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INTERACTION EFFECT OF COMPOST, BORON AND PHOSPHORIEN ON TOMATO QUALITY AND YIELD

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Abstract

Tomato (*Lycopersicon esculentum* L.) is among the most important vegetable crops grown in Egypt for exportation and local consumption. The purpose of this investigation was to assess the influence of organic and bio fertilizers with foliar spraying of boron element on improving the fruit quality and yield of the tomato plants in the winter season of 2018. The experimental design was a split-split plot design with three replicates for each treatment. The compost treatments were C_1: (5 m^3 compost fed^{-1}), C_2: (10 m^3 compost fed^{-1}) and C_3: (15 m^3 compost fed^{-1}). The foliar boron treatments were B_0: (0.00 mgL^{-1}B), B_1: (50 mgL^{-1} B) and B_2: (100 mgL^{-1}B). The bio-fertilization treatments were I_0: without inoculation and I_1: with inoculation at rate of 200 g phosphorien Fed^{-1} in addition to control treatment. The values of all quality parameters of tomato fruits at harvest stage as well as tomato yield were significantly affected by the addition of all investigated treatments. For all traits except acidity%, the highest values were obtained at [C_3 (15 m^3 plant compost fed^{-1}) × B_2 (100 mg B L^{-1})×I_1 (with inoculation)] treatment, while the lowest values were obtained at control treatment [C_0 (without plant compost) × B_0 (without B foliar application) ×I_0 (without inoculation)].On the contrary, the acidity % took an opposite trend, where the lowest values were obtained at [C_3×B_2×I_1] treatment, while the highest values were obtained at control treatment [C_0×B_0×I_0].

Keywords: Compost, phosphorien, boron, tomato plant.

Introduction

Tomato (*Lycopersicon esculentum* L.) of the family Solanaceae, is one of the most important vegetable crops from nutritional as well as consumptional point of view. More than 90% of the vitamin C in human diets is supplied by vegetables and fruits (of which tomato is the most important). Tomato fruits contain high amount of lycopene and ascorbic acid (Ilupeju *et al*., 2015). In the recent past, some investigations have been conducted to study the beneficial influences of adding crop residue compost into the soil. The practice enhances soil physical, chemical and biological activities in addition to improving crop yields and nutritional values (Ghosh *et al*., 2004; Ashutosh *et al*., 2006). The supply of organic materials on farms, even with the use of farmyard manure and or plant compost (from crop residues), will likely be insufficient to overcome soil nutrient deficiency. For example, high fruit yield due to compost addition were reported on tomatoes with combine application of 2 ton compost ha^{-1} and 30 kg nitrogen ha^{-1}. In most of these studies, compost addition was observed to have positive influences which aid crop growth and development thereby enhancing the crop phytonutritional components (Togun *et al*., 2003 and Ilupeju *et al*., 2015).Boron plays an important role in the insemination and reproductive growth of tomato. It can impact on the tomato flowers and fruits production. B deficiency is one of the widely reported nutritional disorder in commercial tomato production, where it can reduce root growth and cause swollen hypocotyls and cotyledons, shortened internodes, irregular leaf expansion and abnormalities in cellular structure. The deficiency is accelerated by raising in soil pH and dryness around the root zone. B fertilization significantly increased yield of greenhouse tomato (Dursun *et al*., 2010 and Harris and Puvanitha 2018). In Egypt soils that characterized by high calcium carbonate content and pH, phosphorus precipitation and immobilization is the most important problem. Phosphorien is a bio-fertilizer product which is phosphorien-containing phosphate-dissolving bacteria (PDB).application of the PDB to such soils caused significant increments in vegetative growth parameters and crops productivity (Taha, 2015).The objective of this study is to enhance the quality and fruit yield of tomato plants grown under alluvial clay condition in Delta region, Egypt and evaluation of different compost levels (rice straw) with foliar spraying of different boron rates under inoculation (phosphorien-containing phosphate-dissolving bacteria PDB) and find out the positive effect of these treatments on grown tomato plants because of the tomato importance as a strategic crop in Egypt.

Materials and Methods

To achieve the goal of this investigation, field experiment was conducted in the Gawadya Village, Belqas District, Dakahlia Governorate, Egypt during the winter season of 2018 to assess the effect of plant compost, boron foliar application, phosphorien and their interactions on tomato (*Lycopersicon esculentum* L.) under alluvial clay soil conditions. The combined effects of compost, boron element and phosphorien on quality and yield of tomato plants were investigated by combining three compost rates and three spraying rates of boron. Also, each treatment was studied twice; once in the presence of strains inoculants and the other without inoculation. The used experimental design was split-split plot design. There are 3 factors under experimentation: Main plots were compost (rice straw) treatments which included compost levels i.e. **(C_1):** Compost was applied at rate of 5 m^3fed^{-1}two weeks before sowing, (C_2): Compost was applied at rate of 10m^3fed^{-1}two weeks before sowing and (C_3): Compost was applied at rate of 15m^3fed^{-1}two weeks before sowing. Sub plots were the foliar boron application treatments i.e., (B_0): without boron addition (0.00 mgL^{-1} B), (B_1): B was foliar applied as boric acid at rate of 50 mg L^{-1} and (B_2): B was foliar applied as boric acid at rate of 100 mg L^{-1}. Sub sub plots were bio-fertilization treatments i.e., (I_0): without inoculation and (I_1): with inoculation at rate of 200 g phosphorien Fed^{-1}. Therefore treatments of the field experiment were 3 "compost rates" ×3 "boron rates" × 2 "bio fertilizer" in addition to control treatment (without inoculation, any addition of compost and foliar spraying of boron [C_0 B_0 I_0]) done in 3 replicates. Plot area = 6 m^2.

Analysis of Soil: The soil was analyzed before planting as a routine work according to Dewis and Fertias (1970), Table 1 shows the some chemical and physical characteristics of alluvial soil. Chemical analysis of the compost (rice straw) used are presented in Table (2). All agricultural operations were performed according to the traditional local agriculture management practices. Tomato seedlings 'Super strain B' were transplanted on the 15th of October, 2018. At soil preparation, the compost was applied according to treatments two weeks before sowing. Phosphorien (*Bacillus megatherium*; phosphate-dissolving bacteria) was provided by the Egyptian Ministry of Agriculture and mixing with fine clay soil and added at 7 days after sowing at the rhizosphere area. Boron fertilization; as boric acid was added by foliar at two different stages from transplanting (after 40 and 50 days). The amounts of mineral fertilizers were used as recommended by Egyptian Ministry of Agricultural. The plants were irrigated every week during the growing season. Other cultural practices; such as, plant protection against weeds, diseases and insects; were performed whenever they were thought to be necessary as recommended for commercial tomato production. Tomato fruit were hand-harvested at the fully ripe stage. One picking was harvested on January 25, 2019.

Table 1 : Some physical and chemical characteristics of the experimental soil before transplanting tomato seedlings.

Soil Characteristics		Values
Particle size distribution (%)	C. Sand	2.100
	F. Sand	19.60
	Silt	28.00
	Clay	50.30
	Textural class	Clay
EC dSm^{-1*}		1.500
pH^{**}		8.160
$CaCO_3$ %		2.090
O.M %		1.130
F.C %		35.50
S.P %		71.00
Soluble cations, meq L^{-1}	Ca^{++}	5.500
	Mg^{++}	2.900
	K^+	2.000
	Na^+	4.600
Soluble anions, meq L^{-1}	CO_3^-	--
	HCO_3^{--}	0.900
	Cl^-	7.900
	SO_4^{--}	6.200
Available element, mg kg^{-1}	Nitrogen (N)	66.00
	Phosphorus (P)	9.300
	Potassium (K)	285.6
	Boron (B)	1.980

Table 2 : Chemical analysis of the compost used.

Characteristics		Values
Weight of m^3 kg^{-1}		325.0
pH 1:5		6.140
EC (1:10) (dSm^{-1})		3.710
OM%		35.10
Organic carbon%		20.41
C/N ratio		13.90
Available micronutrients and heavy metals (mg kg^{-1})	Iron	62.32
	Manganese	25.49
	Copper	5.550
	Zinc	18.49
	Lead	5.950
	Nickel	2.150
	Cadmium	0.860
Total Nutrients (%)	Nitrogen	1.490
	Phosphorus	0.490
	Potassium	0.880

The following characteristics were inspected:

Quality parameters of tomato fruits: representative samples of tomato fruits were randomly taken from each treatment at harvest stage to determine the quality parameters of tomato fruits (vitamin C; mg $100g^{-1}$, total acidity in fruits; %, lycopene pigment; %, total carbohydrates and total sugars; %, total soluble solids content (TSS) of the fresh tomato fruits; % and percentage of dry matter after drying fruits at $70^{\circ}c$) according to A.O.A.C (1980).

Fruit yield: Harvesting was after100 days from transplanting. The total fruit yield (gram per plant), average number of fruits per plant and average weight of fruits; gram were recorded.

Statistical analysis: Data were statistically analyzed according to Gomez and Gomez (1984) using CoStat (Version 6.303, CoHort, USA, 1998–2004).

Results and Discussion

1. Fruit nutritional values:

Acidity (%), lycopene (%), total soluble solids(TSS %), total sugars(%), total carbohydrates (%) and ascorbic acid (V. C mg/100g) of tomato fruits as influenced by plant compost, phosphorin and boron foliar spraying as well as its interactions are presented in Tables (3 and 4). Data in Table (3) indicate that the values of all above mentioned parameters were significantly affected due to any addition of plant compost. On other words; this parameters were significantly increased with raising of adding level of plant compost, except for acidity % which significantly decreased with increase of adding level of plant compost.

Table 3 : Effect of compost, phosphorin and foliar spraying with boron on acidity(%), lycopene(%), TSS (%), total sugars (%), total carbohydrates (%) and V.C (mg/100g) in tomato at harvest stage.

Treatments	Acidity	Lycopene	TSS	T. Sugar	T. Carbohydrates	V.C
	%					mg/100g
Compost level						
C_1 (5 m^3 fed^{-1})	0.90	10.78	5.05	4.24	38.36	29.99
C_2 (10 m^3 fed^{-1})	0.86	11.12	5.20	4.44	38.68	30.50
C_3 (15 m^3 fed^{-1})	0.82	11.35	5.32	4.57	38.91	30.87
$LSD_{\text{at 5\%}}$	**0.03**	**0.07**	**0.05**	**0.04**	**0.06**	**0.05**
Boron level						
B_0 (0.0 mgL^{-1})	0.93	10.53	4.93	4.11	38.12	29.61
B_1 (50 mgL^{-1})	0.84	11.24	5.26	4.50	38.80	30.69
B_2 (100 mgL^{-1})	0.81	11.49	5.38	4.63	39.03	31.06
$LSD_{\text{at 5\%}}$	**0.02**	**0.06**	**0.02**	**0.03**	**0.03**	**0.06**
Phosphorin application						
I_0 (without inoculation)	0.97	10.27	4.78	3.97	37.87	29.20
I_1 (with inoculation)	0.75	11.90	5.60	4.86	39.43	31.71
$LSD_{\text{at 5\%}}$	**0.01**	**0.04**	**0.02**	**0.02**	**0.02**	**0.05**

In this respect, for all above mentioned parameters except acidity, the highest values were realized due to the addition of 15 m^3 plant compost fed^{-1} (C_3) as soil application followed by 10 m^3 plant compost fed^{-1}(C_2) and 5 m^3 plant compost fed^{-1} (C_1), respectively. As for total acidity %, the lowest values were realized due to the addition of 15 m^3 plant compost fed^{-1} (C_3) as soil application followed by 10 m^3 plant compost fed^{-1}(C_2) and 5 m^3 plant compost fed^{-1} (C_1), respectively.

Regarding the effect of boron foliar spraying on aforementioned traits data at the same Table (3) indicate that the values of lycopene (%), total soluble solids(TSS %), total sugars(%), total carbohydrates (%) and ascorbic acid (V. C mg/100g) of tomato plants were significantly increased as the levels of B were increased, where the highest values were realized for the plants treated with boron foliar spraying at the rate of 100 mg B L^{-1} (B_2) while, the lowest one was happened for the B_0 treatment (0.0 mg B L^{-1}). On the contrary, the values of acidity% of tomato plants were significantly decreased as the levels of B were increased, where the lowest values were realized for the plants treated with boron foliar spraying at the rate of 100 mg B L^{-1} (B_2) while, the highest one was happened for the B_0 treatment (0.0 mg B L^{-1}). Concerning the effect of phosphorin data at Table (3) reveal that; the values of all above mentioned parameters of tomato plants treated with phosphorin (I_1) were more than obtained for the untreated plants (I_0), except for acidity % which significantly decreased with phosphorin (I_1). The differences between these values were significant during the season of the experimentation.

The interaction effect between the treatments under study are presented in Table (4). It could be observed that; the values of acidity (%), lycopene (%), total soluble solids(TSS %), total sugars(%), total carbohydrates (%) and ascorbic acid (V. C mg/100g) of tomato fruits were significantly affected due to the addition of all investigated treatments. For all above mentioned parameters except acidity%, the highest values were at [C_3 (15 m^3 plant compost fed^{-1}) × B_2 (100 mg B L^{-1})×I_1(with inoculation)] treatment, while the lowest values were at control treatment [C_0 (without plant compost) × B_0 (without B foliar application) ×I_0 (without inoculation)]. Also, the data show that spraying boron at the rate of 100 mg B L^{-1} (B_2) with inoculation (I_1) gave higher values at any level of plant compost compared to that same plant compost level without both boron application and inoculation. As for acidity, the lowest values were at [C_3 (15 m^3 plant compost fed^{-1}) × B_2 (100 mg B L^{-1})×I_1(with inoculation)] treatment, while the highest values were at control treatment [C_0 (without plant compost) × B_0 (without B foliar application) ×I_0 (without inoculation)].Also, the data show that spraying boron at the rate of 100 mg B L^{-1} (B_2) with inoculation (I_1) gave lower values at any level of plant compost compared to that same plant compost level without both boron application and inoculation. This trend was realized for the two studied seasons.

The results presented here, in agreement with several earlier reports, show that total sugars (primarily reducing sugars) were positively correlated to pH and titratable acidity. The authors illustrated that positive correlation between sugars and pH and between sugars and titratable acidity means that plants with high sugars have more free organic acids and less hydrogen ion concentration than plants with low sugars Getinet *et al.* (2008). Our results were in harmony with the results of Mohd *et al*. (2002); Kumar *et al*. (2007); Ghorbani *et al*. (2008); El-Tohamy *et al*. (2009); Ekinci *et al*. (2015) who reported that contents of total soluble solids (TSS) and vitamin C increased in the fruits harvested from the plants treated with combination of compost and boron under inoculation. Boron significantly increased total sugars, vitamin .C and TSS of tomato cv. Zare (2013). Also, our results agree with Mahmoud *et al*. (2009) who reported that plant residues compost significantly increased quality of cucumber like vitamin .C and TSS and when compared to the control (without compost).

2- Yield and its components:

Data in Table (5) show the individual effect of different plant compost levels on yield and its components i.e. fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) of tomato plant . It could be observed that; the values of all aforementioned traits were significantly affected due to the application of different levels of plant compost, except for No. of fruits plant $^{-1}$ which had no significant effect, where the highest values recorded with addition of plant compost at rate of 15 m^3 fed^{-1} (C_3) following with addition of plant compost at rate of 10 m^3 fed^{-1} (C_2) and lately addition of plant compost at rate of 5 m^3 fed^{-1} (C_1). Treatments sequence from top to less was the C_3 (15 m^3 fed^{-1}) > C_2 (10 m^3 fed^{-1}) > C_1 (5 m^3 fed^{-1}).

The statistical analysis of the data presented in Table (5) indicate that spraying boron element at the rate of 50.0 and 100 mg B L^{-1}significantly increased the yield and its components i.e. fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) of tomato plant .The data indicate that the spraying of 100 mg B L^{-1} (B_2 treatment) produced higher values of all above mentioned parameters than that obtained for the B_0 and B_1treatments. Treatments sequence from top to less was the B_2 (100 mg B L^{-1}) > B_1 (50 mg B L^{-1}) > B_0 (0.0 mg B L^{-1}). Data of the same Table indicated that the tomato plants treated with phosphorin (I_1) had the highest values of fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) comparing with untreated plants (I_0).

Data presented in Table (6) indicate that the interaction effect between plant compost, boron element and inoculation on fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) of tomato plant of tomato plants , where the application of plant compost at a rate of 15 m^3 fed^{-1} (C_3) with the application of boron at a rate of 100 mg L^{-1} (B_2) under inoculation (I_1) produced higher values of above mentioned parameters ,while the lowest values were recorded at the control treatment [C_0 (without plant compost) × B_0(without B foliar application) ×I_0 (without inoculation)].

Also, the data show that spraying boron at the rate of 100 mg B L^{-1} (B_2) with inoculation (I_1) gave higher values at any level of plant compost compared to that same plant compost level without both boron application and inoculation. Generally, the highest values were at (C_3 B_2 I_1) treatment, it were 6.87, 22.33, 50.90 and 1134.67 for fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) of tomato plant of tomato plants, respectively, while the lowest values were at control treatment (C_0 B_0I_0), it were 4.25, 16.00, 40.57 and 786.67 for fruits dry matter (%), No. of fruit $plant^{-1}$, fresh weight of fruit (g $plant^{-1}$) and total yield (g $plant^{-1}$) of tomato plant of tomato plants, respectively. In this concern, many authors proved that plant compost, phosphorine, boron and their interaction affected fruit yield of tomato (Mohd *et al*., 2002; Kumar *et al*., 2007; Ghorbani *et al*., 2008; El-Tohamy *et al*., 2009 ; Ekinci *et al*., 2015; Athokpam *et al.* (2016); Marajan *et al.* (2017) and Harris and Puvanitha, 2018). Besides, Mahmoud *et al*. (2009) stated that plant residues compost increased early and total yield of cucumber fruits . Also, These results are supported by the findings of (Meena, 2015), suggested that superior results of boron treatments to participate a beneficial role during cell division, nucleic acid synthesis, uptake of calcium and transport of carbohydrates. It also plays an important role in flowering and fruit formation (Alpaslan and Gunes 2001, Meena, 2015 and Harris and Puvanitha, 2018). The present results are in agreement with those obtained by (Tonfack *et al*., 2009). Also, the results of yield and its components of tomato were in harmony with the results of Patil *et al*. (2008) who suggested that the application of boric acid of 100 ppm resulted in maximum fruit yield of tomato (30.50 t ha^{-1}). Direct and residual effect of organic manures significantly increased the yield and quality of tomato fruit compared to no manure application (Kavitha *et al.,* 2010). Also, our results are agree with Kamal *et al*. (2018) who indicated that PSB significantly increased tomato fruits per plant and yield.

Table 4 : Interaction effects between compost, phosphorin and foliar spraying with boron on acidity(%), lycopene(%), TSS (%),total sugars (%),total carbohydrates (%) and V.C (mg/100g) in tomato fruits at harvest stage.

Treatments			Acidity	Lycopene	TSS	T. Sugar	T. Carbohydrates	V.C
			%					mg/100g
Control			**1.08**	**9.34**	**4.33**	**3.47**	**37.02**	**27.82**
C_1 (5 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	1.06	9.53	4.45	3.55	37.18	28.07
		I_1 (with inoculation)	0.85	11.18	5.28	4.45	38.72	30.57
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	1.00	10.09	4.68	3.87	37.71	28.95
		I_1 (with inoculation)	0.78	11.71	5.51	4.74	39.26	31.43
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	0.96	10.27	4.77	3.97	37.87	29.19
		I_1 (with inoculation)	0.76	11.91	5.60	4.87	39.42	31.72
C_2 (10 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	1.04	9.72	4.52	3.67	37.34	28.37
		I_1 (with inoculation)	0.83	11.34	5.32	4.58	38.88	30.86
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	0.94	10.45	4.86	4.08	38.04	29.46
		I_1 (with inoculation)	0.74	12.09	5.67	4.97	39.64	32.00
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	0.90	10.88	5.04	4.27	38.39	30.03
		I_1 (with inoculation)	0.70	12.28	5.76	5.06	39.78	32.28
C_3 (15 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	1.01	9.88	4.60	3.77	37.53	28.64
		I_1 (with inoculation)	0.81	11.53	5.42	4.66	39.06	31.13
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	0.92	10.63	4.97	4.17	38.22	29.75
		I_1 (with inoculation)	0.67	12.44	5.85	5.18	39.95	32.55
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	0.89	10.98	5.12	4.37	38.57	30.32
		I_1 (with inoculation)	0.64	12.62	5.96	5.26	40.13	32.82
LSD $_{at\ 5\%}$			**0.04**	**0.12**	**0.06**	**0.06**	**0.07**	**0.14**

Table 5 : Effect of compost, phosphorin and foliar spraying with boron on yield and its components of tomato plant.

Treatments	D.M fruits %	No. of fruit plant^{-1}	Average fruit weight (g plant^{-1})	Total yield g plant^{-1}
Compost level				
C_1 (5 m^3 fed^{-1})	5.62	19.78	45.30	968.67
C_2 (10 m^3 fed^{-1})	5.98	19.72	46.80	1003.11
C_3 (15 m^3 fed^{-1})	6.21	20.72	47.81	1055.61
LSD $_{\text{at 5\%}}$	**0.04**	**n.s**	**0.13**	**5.87**
Boron level				
B_0 (0.0 mgL^{-1})	5.48	19.39	44.88	975.28
B_1 (50 mgL^{-1})	6.03	20.00	46.69	998.67
B_2 (100 mgL^{-1})	6.30	20.83	48.33	1053.44
LSD $_{\text{at 5\%}}$	**0.05**	**0.98**	**0.09**	**4.89**
Phosphorin application				
I_0 (without inoculation)	5.55	19.67	45.48	967.81
I_1 (with inoculation)	6.32	20.48	47.79	1050.44
LSD $_{\text{at 5\%}}$	**0.04**	**0.58**	**0.08**	**5.08**

Table 6 : Interaction effects between compost, phosphorin and foliar spraying with boron on yield and its components of tomato plant.

Treatments			D.M fruits %	No. of fruit plant^{-1}	Average fruit weight/g	Total yield g plant^{-1}
Control			**4.25**	**16.00**	**40.57**	**786.670**
C_1 (5 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	4.57	18.00	42.60	884.670
		I_1 (with inoculation)	5.54	19.00	44.67	982.330
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	5.40	19.67	44.07	925.330
		I_1 (with inoculation)	6.15	20.33	46.73	1002.33
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	5.67	20.33	45.63	970.670
		I_1 (with inoculation)	6.40	21.33	48.10	1046.67
C_2 (10 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	5.15	19.33	43.93	921.670
		I_1 (with inoculation)	6.02	19.67	46.00	1021.67
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	5.65	19.33	45.77	952.670
		I_1 (with inoculation)	6.40	20.00	48.03	1031.67
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	5.95	19.67	47.20	1005.00
		I_1 (with inoculation)	6.72	20.33	49.87	1086.00
C_3 (15 m^3 fed^{-1})	B_0 (0.0 mgL^{-1})	I_0 (without inoculation)	5.35	20.00	45.10	971.670
		I_1 (with inoculation)	6.22	20.33	46.97	1069.67
	B_1 (50 mgL^{-1})	I_0 (without inoculation)	6.00	19.67	46.70	1001.00
		I_1 (with inoculation)	6.60	21.00	48.87	1079.00
	B_2 (100 mgL^{-1})	I_0 (without inoculation)	6.20	21.00	48.30	1077.67
		I_1 (with inoculation)	6.87	22.33	50.90	1134.67
LSD $_{\text{at 5\%}}$			**0.11**	**1.730**	**0.240**	**15.2500**

Conclusion

According to the obtained results in this investigation, tomato c.v 'Super strain B' treated with compost before planting at a rate of 15 m^3 fed^{-1} and sprayed with boron element at a rate of 100 mg L^{-1} under inoculation with phosphorien was the best treatment that could be recommended to obtain the highest yield as well as improve fruit quality, especially TSS%, lycopene % and vitamin C of tomato fruit in Delta area and other regions with similar agro-climate conditions.

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