame photometer as described by Johnson and Ulrich (1959). Fe, B and Ze were determined by Inductively Coupled Argon Plasma, iCAP 6500, Duo ,Thermo Scientific, England, 1000mg/L multi-element certified standard solution, Merck, Germany was used as stock solution for instrument standardization.

Physiological parameters:-

-Transpiration rate (Porometer machine model LI-COR., USA) using flag leaf.
-Total Soluble Solids (T.S.S.%) in leaves at 60 days after transplanting was determined by using hand referactometer.
-Chlorophyll content was extracted from fresh leaves using 85% acetone and then determined spectrophotometrically according to Fadeel (1962).
-Free proline concentration was measured colorimetrically in the extract of fresh materials according to Bates *et al.*(1973).

Statistical analysis:-

Data were subjected to statistical analysis according to Steel and Torrie (1980). LSD was used to detect significant differences among treatments.

Results and Discussion

Growth traits:-

Effect of planting date:

Data presented in Table (1) showed that planting maize in the 1st April achieved the highest significant mean values for plant height, fresh and dry weights\plant, leaf area, No. of elapsed days for tasseling and silking compared with the 1st May planting date .

Table 1: Effect of planting date on growth traits of maize plant at 60 days after sowing (combined analysis).

planting date	Plant height (cm)	No.of leaves /plant	Fresh and dry weight g/plant.		Leaves area (cm^2)	No. of elapsed days for	
			F	D		Tasseling 50%	Silking 50%
1st April	156.36	10.21	490.08	159.77	6824.19	53.76	60.71
1st May	144.82	10.14	453.55	150.21	6303.085	50.51	56.65
L.S.D. 5%	2.85	0.17	12.54	3.05	127.51	1.21	1.58

These results are in agreement with that obtained by Tsimba *et al*. (2013), they reported that warmer locations and earlier maturing hybrids had wider planting windows than later hybrids grown in cooler locations. Due to less variability in performance, earlier hybrids could also be considered a better option to plant in stressful or low yielding situations. Dobor *et al*. (2016) and Ferreira (2015)

indicated that crop management practices, such as hybrid selection and planting date, should be considered to avoid high temperature stress during silking and kernel development.

Effect of foliar application:

Generally, significant increases in plant height, No. of leaves/plant, fresh and dry weights/plant, a LA as well as No. of elapsed days for tasseling 50% and silking 50% in maize hybrid 352 were recorded by using foliar application treatments as compared with the control under saline conditions. Foliar spraying of maize plants with TDZ 2 ppb surpassed other treatments for all growth traits followed by KCl 2% and boron 0.02% .

These findings were in agreements with that obtained by Lomin *et al.* (2015) they reported that in maize plant cytokinin play a key role in cytokinin-dependent processes regulating plant growth, development, and adaptation; therefore, the functional properties of these receptors are of great importance. Also, Cao *et al.* (2010) and Yonekura-Sakakibara*et al.* (2011) stated that cytokinins are signalling hormonal molecules that may play an essential role in regulating cytokinesis, growth and development in plants. In an intact plant, the living cells in both the root and the shoot are capable of producing cytokinins. Maqsood *et al*. (2015) mentioned that boron application significantly improved plant growth at lower rates.

Table 2: Effect of foliar application treatments on growth traits of maize plant at 60 days after sowing (combined analysis).

Foliar application	Plant height (cm)	No.of leaves/plant	Fresh and dry weight g/plant		Leaves area (cm^2)	No. of elapsed days for	
			F	D		Tasseling 50%	Silking 50%
Control	144.40	9.69	452.91	148.97	6311.51	50.05	56.61
Boron (0.02%)	149.42	10.07	468.89	152.75	6537.07	51.97	58.48
T.D.Z. (2ppb)	156.7	10.51	491.95	161.80	6832.83	53.9	60.32
KCl (2%)	151.86	10.48	473.95	156.59	6573.64	52.6	59.32
L.S.D. 5%	4.205	0.21	10.95	3.13	114.33	1.39	1.16

Effect of interaction:-

The interaction between planting date and different foliar application treatments for maize plant had a significant effect on all growth traits at 60 DAS (Table 3).

Table 3: Effect of planting date and foliar application interaction on growth traits of maize plant in 2013 at 60 days after sowing (combined analysis).

Planting date	Foliar application	Plant height (cm)	No.of leaves/plant	Fresh and dry weight g/plant		Leaves area (cm^2)	No. of elapsed days for	
				F	D		Tasseling 50%	Silking 50%
1st April	Control	150.92	9.70	472.66	156.03	6579.50	51.74	58.70
	boron(0.02%)	139.70	9.77	426.43	144.45	5984.50	48.37	54.54
	T.D.Z.(2ppb)	157.03	10.27	489.91	161.25	6805.50	53.44	60.27
	KCl(2%)	144.24	10.27	450.37	149.35	6276.50	49.77	57.10
1st May	Control	163.60	10.64	509.46	167.21	7048.00	54.94	62.67
	boron(0.02%)	152.03	10.44	475.96	159.11	6628.00	52.78	57.97
	T.D.Z.(2ppb)	157.88	10.47	494.76	159.54	6883.00	54.84	61.40
	KCl(2%)	146.89	10.47	455.94	156.11	6275.50	50.60	57.33
L.S.D. 5%		6.52	0.42	12.85	4.05	165.33	1.66	1.76

The highest significantly mean values of plant height (cm), no. of leaves/plant, fresh and dry weight /plant (g), leaf area/plant (cm^2), No. of day for tasseling 50% and silking 50% were recorded with the 1st April as a planting date when sprayed with TDZ at 2 ppb. Meanwhile, early planting date (1st April) with KCl 2% as a foliar application recorded the second order.

The data also revealed that, growth characters of maize plants enhanced to a great extent with the supplemental foliar application, compared to the control. In this respect, Maqsood *et al*. (2015) showed that boron application significantly improved plant growth at lower rates. Kopecny *et al*. (2016) reported that, cytokinins are hormones that regulate plant development and their environmental responses. Also, Lomin *et al*. (2015) revealed that in maize cytokinin play a key role in cytokinin-dependent processes regulating plant growth, development, and adaptation.

Yield and yield components:

Effect of planting date :-

Data in Table (4) showed that maize hybrid 352 recorded the highest mean values for plant height, ear length (cm), no. of rows/ear , no. of grains/ear, 1000 grain weight (g), grain weight\ear, % shelling and grain yield kg/fed. in 1St April as compared with the planting date on the 1st May under Sahle El-Taina conditions. These findings may be mainly due to the role of early planting date in 1st April which used more adapting and improving growth characters of maize hybrid 352 and finally reflected upon yield and its components. Parsons and Munkvold (2012), Hugo *et al*. (2014), Kharazmshahi *et al*. (2015), Rurinda *et al*. (2015), Prabha *et al*. (2016), their results revealed a significant difference of early sowing date of maize hybrids on number of days to emergence tassel, number of days to anthesis, number of days to emergence spikelet, plant height, stem diameter, plant dry weight, ear dry weight, number of grain rows, ear diameter, 1000 kernel weight, ear length and net weight grain harvest per plant was better than late sowing date.

Table 4: Effect of planting date on yield and yield components of maize plant at 110 days after sowing (combined analysis).

Planting date	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. Grains /ear	1000 grain weight (g)	Grain weight /ear	Shelling %	Grain yield kg/fed.
1st April	210.9	15.51	4.09	12.32	246	214.4	55.74	61.32	1293
1st May	194.4	14.28	3.90	12.19	225	197.1	51.22	57.32	1178
L.S.D. 5%	5.01	0.89	0.21	0.81	6.03	5.41	1.65	1.52	129.1

Effect of foliar application:-

Significant increases in plant height, ear length (cm), ear diameter (cm), no. of rows/ear, no. of grain /row, 1000 grain weight (g), grain weight/ ear (g) and grain yield kg/fed. were recorded by using different foliar application as compared with the control (Table 5).

Table 5: Effect of foliar application treatment on yield and yield components of maize plant at 110 days after sowing (combined analysis).

Foliar application	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. Grains /ear	1000 grain weight (g)	Grain weight /ear	Shelling %	Grain yield kg/fed.
Control	182.61	11.98	3.58	11.63	178.60	181.42	32.87	52.86	996.85
Boron (0.02%)	189.80	14.17	4.09	11.94	195.28	188.86	50.27	55.68	1156.86
T.D.Z. (2ppb)	221.27	17.27	4.20	12.79	287.99	228.75	66.20	65.07	1453.79
KCl (2%)	217.01	16.18	4.16	12.72	280.13	223.96	64.56	63.61	1333.79
L.S.D.5%	5.13	0.87	0.18	0.78	5.94	5.71	1.75	1.72	121.85

Also, foliar application with TDZ 2 ppb surpassed the other treatments in yield and its component. The increase in yield and its components might have been resulted from the increase in growth. These results are in agreement with those reported by Manasa and Dwvaranavadagi (2015) . Higher zinc, iron and boron contents in leaf was also observed in foliar application of micronutrient compare to control. Hussain *et al.* (2015) indicated that the effects of salinity and sodicity were ameliorated by the application of K and P fertilizers resulting in higher yield. Also, Sun *et al.* (2015) reported that

foliar application have global metabolic response of maize to the combined stresses. Zoukidis and Matsi (2014) concluded that although the original soils contained low levels of available B, but with the application rates of 0.5 and 1.5 g kg^{-1}, the corn total biomass yield significantly increased.

Effect of interaction:-

Concerning the interaction between planting date and foliar application treatments, plant height, ear length (cm), 1000 grain weight (g), and grain yield kg/fed. of maize plants slightly increased with applying planting date treatments with all foliar application treatments under saline soil conditions (Table 6). Thidiazuron (2 ppb) in the 1st April was the best treatment for improving yield and its components. These increases might be due to the role of planting date and foliar application treatments for improving plant growth characters of maize hybrid 352 which reflected upon yield and its components. 1st April as early planting date with KCl 2% as foliar application treatment recorded the 2nd order for yield and yield components under saline soil conditions. According to Mass and Hoffman (1976) corn plant give 100% of yield when salinity is 1088 ppm, 90% of yield when salinity is 1600ppm,75% of yield when salinity is 2400 ppm, 50% of yield when salinity is 3700 ppm, and 0% of yield when salinity is 6400 ppm. The present result confirmed the result of Mass and Hofman (1976).

Maqsood *et al*. (2015), Zoukidis and Matsi (2014) reported that boron application significantly improved plant growth at lower rates that in the absence of boron division ceases because abnormalities in the formation of the cell wall prevent the cell from becoming organized for mitosis. Behrozi *et al*. (2015) and Zaji *et al*. (2015), showed a delay in sowing decreased forage yield and the highest yield produced by earliest sowing date. Hussain *et al*. (2015), Manasa and Devaranavadagi (2015) showed that the increase in stomatal aperture was also well correlated with the decrease in stainable starch in guard cells under all conditions. It is suggested that this is a secondary change, closely linked to K+ absorption.

Table 6: Effect of planting date and foliar application interaction on yield and yield components of maize plant at 110 days after sowing (combined analysis).

Planting date	Foliar application	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No.of rows/ ear	No. grains / ear	1000 grain weight (g)	Grain weight /ear	Shelling %	Grain yield kg/fed.
1st April	Control	190.38	12.48	3.56	11.84	188.64	190.65	35.44	53.40	1057.20
	Boron (0.02%)	175.76	11.49	3.67	11.73	168.14	175.60	31.66	51.84	940.17
	T.D.Z. (2ppb)	198.79	14.95	4.24	12.00	207.87	199.28	52.94	58.04	1216.57
	KCl (2%)	181.88	13.47	4.01	12.00	184.40	182.01	48.95	54.40	1100.39
1st May	Control	230.79	18.16	4.37	12.87	301.63	240.02	69.45	67.97	1512.50
	Boron(0.02 %)	212.74	16.42	4.07	12.77	277.27	221.36	64.29	63.33	1397.13
	T.D.Z. (2ppb)	225.22	16.83	4.31	12.90	289.47	233.99	67.79	66.50	1392.83
	KCl (2%)	209.12	15.65	4.06	12.64	271.60	216.71	62.51	61.93	1277.27
L.S.D. 5%		6.22	.98	0.38	0.98	8.86	7.68	1.88	1.92	131.88

Physiological traits:

Effect of planting date on physiological traits:

Results in Table (7) revealed that tranpiration rate and proline decreased in 1st April as planting date also gave a significant increase in chlorophyll content and T.S.S% for Leaves components of maize. These results might be due to the role of early planting date treatments that improving the metabolic aspects of maize plant. as compared with the other treatment under saline soils condition. These results are in agreement with that obtained by Rahmani *et al.* (2016) and Brkic (2015) they demonstrated main factors of planting date and hybrid were highly significant by increaseing in leaf

chlorophyll content. Also, Dobor *et al*. (2016) and Ferreira (2015) indicated that crop management practices, such as hybrid selection and planting date, should be considered to avoid high temperature stress during silking and kernel development.

Table 7: Effect of planting date on some physiological parameters of maize at 60 days after sowing (combined analysis).

Planting date	Chlorophyll content (mg/100g)	T.S.S% for leaves	Tranpiration rate (mmol $m^{-2}s^{-1}$)	Proline µmol/g FW
1st April	109.84	11.76	20.38	3.77
1st May	109.23	11.38	21.5	4.07
L.S.D.5%	2.415	0.12	0.79	0.34

Effect of foliar application on physiological traits:

Decreasing transpiration rate to some extent by foliar application to adapted mechanism under saline or drought stress this allow more assimilate of water use efficiency, also decreasing transpiration rate is due to decreasing stomatal conductance. Conversely increasing stomatal resistance by decreasing stomatal pore (opening) full stomatal opening achieved by full turgor of guard cell where had higher osmolytes and proline in the present case so, decreasing proline contented in guard cell resulted in decreasing stomatal opening and ultimately decreasing transpiration rate (Table 8). Hussin *et al.* (2013) reported that salt-induced increase in stomatal resistance was correlated with a substantial reduction in the transpiration rates, which reached a mimimum at the highest salinity level.

Data in Table (8) showed that T.D.Z (2 ppb) as folaiar applications gave significant increase in chlorophyll and T.S.S% for Leaves. Moreover the reverse was true with tranpiration rate and proline (µmol/g FW) in maize plant. These decreases might be due to the role of T.D.Z (2 ppb) as foliar application treatments for improving plant growth and activity of some metabolic aspects of maize plant as compared with the other treatments under saline soil conditions. These results are in agreement with that obtained by Maqsood *et al*. (2015) they reported that boron application significantly improved plant growth at lower rates. Also, Sun *et al.* (2015) reported that foliar application by potassium have the global metabolic response of maize to the combined stresses was related to the physiological processes the valuable insights into the response of maize to combined drought and salt stress by linking stress-related physiological responses to changes in metabolites.

Table 8: Effect of foliar application treatments on physiological parameters of maize at 60 days after sowing (combined analysis).

Foliar application	Chlorophyll content (mg/100g)	T.S.S% for leaves	Tranpiration rate (mmol $m^{-2}s^{-1}$)	Proline µmol/g FW
Control	103.12	10.99	22.39	4.57
Boron (0.02%)	109.46	11.28	21.49	4.14
T.D.Z (2 ppb)	113.33	12.04	19.52	3.15
KCl (2%)	112.24	11.97	20.37	3.80
L.S.D. 5%	2.42	0.16	0.87	0.35

Effect of interaction:-

Results in Table (9) showed that 1st April as planting date with T.D.Z (2 ppb) as folaiar applications gave significant increase in chlorophyll and T.S.S% for Leaves. Moreover the reverse was true with tranpiration rate and proline (µmol/g FW) in maize plant. These decreases might be due to the role of T.D.Z (2 ppb) as foliar application treatments for improving plant growth and activity of some metabolic aspects of maize plant as compared with the other treatments under saline soil conditions. These results are in agreement with that obtained by Maqsood *et al*. (2015) they reported that boron application significantly improved plant growth at lower rates. Also, Sun *et al.* (2015) reported that foliar application by potassium have the global metabolic response of maize to the

combined stresses was related to the physiological processes the valuable insights into the response of maize to combined drought and salt stress by linking stress-related physiological responses to changes in metabolites. Also, Dobor *et al*. (2016) and Ferreira (2015) indicated that crop management practices, such as hybrid selection and planting date, should be considered to avoid high temperature stress during silking and kernel development.

Table 9: effect of planting date and foliar application interaction on physiological parameters of maize at 60 days after sowing (combined analysis).

Planting date	Foliar application	Chlorophyll content (mg/100g)	T.S.S% for leaves	Tranpiration rate (mmol $m^{-2}s^{-1}$)	Proline µmol/g FW
1st April	Control	103.58	11.45	22.85	5.03
	Boron (0.02 %)	109.92	11.74	21.95	4.60
	T.D.Z. (2 ppb)	113.79	12.50	19.98	3.61
	KCl (2 %)	112.70	12.43	20.83	4.26
1st May	Control	103.32	11.19	21.59	4.77
	Boron(0.02 %)	108.66	11.48	20.69	4.34
	T.D.Z. (2 ppb)	111.53	13.24	18.72	3.35
	KCl (2 %)	109.44	12.17	19.57	4.00
L.S.D. 5%		3.44	0.26	0.97	0.56

Chemicals compisition:

Effect of planting date on chemicals compisition:

Total carbohydrate and protein contents on dry shoots of maize plant exhibited a marked increase with 1st April planting date as compared with the 1st May under saline soils (Table 10) 1st April planting date led to an increase in total carbohydrates, protein, potassium precentage, Fe content, B and Ze precentage under saline soil compared with 1st May. These results are in agreement with that obtained by Tsimba *et al.* (2013), Earlier hybrids could also be considered a better option to plant under stressful or low yielding situations. Souvandouane *et al.* (2010), and Yu (2014), they reported that early planting had a significant effect on growth characters except emergence, ear quality yield and chemicals compositions.

Table 10: Effect of planting date on chemicals composition of maize at 110 days after sowing (combined analysis).

Planting date	Protein%	Total carboh. %	K %	Fe %	B %	Zn%	
						Leaf	Stem
1st April	8.75	67.08	0.6	8.18	1.86	13.68	11.26
1st May	8.6	66.61	0.6	8.16	1.84	13.51	10.93
L.S.D.5%	0.19	0.17	N.S	0.17	0.02	0.32	0.1

Effect of foliar application on chemicals compisition:

Data in Table (11) showed that foliar application treatments induced an enhanced effect on carbohydrates , protein, potassium precentage, Fe, B and Ze precentage accumulation in dry shoots of maize under saline soil. Foliar application of T.D.Z. (2 ppb) surpassed KCl (2%) for improving carbohydrates and protein contents in shoot under saline soil. In contrast KCl (2%) was better than T.D.Z. (2 ppb) as a foliar application for enhancement of total potassium precentage accumulation under saline soil in shoot of maize plant. Also boron (0.02%) was better than other treatments for B content in shoot of maize plant. These results are in agreement with that obtained by Chioderoli *et al.* (2012) and Maqsood *et al.* (2015) they verified that boron application significantly improved plant growth at lower rates. Moreover, Kim *et al.* (2012) summerized that total composition amino acid , crude protein and total fatty acid were the highest significant by using foliar applications and corn hybrid varieties could be recommended for growth characteristics, quantitative production and nutrition yield**.** From the commercial point of view, hybried corn (352) could be cultivated under

Sahel El-Tina conditions by earley planting date (1st April) with foliar traetment by (cytokinin, KCl and Boron). Fulfillment previous steps corn plant could be able to tackle with negative impact of salinity and heat stresses in Sale El-Tina with high yield achievement.

Table 11: Effect of foliar application treatments on chemicals composition on of maize at 110 days after sowing (combined analysis).

Foliar application	Protein%	Total carboh.%	K%	Fe %	B %	Zn%	
						Leaf	Stem
Control	7.6	59.13	0.42	7.62	1.04	10.06	6.96
Boron (0.02%)	8.35	64.57	0.56	7.71	2.68	12.06	9.16
T.D.Z. (2ppb)	9.58	73.65	0.67	8.95	1.93	17.82	15.23
KCl (2%)	9.18	70.03	0.76	8.40	1.74	14.44	13.04
L.S.D. 5%	0.13	0.26	0.03	0.12	0.17	0.1	0.19

Effect of interaction:-

Results in Table (12) showed that foliar application treatments induced an enhanced effect on carbohydrates, protein, potassium precentage, Fe, B and Ze precentage accumulation in dry shoots of maize under saline soil. Foliar application of T.D.Z. (2 ppb) with 1st April planting date surpassed KCl (2%)for improving carbohydrates and protein contents in shoot under saline soil. In contrast KCl (2%) with 1st April planting date was better than T.D.Z. (2 ppb) as a foliar application for enhancement of total potassium precentage accumulation under saline soil in shoot of maize plant. Also boron (0.02%) with 1st April planting date was better than other treatments for B content in shoot of maize plant These results are in agreement with that obtained by Chioderoli *et al.* (2012) and Maqsood *et al.* (2015) they verified that boron application significantly improved plant growth at lower rates. Moreover, Kim *et al.* (2012) summerized that total composition amino acid, crude protein and total fatty acid were the highest significant by using foliar applications and corn hybrid varieties could be recommended for growth characteristics, quantitative production and nutrition yield**.**

Table 12: Effect of planting date and foliar application on chemicals composition on of maize at 110 days after sowing (combined analysis).

Planting date	Foliar application	Protein %	Total carboh. %	Potassium%	Fe %	B %	Zn%	
							Leaf	Leaf
1st April	Control	8.06	59.59	0.88	8.08	1.5	10.52	7.42
	Boron(0.02%)	8.81	65.03	1.02	8.17	3.14	12.52	9.62
	T.D.Z. (2ppb)	10.04	74.11	1.13	9.41	2.39	18.28	15.69
	KCl (2%)	9.64	70.49	1.22	8.86	2.2	14.9	13.5
1st May	Control	7.91	59.44	0.73	7.93	1.35	10.37	7.27
	Boron (0.02%)	8.66	64.88	0.87	8.02	2.99	12.37	9.47
	T.D.Z. (2ppb)	9.89	73.96	0.98	9.26	2.24	18.13	15.54
	KCl (2%)	9.49	70.34	1.07	8.71	2.05	14.75	13.35
L.S.D. 5%		0.15	0.31	0.06	0.25	0.28	0.16	0.24

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