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Legalize the Use of Irrigation Water for Tomato Plants in Sandy Soils

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Abstract: Pot experiment were carried out under polyethylene chamber at the research station of Institute for vegetable of Horticulture and Food Industries, used sandy soil, washed with distilled water before planting. Sandy soil is less used, poor, suffer from physical properties and low productivity due to deterioration of the fertile content of the soil, water scarcity, environmental and agricultural conditions. The area around the root suitable for growth and keep it in good health, the plants absorb boron from fine soils in greater quantities than coarse soils, as plants can take more boron from sandy soils compared to Soft texture at equal concentrations of boron dissolved in water. The soil was supplied with B application of boron (Na2B4O7. 10H2O) was performed at different rates (control, low medium and high).The boron was determined in soil by the method with hot water extraction and in plant by Azomethine-H. In this research, study the characteristics of sandy soils before and after the addition of boron and its effect on the movement of elements and the yield and its characteristics were shed light on. The optimal dose of boron was determined, which is 6mg/kg, which gave the best results in the quantity and characteristics of the crop using the least amount of irrigation water.

Key words: Sandy soil, boron, root, water stress.

Sandy soils cover many agricultural areas, this type of soil has negative characteristics ,it is the fourth soil of drainage, this limitations make low productivity, caused by : low content of nutrients, low both its specific surface area and CEC, and its low content of the Substance organic matter it is lower ability to retain water and dissolved nutrients in it, which increases the potential for nutrient loss, and the deep infiltration of water necessitates the optimum agricultural utilization of these soils to overcome these agricultural limitations, usually by adding some industrial or natural enhancers (Choudhary 1999).Deficiency in nutrients and quick to dry, with light texture, which causes drain quickly and not hold water well, it can be both good and bad Characteristic, a good option for

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plants that suffer from water-based root, as the sandy soil by nature will provide (Al-Harbi 1998).Soils containing more than 80% of sand are not sandy soil, but simply regular sand. Sand is the largest basic particle in sandy soils, Soil that contains more than 50% of sand between its particles is classified under sandy soil, and it is also low in organic matter. Sandy soil consists of rocks broken down by erosion factors. The source of these soils are different types of rocks such as granite, limestone and quartz Sand formation in it represents more than 15%, and less than 35% of silt and clay, soil contains more than 50% of sand between its particles is classified under sandy soil. It also has a very rough texture; structure is mainly determined by the size of the mineral particles that make it up. Sand is the largest basic particle in sandy soils (Islam& Munda 2012). Soil structure is mainly determined by the size of the mineral particles that make up, sandy soil is less used, poor, suffer from physical properties and low productivity due to deterioration of the fertile content of the soil, water scarcity, environmental and agricultural conditions. The area around the root suitable for growth and keep it in good health, water leakage is a useful from one side but may be a problem on the other side especially during summer days but it is treatable (Bambi turner 2018(. Among its characteristics it has a light texture, which causes a drain quickly and not hold water well. It also leads to bigger problems such as lower fertility rates in the soil, but with the addition of fertilizers and decomposing leaves, it can be addressed to provide a satisfactory growth process for plants (Patrick et al 2020). Sandy soils suffer from poorly physical properties and low productivity due to deterioration of the fertile content of the soil, water scarcity, agricultural and environmental damages (Campbell & Zentner 1993), this soils tend to work on more easily than clay soils, and this reflects a difference between both soils, soil texture and structure can be modified by using soil conditioners compost, peat moss, wood chips or sawdust. The addition of organic matter gives the mineral particles material to bind with and this improves water retention. Minerals are then absorbed easily by vegetable and fruit root systems. Organic matter has a greater exchange capacity than mineral colloids, as it is responsible for the ion exchange of mineral soils produced upon mineralization and the dissolution of organic wastes into ammonium ions that liberate hydrogen ions and contribute to the formation of amino acids and a lot of organic acids (Patrick et al 2020), its role in improving the properties of soils chemically comes through the fact that the humus resulting from its decomposition has a high action exchange capacity (Kohnke 1968). The important role of organic matter in soils including animal or plant residues, which were induced in an active state of decomposition due to an attack

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of organisms. Which must be constantly replenished by addition organic waste to preserve the soil's physical, chemical and fertility properties in a developing state that contributes in agricultural production through the supply of nutrients necessary for growth as well (Communar& R. Keren 2008), Therefore, various methods have been applied around the world to improve sandy soil properties by collecting water and preparing groundwater reserves, and in areas where water is scarce and precipitation rates are low, simple techniques that suit their area and meet a large part of their water need, and the irrigation techniques used to rationalize water Consumption (Mamta Kumari 2016), use of salt water -Saline water- is widely available, but it is rarely used in agriculture because it reduces the growth of plants and the transport of the crop. However, in recent times different types of salt-tolerant crops have been developed (Dr jagdeep Singh 2019). (Irrigation Water Use Management 2020) its ability to preserve water can be improved through the addition of organic materials (Oqba & szabo 2020) in addition, due to the fact that boron in sandy soils is not clogged and easy to absorb, but at the same time it is more susceptible to loss by washing, the effect of temperature may be interfering with soil moisture and boron deficiency is usually associated with dry weather conditions and soil moisture conditions. Increased heat and less moisture reduce the diffusion of boron to the root absorption surfaces. In hot and dry conditions as well the organic matter present on the soil surface thus reduces the amount of boron released, many crops show symptoms of boron deficiency, and plant growth is negatively affected (Goldberg, 1997),the role of boron in agricultural crops worldwide, and the response of many species has been documented from fruits, vegetables, field crops and alfalfa to fertilize with the addition of boron, (Haby, et al 1995). In 1923, it was revealed that boron should be present in higher plants, in addition two compounds are carried in the soil solution, and its adsorption may occur to them on the surface (Hanson, 1991), organic matter is the most important store of boron in the soil. Its decomposition affects the content of boron: cold conditions slow down the rate of material degradation boron. Rough sandy soils made up of a large proportion of quartz, it contains small amounts of other boron-bearing minerals, and therefore it is common for them to appear symptoms of boron deficiency on plants cultivated in these soils (Communar& Keren(2008). Sandy soils with coarse-hulled, well-drained soil, low with boron, a large part of boron added to the soil, remains dissolved (up to 85%) exposed by separation in sandy soils with a low content of organic matter, longer than coarse soils irrigated with higher boron pride by clays However the plants will adsorb boron from fine soils in greater quantities than coarse soils, as plants can take more boron from sandy soils compared to Soft texture at equal concentrations of boron dissolved in water (Havlin et al., 2005). In general, boron adsorption in soil is affected by factors such: iron, aluminum hydroxides, clay minerals oxides, clay minerals, carbonate, and soil organic matter (Goldberg 1997, Al-falahi 2000, Bingham et al 1971) found a positive correlation in the content of aluminum oxide (Al_2O_3) and the adsorption of boron in the crystalline (amorphous oxides) extracted with ammonium oxalates, (Sims and Bingham 1968 and Goldberg & Globage, 1985). Soil organic matter plays an important role in soil absorption of boron, its adsorbent release from minerals, or from mineralization of organic matter or adding it to composting a large area of it in soil solution, while another part is adsorbed on Soil granules (Gupta et al. 1985). As the ready-made boron is present mainly conjugated with organic matter, this indicates the high content of ready-made boron in the surface horizons (Evinas and Sparks, 1983). As boron is adsorbed from iron and aluminum oxides and their aqueous oxides or by number from clay minerals (Keren & Gast, 1983(&) Goldberg Glaubig, 1985).

Materials and methods

Pot experiment were carried out under polyethylene chamber at the research station of Institute for vegetable of Horticulture and Food Industries in Budapest. Seeds of tomato plant *Solanum lycopersicum* were sown and seedlings of 12-14 cm height were transplanted in plastics contains of 34 cm depth and 24 cm diameter, filled with sandy soil, washed with distilled water, (table1) showed that, the chemical composition of sandy soil before treatment. The pots were arranged in a randomized block with four replications system in five replications, each replicate experiment consisted of 16 plants. The soil was supplied with B application of boron ($Na_2B_4O_7$. $10H_2O$) was performed at different rates (control, low medium and high) soil and plant sampling and fruit picking. The growing plants were watered by hand sprinkler using a tap water. Four plants were randomly chosen at every sampling date from each treatment. The plants were washed with distilled water and divided into upper leaves, lower leaves, upper steam, lower steam and roots. The different parts were then dried at 70 ° C for 36 hours and ground to pass through a sieve of 20 mesh. Soils were sampled from all treatments at four times and then air - dried, ground to pass throng a 2 mm and stored for different analyzes. The plants were supplied with nutrient solution containing most of the essential macro- and micronutrients at suitable concentrations according to Hogland 1970. Total yield of tomato plants was considered as the total weight of fruits for all harvests during the entire harvesting season. Total yield of tomato

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plants was considered as the total weight of fruits for all harvests during the entire harvesting season. A short summary about variety of tomato plant used in the experiment Balca - Fl hybrid is necessary. It is an early hybrid for glass house or plastic tunnel production. The obtained fruit in average is big. Balca is a green back type with firm smooth fruits, resistant to Tobacco mosaic virus and Vertacilli um. Setting is excellent even under difficult condition, early in the season and the fruits have excellent quality. Standard fruit weight is 100-110 g this is mentioned by (Sluis & Croote desriptun 1987). The analysis of soil and plant samples was carried out in the university's laboratory within the routine analytical methods and some elements were quantified in the ICP device. The boron was determined by the method with hot water extraction according to Berger - Truog (1944) and modified by Sippolas and Arvid (1977) then the B was determined by atomic absorption method as described in detail by Sillanad. (1982). Determination of B in the plant parts the method has been described by John et al. (1975): Passon and Sippola, (1969). 100 mg of dried plant samples were weighted and placed in a quartz tube. The sample was then burned at 450 ° C for 3 hours followed by cooling at room temperature. About 10 ml of 0, 1 M HCL was added to the ash and the mixture left stand for about 4 hours followed by filtration. 2 ml of A-zomethine. H was mixes with the solution and let stand for about one hour to develop the color, the B content was estimated by a spectrophotometric method involving detection at Statistical analysis: Analysis of variance, least significant difference (LSD5%) and simple multiple correlation equations were calculated by computer program in the Department of Arithmetic and Counting Techniques, University of Horticulture and Food Industries - Budapest. The methods and equations are reported by, Sváb (1981).

Table1. Chemical composition of sandy soil before treatment

parameters	!st year	2^{nd} year	Parameters mg/100g	
SP. Gravity (g/l)	1.58	1.54	Total N mg/100g	98.2
Humidity	0.13	0.22	Total P mg/100g	33.3
PH	7.80	8.85	Total K mg/100g	160.2
$CaCo_{3\%}$	7.55	7.60	Available N mg/100g	5.4
Humus%	0.930	0.90	Available P2O5 mg/100g	1.02
Stability coefficient	0.102	0.09	Available K2O mg/100g	3.4
T.S.S.	5.3	5.2	NH4-N mg/100g	20.4
C/N	4.38	4.04	NO3-N mg/100g	20.94
			B mg/ kg	0.53

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Results and Discussion

Soil Analysis:

Tomato plants, prefer a pH range between 5.5- 7, tomato grown in soils with alkaline pH values, shows, seek growth gives low yield probably due to fixation in unavailable forms of some essential elements such as P. Fe, Cu, B, Mn and Zn (Geisenberg and Stewart1986). Results given in (table 2) show the changes in pH value of the soil during growing season in accordance with the B treatments. Increase in B dose was found to slightly increase soil pH, when B dose was too high, soil pH increased to 7.89, but had never exceeded the value of 8.00. Similar tendencies were observed even when sandy soils have been used with application of nutrient Solutions.

Table2. PH, CaCO3 % and T.S.S%. Of sandy soil during plant vegetation

Boron treatment	1st year									2nd year								
Mg/kg	PH/H2O			CaCo3 %			T.S.S. %			PH/H2O			CaCo3%			T.S.S%		
	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120
0	7.20	7.33	7.40	6.80	6.99	7.20	4.90	4.70	4.99	7.40	7.54	7.60	6.80	6.88	6.90	4.20	4.50	4.90
6	7.20	7.80	7.86	7.02	7.14	7.33	5.02	5.12	5.13	7.60	7.65	7.88	6.84	6.95	6.98	3.95	4.98	5.00
9	7.73	7.78	7.84	7.40	7.42	7.63	5.15	5.18	5.30	7.73	7.82	7.86	7.04	6.01	7.00	5.02	5.15	5.25
18	7.75	7.83	7.89	7.06	7.20	7.40	5.2	5.25	5.35	7.56	7.67	7.80	7.10	7.20	7.35	5.14	5.30	5.49

With respect to soil salinity, tomato plants are not so tolerant to the high level of soluble salt in the soil or growing media. The maximum concentration of salt over which tomato growing isn't possible has been reported to be 6400 ppm (Hassen - Desouki 1982). At higher level the quality attributes such as dry matter content of tomatoes is substantially reduced. On contrast, low concentrations of salt can improve production and quality parameters of tomatoes (Adam, 1986). Dealing with the change in CaCO3, and T.S.S. % as a function of growing season. In sandy soils an increase in CaCO3%, ad T.S.S. % was recorded during growing season probably due to the salts accumulated from the irrigation water.

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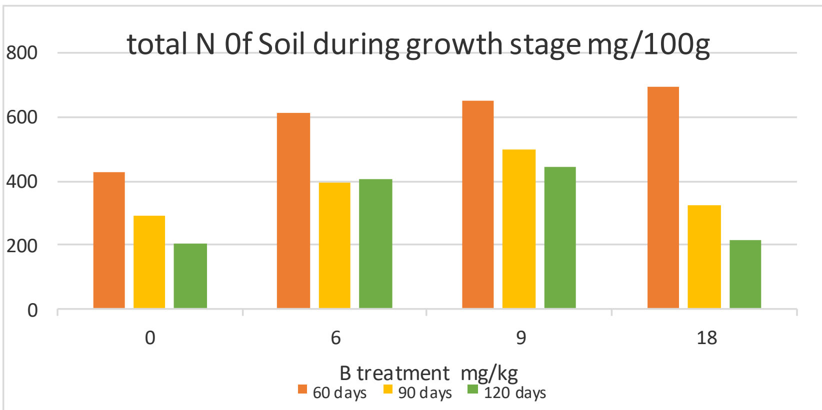
Nitrogen content of the soil:

Total content of N in sandy soil was found to be 100 1160 and 426-483 mg / 100 g respectively. The estimated targets the different form of N among which the organic distribute about 98-99 %. It was found that the total N content of sandy soil decreased with the progressive development of plant (Fig 1). Regression analysis of the data from the years of the experiments indicated that the increment in B dose application caused slight linear decrease in the total N content, such observation revealed that B affects by different mechanisms, the N metabolism and its uptake by environmental conditions such as the presence of other microelements at considerably high concentration. It should also be concluded that the highest consumption of soil N, as a major essential macronutrient, by plants, occurred at flowering and fruiting stages, this result agree with Shalabi …..



(Fig 1): Total N in Soil during growth stage mg/1oog

Table3. The hydrolysable N content & available P2O5, K2O content

Boron treatment	1st year mg/100g	2nd year mg/100g	1st year mg/100g	2nd year mg/100g	1st year mg/100g	2nd year mg/100g
O	9.71	6.50	80.3	75	67.3	80.3
6	9.27	8,96	100.4	88.4	71	85.4
9	9.26	8.94	96	80.1	75.6	90.3
18	7.64	7.46	108.3	94	76.9	94.2
LSD 5%	0.25	1.37	6.9	4.1	1.3	0.8

Hydrolysable N2 **K2O** **P2O5**

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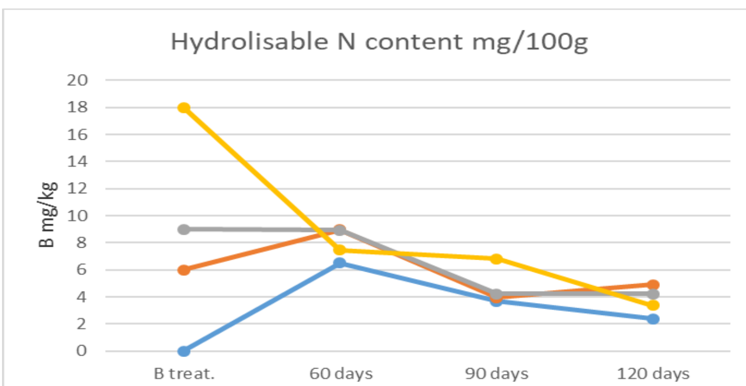
Hydrolysable N content of the Soil:

The Hydrolysable N implied (NH_4^+ and, NO_3^-,) content: Two forms of available N are considered in this study (table 3, Fig2). NO_3^-, is the most important source of available N for cultivated plants. NO_3^-, does not react with soil clays, the total supply of NO_3^-, in the root zone is available. (Fig 4) summarizes the results obtained for NO_3^- content of soil samples. Sandy soils being poor in organic matter there was a further decrease in NO_3^-content to fulfill the requirement of growing plants for the essential nitrogen. Relationship between B dose and the NO_3-content of soils is depicted in (fig4). It was found that if B dose increased up to 18 pp. It would result in a significant increase in NO_3^-, in sandy soil. (Bartholomew and Clark 1968) as the later effectively blocks the release and nitrification of fixed NH_4^+ions (table4). Regression analysis, asserted the linear relationship between B dose and NO_3^- content of the soils (r values were in the range of 0.903-0.99 for the different treatments) In connection with concentration behavior of NH_4^+ inverse correlation was observed between content of $NH_4^+$and NO_3^-. The obviously mentioned that NH_4^+ ions are the source of available NO_3^-, "through nitrification on reactions is supported here. Under the conditions of our work, the concentration of available NH_4^+ decrease proportionally to the advanced growth of tomato plants (Fig3).



(Fig 2):Hydrolysable N content of the Soil

Table4. NH_4^+contentof soil at different period of plant growth mg/kg

Boron treatment	1st year 60	90	120	2nd year 60	90	120
0	7.6	3.4	2.8	14.6	4.83	4.26
6	8.6	2.5	3.3	16.5	6.36	4.50
9	5.1	2.0	2.6	16.7	4.56	3.40
18	4.9	2.1	3.5	8.86	6.53	4.16
$LSD_{5\%}$	0.75	0.22	0.45	1.23	0.51	0.22

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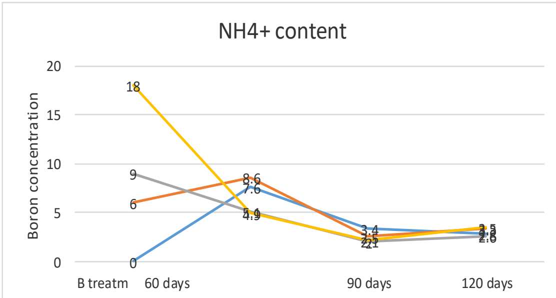
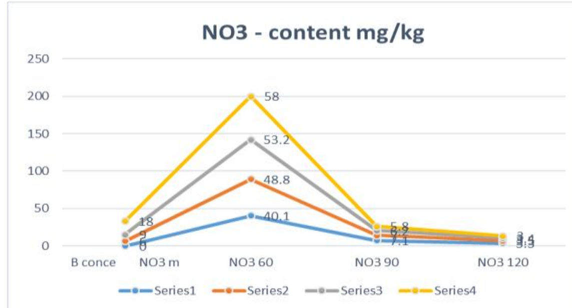


(Fig3) NH4+contentof soil at different period of plant growth mg/100g

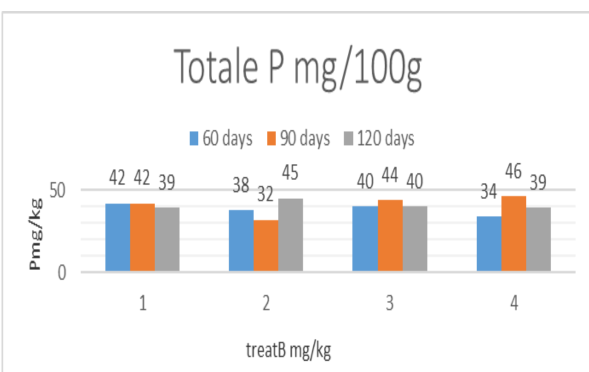


(Fig4) NO3+contentof soil at different period of plant growth mg/100g

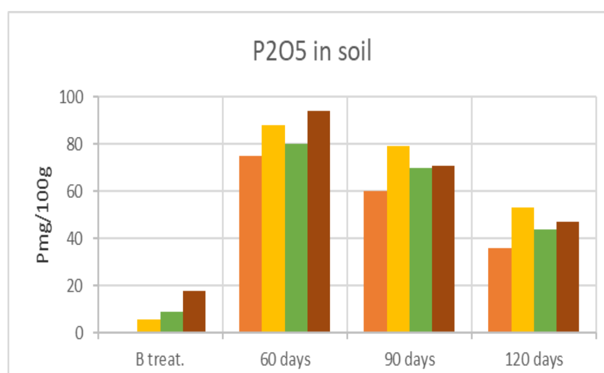
(Fig.4) indicate the effect on NO_3^-, increasing B doses caused correspondent decrease in NH_4^+ content of the soils. The linear correlation between B dose and content of sandy soils can be seen.

Changes in Phosphorus content of soil

The date show in (table3), (Fig5 &Fig6-) show changes in the available P_2O_5 content of sandy soils during growing season of tomato plants. The results indicated that easily soluble P_2O_5 content approached the maximum value at the first stage of plant growth (60 days) and then decreased. The tendency of the changes observed supported the results given by Morgan, J.)2013 (in which P up take of tomato plant has been improved to be very intensive at the first stage of plant growth. Similar tendency has also been reported by Oudeh (1987). Such behavior reveals that B increases plant capacity for absorption of Phosphor and its derivate. Our results are in agreement with those given by Pollard and co - workers (1977).



(Fig 5): Effect of B treatment on the total P during 120 days of vegetation LSD5% 2.29



(Fig 6): P_2O_5 content during 120 days of vegetation mg/100g

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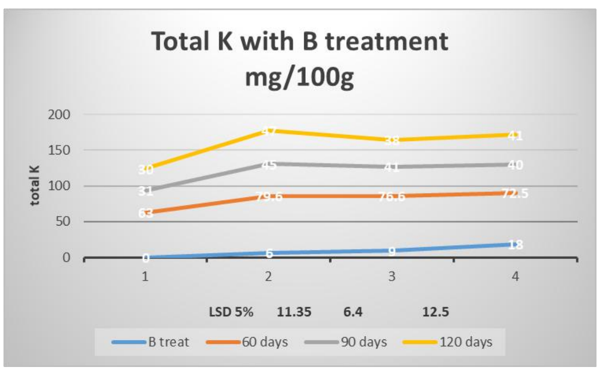
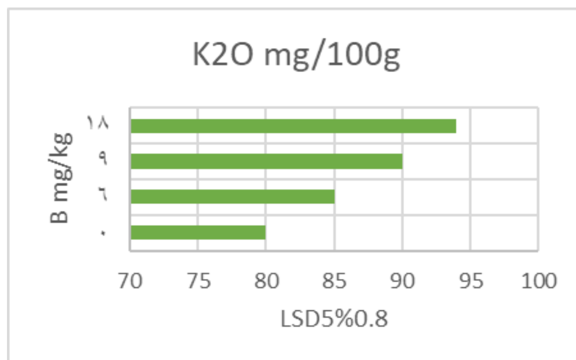
Change in potassium content of soil:

The values of the available K_2O presented in (table 3) & (Fig 7), demonstrate that K_20 showed similar behavior to that observed with P_2O_5, the high concentration of B (18 mg/kg) induced an increase in residual amount of the available K in sandy soil at the final stage of plant growth. This may be due to the depressive effect of the higher level of applied on the uptake of K by plants (Kádár and Shalaby, 1985) our results are in agreement with those obtained by Dijkshoorn et al. (1974) who attributed such behavior to ion.

K content of such soils however, was inversely responding to the increasing dose of B in comparison with its response to increasing dose of B in comparison with its response to B (Fig 8): show an increasing in the concentration of K_20 content in relation with B addition (Fig: 8)



(Fig7): Effect of B treatment on the total K during 120 days of vegetation



(Fig: 8)Effect of B treatment on K_2O of soil

Calcium relationship in the soil:

It has been evident from many works that the dynamics of some exchangeable cations as well as the uptake by several plants can be influenced to substantial extant by supply at different rates Parker and Gardner, (1982).

Table 6. Ca, Mg content of soil during growth stage

Boron Mg/kg	Ca mg/100g			Mg mg/100g		
	60	90	120	60	90	120
0	148.6	99	85.3	312	255	265.3
6	156	111.6	131.3	355	357	385.3
9	165	111	121.6	412	366	393.6
18	150	111.3	140	439.6	249.6	269
$LSD_{5\%}$	3.8	1.9	3.8	7.0	7.6	7.3

(Table 6, Fig9) showing the relationship between increasing B dose and Ca

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content. In general, there was a decrease in the Ca content of the soils during the growing season. In some cases, particularly with treatments of 6 and 9 ppm, a slight increase was recorded in concentration of available Ca in the soils probably due to the effect of B on there lease of Ca through the Hydrolysis processes occurring at the final stage decomposition stage of plant growth, a significant increase in Ca content of the soils reflexing the antagonist effect of another element on Ca uptake by tomato plants, this result explain by (Wilcox et .al 1973)

Boron - Magnesium relationship in the soil:

Mg is another interesting divalent cation in the exchange and antagonism with another nutrient in soils. Tomato plants showed a capacity to absorb Mg ions similar to that observed to Ca ions in most of treatments used, there was an inverse relation between Ca and Mg content of due to the antagonist between such cations. (Fig: 9) Shows a correlation between the B dose and available Mg content of sandy soils. It can be seen that Mg ion concentration was proportionally increasing with the increasing dose of B. Ca ions can be adsorbed more easily than Mg ions emphasizing the high antagonism between Mg and other elements. The correlation between B treatment and Mg content is Y 406.5 x 6.13 x r = 0, 96

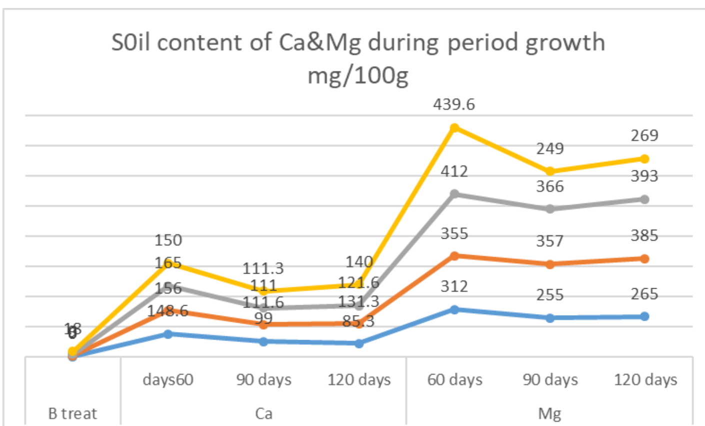

Fig 9: Ca, Mg content of soil during growth stage mg/100g

Results of plant analyses

N content of different plant parts: Tomato plants require considerable amount of fertilizers (Somos 1971). The required amount however, should not be great enough to initiate big vegetation from the point of view of the essential role of B and its effect on the plant development, it is of great importance in regulation the functions of cell walls and being effective factor in carbohydrate metabolism. This latter effect is in connection with the fact that

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borates are playing a considerably great role in the esterification of carbohydrates (Hargitai, 1984). Therefore, the plants are suffering when they are grown under B deficiency or toxicity conditions of the plant at the account of its flowering and reproduction capacity (Wilcox et al 1973).

(Tables7, Fig 10): Show the changes occurred in the total N content of tomato plant roots, stems, and leaves at the different stages of vegetation and growth as influenced by the different treatments of B. It was clearly evident that leaves of tomato plant are containing more N than the other parts of the plant. Furthermore, the total N content of the upper leaves was significantly higher than that of the lower leaves. These results are in agreement with those obtained Hargitai (1986), Hargitai - Vass (1976) and Oudeh (1987). The lowest values for the total N were estimated in the lower stems. With regard to the dynamics of total N during plant growth, substantial decrease was obtained in the different parts as a results of the further vegetation, Flowering and fruiting process.

Table 7. Plant part content of some macro nutrient.

mg/100g	1st year			2nd year		
	Root	stem	leaves	Root	stem	leaves
Total N	1008	904.3	1150	940	816.8	830
Total P	114.3	120.8	160.3	100	110.3	133
Total K	141.5	120.3	150.2	1110	1504	1350
Available N	413.2	318.2	380.	240	290	370.4

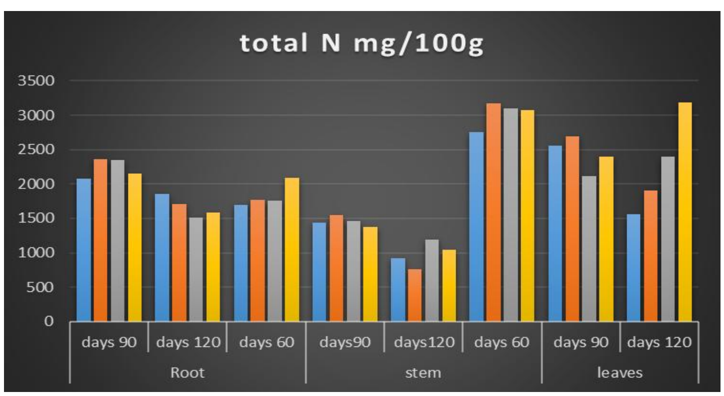

Fig10: Total N content in different part of plant

An exception of this case was that in both lower and upper stems of plants harvested at 120 days of growth (table 8) there was an increase in the total content probably due to N metabolism processes in the other parts such as leaves and roots particularly under toxicity conditions that lead to

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irregularity in the uptake and translocation of N within the plant parts. On contrast, lower rates of B application seemed to be necessary for the regulation of N metabolism, the same for P&K. In general, roots, lower stems &leaves showed remarkable decrease in their total N content as B doses were increased that much it seems to be a greater movement of N to the top of the plants affected by B. This latter fact is very clearly to see in the accumulation of N in the reproductive parts and growing tops. Similar trend has been reported for the effect of on the N concentration in some cereal grains (Maher, &Pungor.1977). As indicated by the results an increasing B rate caused proportional decrease in the total N content of different parts (except leaves). The tendency of the changes occurring in the N content of the different parts during the growing season.

Easy hydrolysable N content of different part of plant: The data given in (table 8) is the results of several determinations of the easily hydrolysable N in the different parts of tomato plant grown in soils treated with B with various concentrations. It can be well seen that the content of N form was in the order of lower leaves, upper leaves, upper stems, lower stems, roots and upper leaves, upper stems, lower leaves, lower stem, root at 60 and 90 days of plant growth respectively. This means that at the first stages of plant Vegetation the lower parts are the actual stores of the hydrolysable N, when plant maturation, flowering and fruiting is starting N accumulates.At the upper part of the plant and at the generative organs where N is greatly needed for the physiological processes of plant reproductively. These results conformed those of Hargitai and Vass (1976). Increasing the dose to 18 ppm was accompanied by a decrease in the soluble N content of the lower leaves. Regression analysis indicated positive correlation between B dose and easily soluble N content of the upper leaves (r = 0.83).

Table 8. The ratio of hydrolysable N upper / lower part (average 2 years)

B Treatment	Stem			leaves		
	60	90	120	60	90	120
0	1.18	1.34	1.19	0.74	1.85	1.13
6	1.47	1.02	1.15	1.08	1.51	1.02
9	1.27	1.03	0.97	1.04	1.20	1.08
18	0.68	0.90	1.14	0.94	1.32	1.11

Boron content in different part of plant:

Boron is one of the seven recognized essential micronutrients required for the normal growth (Gupta 1979), in the absence of organic matter B uptake is unregulated and the relationship between B with the other elements is more

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troubled and unfavorable consequences, generally an increase in elemental concentration occurred with high concentration of boron. In sandy soil of low organic matter content, generally B uptake was increased by increasing B levels in the soil. In the leaves, a higher amount of B was detected than in the stem. In the roots the movement and uptake of B was also increased with increasing of B doses. By B treatment a very high uptake was happening at 90 days and by toxic high treatment after 120 days the content was higher than at 60 days. The processes in the stems were very similar to those observed in the other part then gradually decreased, this respect, micronutrients having an effective role in the processes of flowering and fruiting such as B of special importance (Gupta, 1979; Gupta, 1985). In the crops is considerably reduced when compared with that of a plants possessing sufficient amount of the micronutrients.

Effect on tomato yield:

Fruit content of N, P, and K slightly increase with B concentration (Fig11) as know the role of boron increase the absorption of nitrogen, phosphor & potassium by the plant, so increase in N, P, K content with an increase in the concentration of boron, this result agree with Communar& Keren (2008), negative correlation between High dose of B and tomato yield indicating that tomato plants suffered from a toxicity

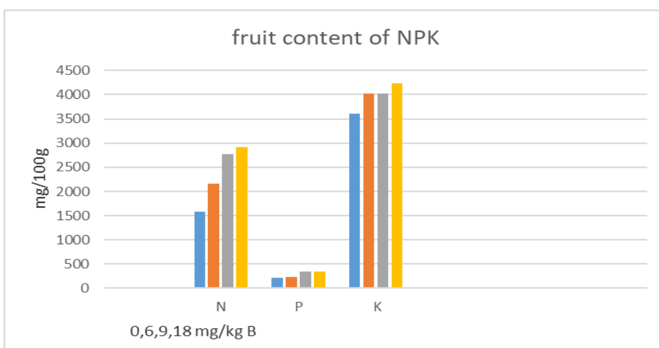

Fig 11: NPK content in tomato fruit mg/100g

The highly toxic concentration of B resulting in a significantly lower yield of tomato plants as compared to that of control ones. This may be due to the lower content of organic matter (Gupta, 1985). Fig 13 show the negative correlation between weight of crops and boron concentration, the data show the highest yield of tomato, is at a concentration of 6 mg/kg, the amount of tomato yield decreases with increasing the boron concentration due to the toxicity of the concentration, this applies to the weight of the tomato fruit.

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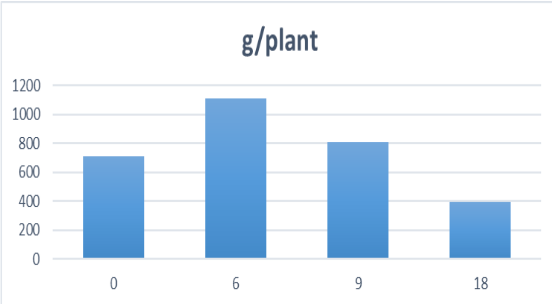
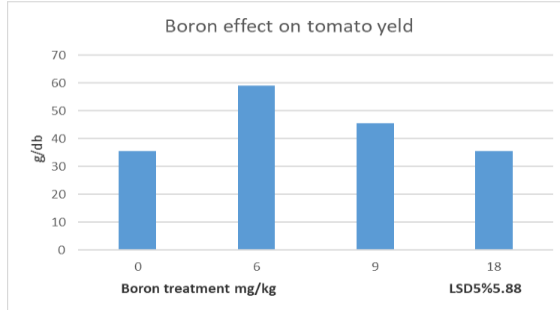


(Fig: 12); effect of boron doses on weight of tomato



Fig; 13 effects of boron doses on weight fruit

Boron content of tomato fruit:

As for the concentration of boron in the fruit, and a result of the accumulation of boron in the upper vegetative part (Fig 14), the fruit's content of boron is low even at a higher concentration of it the same result found by Gupta (1985); Vlamis and Ulrich (1971).

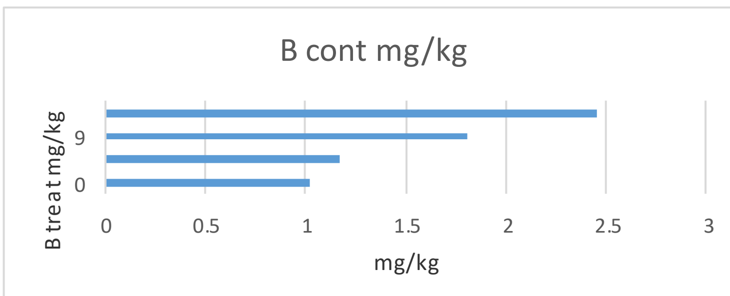


Fig14: Boron content of tomato fruit

Conclusion:

Conclusion: In sandy soils where the roots extend freely, adding a small amount of boron helps reduce the amount of water needed for irrigation, improve the characteristics of sandy soil and improve the quality of production.

References:

1. Adams, P. (1986): Mineral nutrition tomato crop pp.: 281 -334 Chapman & Hail London.

2. Al-Falahi Ahmad Adnan Ahmad, 2000. The status and behavior of boron

In royal drinking in Iraq, PhD class, College of Agriculture, University of Baghdad

3. Al-Harbi, A.R., A.M. Al-Omran, A.A, Shalaby,and M.I. Choudhary. (1999).

Efficacy of hydrophilic polymer reduced with time under greenhouse experiments. Horti-Science 34:223-224.

4. Bartholomew,W.V. & Clark,F.G. (1968): Nitrogen availability in different soils .Agronom.10.Am .Soil. Sci. Soc. Agron .Madison.

5. Bingham, F. T., A. L. Page, N T. Coleman, and K. Flach. 1971. Boron adsorption characteristics of selected soils from Mexico and Hawaii. Soil Sci. Soc. Am. J. 35: 546-550.

6. Campbell, C. A. Zentner. (1993). Soil organic matter as influenced by crop rotation and fertilization. Soil. SCI. Soc. Amer. J. 57:1034-1040.

7. Choudhary, M.I., A.M. Al-Omran and A.A.Shalaby. (1998.) Physical properties of sandy soil as affected by a soil conditioner under wetting and drying cycles. Sultan Qaboos Univ. J. Sci. Res. Agric. Sci. 3(2):69-74

8. Communar, G., and R. Keren. 2008. Boron Adsorption by Soils as affected by Dissolved Organic Matter from Treated Sewage Effluent. Soil Sci. Soc. Am, J. 72: 492- 499

9. Dijksnoorn, W.S. –SUJITNO, S.A-Ismael, I.M. (1974) Potassium uptake by rice plants and interaction with other cation. Plant and Soil 40, 525-534

10. Evans, C. M. and D. L. Sparks. 1983. The chemistry and mineralogy of boron in pure and mixed systems: a review. Comm. In Soil Sci. And Plant Analysis, N. Y., 14: 827-846.

11. Goldberg, S., and C. Su, 2007. New Advances in Soil Chemistry Advances in Plant and Animal Horon Nutrition F XII Gol P.H. Brown, R. W Bell, T. Fulwara, CH, S Goldbergoddi Sht. US Governmeni

12. Goldberg, S., and D. Suarez. 2011. Release of native and amended boron from arid zone soils after varying incubation times. Soll Selence IX (5). 213-217

13. Goldberg, S., H. S. Forster, S.M. Lench, and E. L. Heick. 1996. Influence of anion competition on boron adsorption by clays and soils. Soll Science 161 (2): 99-103

14. Goldberg, S., and C. Su, 2007. New Advances in Soil Chemistry Advances in Plant and Animal Horon Nutrition F XII Gol P.H. Brown, R. W Bell, T. Fulwara, CH, S Goldbergoddi Sht. US Governmeni

15. Goldberg, S., and R. A. Glaubig. 1985. Boron adsorption on aluminum and iron oxide minerals. Soil Sol. Soc. Am. J. 49: 1374-1379.

16. Goldberg, S., and R. A. Glaubig. 1985. Boron adsorption on aluminum and iron oxide minerals. Soil Sol. Soc. Am. J. 49: 1374-1379.

17. Gupta, U.C. , Y. W. Jame, C. A. Campbell, A. J. Leyshon, and w Nicholaichuk. 1985. Boron toxicity and deficiency: a review. Can J. of Soil Sol, Ottawa, 65: 387-409.

18. Gupta, U. C. 1979. Boron nutrition of crops. Adv. Agron. 31: 273-307.

19. Gupta, U.C. , Y. W. Jame, C. A. Campbell, A. J. Leyshon, and w Nicholaichuk. 1985. Boron toxicity and deficiency: a review. Can. J. of Soil Sol, Ottawa, 65: 387-409.

20. Grootste assortiment zaden van Nederland!

21. Geissler and Kurnoth1968

22. Haby, V.A. et al., 1995. In Plant-Soil Interactions at Low pH: Principles and Management. Developments in Plant and Soil Sciences 64:505-510

23. Hargitai, L.(1984) Ahazai talaj tipusok specials humusz allapotanak jellemzese.ker.Egyt.kozi .48:195-201.

24. Hargitai, L.-Vass,E (1976): A nitrogen novenybeli forgalmanak ,anitrogen ellatottseg nehany alapveto kerdesenek vizsgalata kerteszeti novenyeken .Kert.Egyet. kozl.vol.40:61-73.

25. Hargitai .L. (1986):Talajtan Es agrokemia II. Alkalmazott Talajtan es agrokemia>Budapest, kerteszti Egyetem Kiado.

26. Hassan, A.A.-I.A.M. Desouki (1982): Tomato evaluation & selection for sodium chloride tolerance Egypt. J.Hort, 9:153-162

27. Havlin, J. L, J. D. Beaton, S. L. Tisdal, and W. L. Nelson 2005. Soil Fertility and Fertilizers. 7 Ed. An introduction to murient management. Upper Saddle River, New Jersey.

28. Islam, M. and G. C. Munda.(2012). Effect of organic and inorganic fertilizer on growth, productivity, nutrient uptake and economics of maize (Zea mays L.) and toria (Brassica campestris L.). Agric. Sci. Res. J., 2(8): 470-479.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 9464 - 9482
Received 25 April 2021; Accepted 08 May 2021.

29. Keren, R., and R. G. Gast. 1983. pH-dependent boron adsorption by montmorillonite hydroxyl-aluminum complexes. Soil Sol. Soc. Am. J. 47: 1116-1121

30. Kohnke, H. (1968). Soil physics. Tata-McGraw. Hill Publishing Co. Ltd., Bombay .New Delhi, India.

31. Kumari,M, Singh.J (2018)Application of Quality Function Deployment in design and development of Lathe Machine

International Journal of Advanced Research and Review 1 (4), 75-79

32. Maher, M.-Pungor,E.(1977):Measurement of total N & total P content in vegetable samples by continuous –flow Chemical analysis .Hungarian Scientific Instrument 39:4-17

33. Morgan, J. 2013. Bio fertility: lasting solution micronutrient malnutrition and world hunger. CSA News magazine 58 (1): 4-9

34. Oudeh, M. (1987) Examination of nitrogen molybdenum fertilizations interaction Kandidatusi thesis, Budapest Hungary.

35. Oqba Basal .OrcI .D, and András Szabó (2020): The Combined Effect of Drought Stress and Nitrogen Fertilization on Soybean Agronomy, 10(3), 384 Institute of Crop Sciences, University of Debrecen, 4032 Debrecen, Hungary

36. Parker, D.R., Gardnere, E.H. (1982): Factors effecting the mobility and plant availability of boron in some western Oregon soils .Soil sci. Soc. Am .J .46:573-578.

37. Patrick Liebmann, Patrick Wordell-Dietrich, Karsten Kalbitz, Robert Mikutta, Fabian Kalks, Axel Don, Susanne K. Woche1, Leena R. Dsilva, and Georg Guggenberger (2020): Water conservation: Strategies and solutions Articles 17(12), 3099–3113.

38. Pollard, A.S., Parr, A.J., Loughman, B.C. (1977): Effect of irrigation with different water wastes on the mineral composition of some medicinal plants. J. EXP. Bot.2 8:831-841

44. Shalaby, M.H, Kádár I. (1984) foszfor-és cinktrágyázás közötti kölcsönhatások vizsgálata meszes homoktalajon Agrokémia és Talajtan 33 (1-2), 261-267

43. Shalaby, M.H, Omran, M.S, Raslan. M.I. (1996) Effect of irrigation with

different water wastes on the mineral composition of some medicinal plants Egyptian Journal of Soil Science (Egypt) Menoufia Journal of Soil Science 5 (9), 149-15739. Sims, J. R., and F. T. Bingham. 1968. Retention of boron by layer silicates, sesquioxides, and soil materials: II. Sesquioxides. Soil Sel. Am. Proc. 32: 364-369

40. Sippolla -Ervio(1977): Modified methods of Berger-Truog for determination the B in the soil Sillanpa, M.FAO Soils. Bulletin 48 .Roma.

41. Sillanpa, M.(1982). Micronutrients and the nutrient status of soil. FAO Soils Bulletin 48 .Roma pp:9-11

42. Svab, J. (1981). Biome trial modszerek akutatasban. Mezogazdasagi Konvykiado. Budapest

45.Singh.H, J., Gandhi.J, S. K., and SinghInternational Journal of Management Concepts and Philosophy 11 (3), 239-279.

46. Somos, A.(1971):A paradicsom.Akademia Kiado,Budapest .P20447.

47. Wilcox .G.E.-Hoff,J.E-Jones ,C.M.(1973):Ammonium reduction of Calicum & Mgnesium content of tomato & sweet corn leaf tissue. J. Am. Soc. Soil. Sci. Prec. 98:86-89.