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EFFECT OF THE INTERACTION BETWEEN AZOTOBACTER INOCULATION; ORGANIC AND MINERAL FERTILIZATION ON TOMATO; (*Lycopersicon esculentum* Mill.).

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ABSTRACT

A pot experiment was conducted at El-Mansoura laboratory of plant nutrition; Agric. Res. Center, during the tow seasons of 2008 and 2009 In order to evaluate the effects of Azotobacter inoculation with and without organic and mineral fertilization on yield and chemical composition of tomato plants.

A factorial experiment in the form of complete randomize block design with three replicates has been used. NPK fertilizers were added at the 0,50,75 and 100% of the recommended dose for tomato crop once with inoculation by Azotobacter and the other without inoculation. All treatments were investigated in the presence and absence of organic manure (FYM) giving a total of 16 treatments. Results revealed that inoculation of tomato seedlings with Azotobacter sp. in combination with the rates of NPK fertilizers either with or without FYM significantly gave higher magnitudes of plant growth, yield and its component and chemical composition parameters than the uninoculated treatments. Raising NPK applied levels to 100% of the RD gave insignificant difference during both seasons. In addition, stimulation effect was happened due to using FYM combined with the same rates of NPK fertilization either in the presence or absence of Azotobacter inoculation but the rates of increases over the control treatment were more pronounced during both seasons. The intermediate levels of NPK; 50%+Azotobacter+FYM, seemed adequate and was associated with the highest mean values for the previously mentioned traits.

INTRODUCTION

Fertilizer applications have a major role in growth, yield and chemical composition of tomato plants. In the management of tomato crop the application of fertilizers have a major role for germination and growth. Although these fertilizers contribute a lot in fulfilling the nutrient requirement of vegetable crops but there regular, excessive and unbalanced use may lead to health and ecological hazards, depletion of physiochemical properties of the soil and ultimately poor crop yields. The problems of nutrient drain from the soil are becoming so acute that it is beyond the capacity of any single fertilizer to accept the challenge of appropriate nutrient supply. (*Mahato et al.; 2009*)

These fertilizers not only affect the soil but also influence the characteristics and the product of the crop. Fertility of the soil increases due to the continuous use of the fertilizers but it also reduces the crop productivity. The main reason of reduction in crop productivity is due to soil pollution. Soil pollution is caused due to the use of inorganic fertilizers, pesticides, and other chemicals etc. *(Badoni; 2006)*

Organic matter additions, in arid and semi-arid soils, can increase soil productivity by improving physical and chemical properties. (*El-Ghamry and El-Nagar; 2001)*

In recent years, biofertilizers have emerged as a promising component of intergrating nutrient supply system in agriculture. In this field, many experiments were conducted to study the effect of biofertilizers alone or in combination with other chemical fertilizers*. (Fisinin et al.; 1999. Ghosh et al.; 2000. Kader et al.; 2002 and seema et al.; 2000)*

The evolution of stable and productive soil on the mine spoils requires active microbial populations for effective energy flow and nutrient cycling. This can be achieved either by introducing beneficial microorganisms by way of inoculation or by in-creasing the microbial activity by the incorporation of amendments. *(Rao & Tak; 2001)*

Azotobacter species are free-living, aerobic heterotrophic diazotrophs that depend on an adequate supply of reduced C compounds such as sugars for energy*. (Kennedy et al. 2004)*

Azotobacter is used as a biofertilizer in the cultivation of most crops. Azotobacter is an obligate aerobic diazotrophic soil- dwelling organism with a wide variety of metabolic capabilities, which include the ability to fix atmospheric nitrogen by converting it to ammonia. Azotobacter naturally, fixes atmospheric nitrogen in the plant rhizosphere.P2

They also produce polysaccharides. These are free living bacteria which grow well on a nitrogen free medium. These bacteria utilize atmospheric nitrogen gas for their cell protein synthesis. (*Gonzalea et al.; 1997*)

Besides, nitrogen fixation, Azotobacter also produces thiamin, riboflavin, indole acetic acid and gibberellins. When Azotobacter is applied to seeds, seed germination is improved to a considerable extent, so also it controls plant diseases due to above substances produced by Azotobacter (*Kader et al.; 2002)*

The present investigation was imposed to study the effects of Azotobacter inoculation in combination with the level of N, P and K fertilization in the presence and absence of organic manure on the growth, fruit yield and chemical composition of tomato plant.

MATERIALS AND METHODS

A pot experiment was set up at El-Mansoura laboratory for plant nutrition; Agric. Res. Center. Dakahlia governorate during two successive summer seasons of 2008 and 2009 to recognize the effects of inoculation with Azotobacter spp.

In combination with various NPK levels on growth, fruit yield and chemical composition of tomato plants grown in the presence and absence of organic manure.

The experimental design was factorial arrangements in the form of randomize complete block design with 3 replicates. The following treatments were used:

Four treatments of NPK fertilizers at the levels of 0, 50, 75 and 100% from the recommended doses by the Ministry of Agriculture for tomato plants (90, 26.2 and 62.3kg.fed^{-1} for N,P and K ; respectively) were used twice, once with inoculation by Azotobacter and the other without inoculation. All treatments were investigated in the presence and absence of organic manure (FYM) giving a total of 48 pots.

Calcium nitrate (15%N), calcium super phosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) were the respective N, P and K sources and were applied at three doses after 3,7 and 10 weeks from transplanting.

48 large plastic pots (25x40 cm diameters) were filled with 15 kg air dried soil. The experimental soil was collected from the upper layer of a special farm near El-Mansoura city and analyzed for some chemical and physical properties according to the published (procedures*; Page; 1982 and Klute;1986*). Results of analysis are shown in Table 1

Table 1. Some physical and chemical properties of the experimental soil in the tow growing seasons.

seasons	Mechanical analysis				T. class	EC dS m^{-1} soil paste extract	p^H 1:2.5 suspension	$CaCO_3$ %	OM %	SP %	Available nutrients , ppm		
	Coarse sand %	Fine sand%	Silt %	Clay %							N	P	K
2008	1.8	28.1	32.6	37.5	Loamy	3.42	7.92	2.95	1.86	48	37	4.7	315
2009	2.3	27.6	33.9	36.2	Loamy	3.16	8.13	3.01	2.05	46	41	3.9	340

Farmyard manure (FYM) as a source of organic manure was taken from the station of Animal production, Fac.of Agric., Mansoura Univ. Half of the experimental pots were mixed with; (15 $m^3.fed^{-1}$) of FYM as recommended by the Min.of Agric. and irrigated with water to reach the saturation percentage. Then, left for a month to elucidate the damage on seedlings and their roots resulted from the heat of decomposition. Some chemical properties of FYM as described by *Jackson; 1967* were presented Table 2.

Table 2: some chemical properties of FYM during both seasons of the experiment

Season	O.M %	C %	N%	C/N	P%	K%	pH 1:5	E.C 1:10
2008	57.6	33.5	1.41	23.8	0.46	1.09	8.77	4.65
2009	55.8	32.4	1.29	25.1	0.33	0.95	8.93	4.87

Pure culture of *Azotobacter chroococcum* was kindly provided from unit of biofertilizers, Fac. Agric., Ain shams Univ., Cairo, Egypt. The inoculant contained 10^6 colony farming unit (CFU) of Azotobacter spp. in 1ml of liquid suspension. Seedlings of tomato plant cv. Castle Rock were inoculated by dipping the roots for 2 minutes in the liquid suspension of Azotobacter bacterial suspension (10^6 CFU). Then seedlings were transplanted in the pots on 5 and 7 February, 2008 and 2009, respectively. The uninoculated seedlings were dipped in distilled water (control). Suspension of Azotobacter (10^6 CFU) was applied into the pots after 20 days from transplanting three times at the rate of 20 ml/pot with a 7 days intervals.

The pots were watered to 70 % water- holding capacity and were maintained at this moisture content by watering to the constant weight every 5-7 days. All other practical agriculture was carried out as recommended by the Min. of Agric. For tomato plant.

During growing seasons the following data were recorded:

1- Vegetative growth parameters:

45 days after transplanting, plant height, No of leaves, No of branches and leaves dry matter g/plant were calculated.

2- Yield and yield components

Five picking with 5 days intervals were harvested starting after 70 days from transplanting to determine the number of fruits/plant, average fruit weight; (gm) and total yield; g/plant.

3- Fruit quality

A random sample of fruits was chosen from each treatment at the 3rd picking to determine the titratable acidity, total soluble solids (TSS) and vitamin-C; as outlined in *A.O.A.C (1992)*. Percentage of dry matter, as well, was calculated after drying fruit at 70°C.

4- Chemical composition

Leaf sample after 80 days from transplanting, and fruit samples were taken from the 5th picking were randomly chosen; dried and ground for chemical determinations. The dried leaves and fruits samples were wet digested using sulpuric-percloric acid mixture (Peterburgski*; 1968*). Nitrogen, Phosphorus and Potassium contents were determined according to (*Jackson; 1967*).

Appropriate analyses of variance were performed using MSTAT-C software (Freed, 1988). Mean of treatments were compared using new list significant differences (NLSD) as described by (Waller *and Duncan; 1969)*.

RESULTS AND DISCUSSION

- **Results**

1- plant growth parameters :

The growth parameters of tomato plants expressed as plant height; cm, No. of leaves and branches per plant and leaves dry weight; g.plant-1 as affected by mineral fertilization, Azotobacter inoculation and farmyard manure are presented in Table; 3.

Data reveal that application of N, P and K fertilizers up to the rate of 75% from the recommended doses (RD) for tomato plants either in the presence and absence of farmyard manure (FYM) significantly increased all the aforementioned traits over the control treatment in both seasons. Raising

NPK applied rates to 100 % from RD one appeared to be approximately similar to that of 75% RD with no significant affect during both seasons.

Data in Table; 3. show that inoculated tomato seedlings with Azotobacter sp. in combination with the rates of NPK fertilizers either with or without FYM significantly gave higher magnitudes of plant height, number of branches and leaves, and leaves dry weight; g.plant-1 than the uninoculated treatments. The intermediate levels of NPK; 50%+Azotobacter+FYM, seemed adequate and was associated with the highest mean values for the previously mentioned traits. Moreover, an application of NPK fertilizer up to 75 or 100% RD did not reflect any significant response on earliness traits. In the 1st season; the highest mean values; 53.90, 6.33, 42.66 and 19.77 cm for plant height, No of leaves.Plant^{-1}, No of branches.plant^{-1} and leaves dry matter weights; g.plant^{-1}, respectively were realized at the best combined treatment; 50%NPK+AZ. +FYM, while the lowest one was obtained from the control treatment. The same trend was realized in the second season.

Table 3: Means of plant height (cm), No. of branches plant^{-1}, No. of leaves plant^{-1} and leaves dry matter (g plant^{-1}) as affected by the interaction between NPK, FYM and Azotobacter inoculation during both seasons of 2007 and 2008.

Treat. Char. seasons			Plant height (cm)		No. of branches/plant		No. of leaves/plant		leaves dry matter (g/plant)	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	0	0	33.30	33.63	2.33	2.67	23.00	23.33	12.86	12.99
		AZ.	36.37	36.73	3.33	3.67	26.33	26.00	13.56	13.70
	FYM	0	39.07	39.46	2.67	3.00	27.33	27.67	15.1	15.28
		AZ.	42.53	42.96	3.67	4.00	30.00	30.33	15.95	16.12
50% RD	0	0	37.33	37.89	4.00	4.00	27.00	27.33	14.28	14.49
		AZ.	46.23	46.93	5.67	6.00	38.45	38.67	17.39	17.65
	FYM	0	43.00	43.65	3.67	4.67	31.40	22.33	16.22	16.46
		AZ.	53.90	54.71	6.33	6.33	42.66	43.33	19.77	20.07
75% RD	0	0	42.13	43.19	4.00	4.33	30.00	30.33	15.08	15.45
		AZ.	49.13	50.37	5.67	6.00	38.45	38.33	17.52	17.95
	FYM	0	45.93	47.08	4.33	4.67	33.00	33.33	16.77	17.19
		AZ.	53.40	54.74	6.00	6.33	42.81	42.00	19.65	19.94
100% RD	0	0	42.20	44.06	4.33	4.67	31.11	31.33	16.01	16.01
		AZ.	49.73	50.73	5.67	6.33	38.66	38.33	18.01	18.01
	FYM	0	46.10	47.02	4.67	5.33	34.66	34.33	16.86	17.40
		AZ.	53.73	53.79	6.33	6.33	42.66	41.67	19.61	19.57
LSD. at 5%			**0.65**	**0.85**	**0.38**	**0.52**	**0.25**	**1.15**	**0.20**	**0.25**

AZ.: Azotobacter FYM: Farmyard manure RD: Recommended doses

2- Yield and its components :

Fruit dry matter (%), No of fruit per plant, average fruit weight; (g) and total yield;(g.plant^{-1}) are shown in Table 4

Except for number of fruits. plant $^{-1}$ which had no significant effects; all the above characters were significantly increased due to the application of NPK fertilizers at the rates of this investigation either separately or in combination with Azotobacter inoculation and/or farmyard manure.

The different comparisons illustrated in Table 4 indicate the increasing NPK applied from 50 to 75 and, further to 100%; RD significantly increased the total yield and its components. The highest mean values for the previously mentioned traits were found to be associated with the addition of 100% RD from NPK fertilizers. In addition, the same trend was realized due to treating the plants with FYM combined with the same rates of NPK fertilization, but the rate of increase over the control treatment were more pronounced during both seasons of the experimentation.

Table 4 : Means of D.M percentage, No. of Fruits/plant, Fruits weights (gm) and total yield (g/plant) as affected by the interaction between NPK, FYM and Azotobacter inoculation during both seasons of 2007 and 2008.

Treat.	Char. / seasons		D.M %		No. of Fr./plant		F.weight gm		T.yield g/plant	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	0	0	3.86	3.74	18.33	18.15	37.54	36.79	702	695
		AZ.	4.34	4.21	16.92	16.75	41.23	40.41	790	782
	FYM	0	4.32	4.21	18.56	18.19	44.25	43.59	773	769
		AZ.	5.29	5.16	23.33	22.86	53.92	53.11	968	963
50% RD	0	0	4.49	4.36	19.36	19.17	42.05	41.21	815	807
		AZ.	6.22	6.03	19.78	19.58	59.63	58.44	1155	1143
	FYM	0	4.77	4.65	19.33	18.94	48.88	48.15	883	879
		AZ.	7.92	7.72	19.95	19.55	81.60	80.38	1498	1491
75% RD	0	0	5.10	4.95	20.05	19.85	47.12	46.18	937	928
		AZ.	6.69	6.49	21.44	21.23	61.75	60.52	1247	1235
	FYM	0	6.38	6.22	19.66	19.27	52.13	51.35	1009	1004
		AZ.	8.16	7.96	20.27	19.86	79.24	78.05	1549	1541
100% RD	0	0	5.38	5.22	20.16	19.96	49.20	48.22	998	988
		AZ.	6.73	6.53	21.45	21.24	62.43	61.18	1266	1253
	FYM	0	6.57	6.41	20.25	19.85	53.19	52.39	1066	1061
		AZ.	8.45	8.24	21.33	20.90	70.15	69.10	1390	1383
LSD. at 5%			**0.08**	**0.40**	**N.S**	**N.S**	**0.70**	**0.068**	**73.5**	**71.66**

The comparisons among the means of the various combined treatments of NPK rates, FYM and Azotobacter inoculation are listed in Table 4 reflects significant differences between the average values of fruit yield and its components.

The most important character ; total fruit yield in the 1st season increased by 12.5,41.8,33.1 and 26.9% at the respective of 0,50,75 and 100% NPK separately and 25.2,69.7,53.6 and 30.4% under the same rates of NPK with FYM as a result of inoculation seedlings with Azotobacter over those uninoculated plants. Such effect was happened in the 2nd season of 2009.

3- Chemical composition

Data reveal that; an application of N, P and K fertilizers at the rates of 50, 75 and 100% from the recommended doses for tomato plant significantly increased N, P and K contents in the leaves and fruits of tomato plants over the control treatment during both seasons. Such effect was true either in the presence and absence of organic manure; FYM, but the average values of N, P and K for the plants received FYM were more than the untreated plants.

Moreover, raising NPK rates to 100% RD had no significant effect on the values of N, P and K in the leaves and fruits of tomato as compared to the same values for the treatment of 75% RD (Table 5 and 6)

Table 5: N, P and K percentage in the dry matter of tomato leaves as affected by the interaction between NPK, FYM and Azotobacter inoculation during both seasons of 2008 and 2009.

Treat.	seasons	Char.	N% leaves 1st	N% leaves 2nd	P% leaves 1st	P% leaves 2nd	K% leaves 1st	K% leaves 2nd
Control	0	0	1.54	1.56	0.349	0.352	1.66	1.67
		AZ.	1.65	1.67	0.364	0.367	1.71	1.73
	FYM	0	1.83	1.84	0.373	0.447	1.95	1.97
		AZ.	1.94	1.96	0.428	0.432	2.02	2.04
50% RD	0	00	1.73	1.76	0.396	0.402	1.82	1.84
		AZ.	2.12	2.16	0.453	0.463	1.98	2.01
	FYM	0	1.95	1.98	0.450	0.457	2.06	2.09
		AZ.	2.41	2.45	0.514	0.521	2.25	2.28
75% RD	0	0	1.83	1.88	0.422	0.432	1.91	1.96
		AZ.	2.23	2.28	0.470	0.481	2.05	2.10
	FYM	0	2.02	2.07	0.470	0.482	2.12	2.18
		AZ.	2.49	2.55	0.523	0.536	2.29	2.34
100% RD	0	0	1.90	1.94	0.440	0.449	1.97	2.01
		AZ.	2.26	2.31	0.490	0.499	2.10	2.17
	FYM	0	2.07	2.11	0.480	0.490	2.15	2.20
		AZ.	2.56	2.61	0.531	0.542	2.30	2.34
LSD. at 5%			**0.08**	**0.07**	**0.002**	**0.020**	**0.06**	**0.04**

Table 6: N, P and K percentage in the dry matter of tomato fruits as affected by the interaction between NPK, FYM and Azotobacter inoculation during both seasons of 2008 and 2009.

Treat.	seasons	Char.	N% 1st	N% 2nd	P% 1st	P% 2nd	K% 1st	K% 2nd
Control	0	0	1.68	1.70	0.259	0.261	2.66	2.69
		AZ.	1.80	1.82	0.274	0.277	2.71	2.74
	FYM	0	1.97	1.99	0.305	0.308	3.13	3.16
		AZ.	2.12	2.14	0.322	0.326	3.20	3.23
50% RD	0	00	1.84	1.87	0.298	0.302	2.82	2.87
		AZ.	2.25	2.28	0.377	0.383	3.01	3.06
	FYM	0	2.09	2.12	0.340	0.345	3.21	3.26
		AZ.	2.56	2.60	.0429	0.436	3.42	3.47
75% RD	0	0	1.97	2.02	0.323	0.331	2.96	3.04
		AZ.	2.34	2.40	0.393	0.402	3.12	3.20
	FYM	0	2.19	2.24	0.358	0.367	3.30	3.38
		AZ.	2.61	2.68	0.437	0.448	3.47	3.56
100% RD	0	0	2.03	2.09	0.340	0.347	3.03	3.11
		AZ.	2.41	2.50	0.406	0.414	3.21	3.28
	FYM	0	2.24	2.28	0.370	0.377	3.31	3.38
		AZ.	2.66	2.71	0.440	0.448	3.48	3.55
LSD. at 5%			**0.08**	**0.08**	**0.019**	**0.025**	**0.08**	**0.12**

Data in the same Tables; 5 and 6, also indicate that inoculation of tomato seedlings with Azotobacter sp. combined the rates of NPK fertilization significantly resulted in higher N, P and K contents in the leaves and fruits of tomato plant than those obtained for the plants treated with NPK rates only. On the other hand, the average values of N, P and K contents were more pronounced and remarkable due to using Fym in combination with NPK rates and Azotobacter inoculation. In this connection; the highest mean values of N,P and K % in the fruits of tomato plants respectively ; 2.66, 0.440 and 3.48% in the 1st season and 2.61, 0.542 and 2.34 % in the 2nd season were associated with the treatment of; 100% NPK+FYM+Azotobacter. While, the lowest one was connected with the plants received NPK only. The same trend was realized in the leaves of tomato plants during both seasons.

4- Fruits nutritional value:

Ascorbic acid (V.C), total soluble solids (T.S.S) and titratable acidity contents of fruits of tomato plants as affected by NPK-fertilization, FYM and Azotobacter inoculation are presented in Table7.

Table 7: Total soluble solids (TSS %), Acidity (%) and Ascorbic acid (V.C) (mg/100g) as affected by the interaction between NPK, FYM and Azotobacter inoculation during both seasons of 2008 and 2009.

Treat. seasons		Char.	TSS%		Acidity %		V.C mg/100g Juice	
			1st	2nd	1st	2nd	1st	2nd
Control	0	0	4.51	4.55	0.59	0.60	26.16	26.42
		AZ.	4.60	4.65	0.65	0.66	26.81	27.08
	FYM	0	5.31	5.36	0.47	0.48	12.73	12.85
		AZ.	5.42	5.47	0.76	0.77	31.54	31.85
50%	0	00	4.80	4.87	0.67	0.68	27.96	28.38
		AZ.	5.31	5.39	0.99	1.00	31.17	31.64
	FYM	0	5.46	5.54	0.79	0.80	31.78	32.26
		AZ.	6.03	6.12	1.13	1.15	35.39	35.92
75%	0	0	5.00	5.13	0.76	0.78	29.11	29.84
		AZ.	5.37	5.50	0.98	1.00	31.53	32.32
	FYM	0	5.55	5.63	0.84	0.86	32.34	33.15
		AZ.	5.97	6.03	1.09	1.12	35.03	35.91
100%	0	0	5.17	5.24	0.77	0.79	30.02	30.62
		AZ.	5.46	5.51	0.98	0.99	31.96	32.60
	FYM	0	5.62	5.73	0.86	0.87	32.62	33.27
		AZ.	5.93	6.05	1.06	1.08	34.73	35.42
LSD. at 5%			N.S	N.S	0.04	0.03	1.22	1.50

Obtained data indicate that the means of the various combined treatments of NPK, FYM and Azotobacter reflected significant difference between the values of the fruits nutritional values, except for TSS% which had no significant difference during both seasons of the experiment.

With respect to the effect of NPk-fertilization it can be noticed from the data in Table; 8 that, solely addition of NPK fertilizers at the rate of 75% RD was superior for increasing the average values of V.C mg.100gm-1 and titratable acidity %. Treating the soil with FYM before sowing combined with the same rates of NPK-fertilization has been recorded more increase for the previously mentioned traits than those obtained for NPK only. Either in the presence or absence of FYM; the difference between the average values of V.C and acidity due to increasing the rate of NPK-fertilizers from 75 to 100% RD did not reach to the level of significance during both seasons.

The combined treatments which included NPK, FYM and inoculation with Azotobacter sp. were considered the best and optimum fertilization treatment. The highest mean values ; 35.39 & 35.92 mg.100g^{-1} for VC and 1.13 & 1.15 % for acidity in the 1st and 2nd seasons, respectively were connected with the treatment of 50% NPK+ Az. + FYM.

- **Discussion**

The above mentioned results clearly showed that the combined treatment which included FYM, NPK and mixed with Azotobacter aided in attainment of well developed plant, highest values of N, P and K and the best quality for tomato fruits and to the role of non-symbiotic N-fixing bacteria; Azotobacter in production of phyto-hermones or improving the availability and acquisition or by both, which promoted the vegetative growth to go forward.

In addition, the beneficial effects of Azotobacter inoculation might be attributed to the importance of this bacteria in fix the atmospheric nitrogen and increase the availability of nutrients in soil, consequently enhance absorb elements by the plant.

These results completely correspond to published findings by (*Monib et al.; 1990, El-Gamal; 1996 and Barakat and Gabr; 1998),*who studied the effect of Azotobacter inoculation in combination with N-fertilizer levels;0,50,100 and 150 kg.fed-1 and found that tomato growth was greatly improved by inoculation with Azotobacter combined N-fertilization at the rate of 100 kg.fed-1; which recorded the heavier shoot dry weight, more number and weight of fruits.plant-1 and the highest contents of N,P and K%

The improving effects of Azotobacter on fruit quality, P and K contents can be related to the role of N2-fixing bacteria in secreting chelater substances, as organic acids which are important for solubilization of springly soluble inorganic P. Moreover, the hormonal exudates of Azotobacter sp. can modify root growth, morphology and physiology, resulting in more absorption of N, P and K from the soil.

These results matched well with those of (*Martin et al; 1989 and Iagnow et al.; 1991)* who indicated that Azotobacter spp. produced adequate amounts of indole acetic acid and cytokines, which increased the surface area per unit root length and were responsible for root hair branching with an eventual increases in acquisition of nutrients from the soil.

The results of the study have proved that organic manure; FYM stimulate the activity of Azotobacter, while mineral fertilization in higher doses; 70 or 100 % from the recommended one inhibited the activity of these bacteria.

These findings in the present study could be supported by the previous studies of *(Kenedy et al; 2004 and Olga et al.; 2009*) who concluded that organic manure stimulates the growth of Azotobacter sp. mineral fertilization in higher doses inhibited the growth of these bacteria.

Conclusion:

Under the same conditions of this investigation it can be concluded that; inoculation of tomato seedlings with Azotobacter sp. in the presence of FYM is beneficial for minimizing the rate of NPK fertilizers to be 50% from the recommended one to realize the best quality and the heights yield for tomato fruits.

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تأثير التفاعل بين التلقيح البكتيري بالأزوتوباكتر والتسميد العضوي والمعدني على نباتات الطماطم .

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أجريت تجربة أصص في الصوبة الزراعية الخاصة بمعمل بحوث تغذية النبات بالمنصورة – مركز البحوث الزراعية خلال الموسمين 2008 ، 2009 م. بهدف دراسة تأثير بكتريا الأزوتوباكتر في وجود او عدم وجود تسميد العضوي والمعدني على المحصول والتركيب الكيماوي لنبات الطماطم .

تم تنفيذ تجربة عاملية مصممة في قطاعات كاملة العشوائية باستخدام 3 مكررات وقد اشتملت كل تجربة على 4 معاملات من التسميد المعدني (NPK) عبارة عن نسبة من الموصى به لكل نوع من السماد لنبات الطماطم (صفر،75،50، 100 %) حيث أن المعدلات الموصى بها هي 90، 26.2 ،62.3 كجم من النيتروجين والفوسفور والبوتاسيوم على الترتيب – وقد استخدمت هذه المعاملات مرتين مره بدون تلقيح بكتيري ةالأخرى في وجود التلقيح بالأزوتوباكتر – وتم دراسة جميع المعاملات في وجود وعدم وجود السماد البلدي ... وبذلك يصبح اجمالي عدد المعاملات المدروسة 16 معاملة.

أوضحت النتائج ان تلقيح شتلات الطماطم بأزوتوباكتر مقترنة بوجود معدلات التسميد المعدني من (NPK) سواء في وجود أو عدم وجود السماد البلدي قد أعطى قيما أعلى معنويا لصفات النمو والمحصول ومكوناته والتركيب الكيماوي من تلك التي تم الحصول عليها في حالة عدم التلقيح البكتيري . زيادة معدل التسميد المعدني (NPK) الى 100% من الموصى به اعطى قيما مشابهة تقريبا لتلك التي تم الحصول عليها باستخدام معدل 75% من الموصى به إضافة الى عدم تأثير معنوي وقد وضح ذلك خلال موسمي النمو.

إضافة الى ما تقدم فقد حدث تاثير مشجع نتيجة لإستخدام السماد البلديي متحدا مع نفس معدلات التسميد المعدني (NPK) سواءا في وجود او غياب التلقيح البكتيري بالأزوتوباكتر وكان معدل الزيادة بالنسبة لمعاملة الكونترول أكثر وضوحا خلال موسمي التجربتز. كما أوضحت الدراسة أن المستوى المتوسط من (NPK)+ أزوتوباكتر+السماد البلدي يعتبر أنسب معاملة وقد سجل اعلى القيم بالنسبة لجميع الصفات موضوع الدراسة .

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