

EFFECT OF ORGANIC AND BIOFERTILIZERS APPLICATION AS COMPARED TO CHEMICAL FERTILIZERS ON: 2- CHEMICAL COMPOSITION, YIELD AND FRUIT QUALITY OF TOMATO PLANTS

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ABSTRACT

The effects of mineral, organic and biofertilizers on tomato plants "Castle Rock cv" were studied at Kaha Vegetable Research Station, Horticultural Research Institute during the two successive summer seasons of 1997 and 1998. Data included plant contents from N, P, K, fruit yield and its components and the physical and chemical fruit characters. Organic manure with biofertilizers resulted in significant increases in N, P contents of tomato plants as compared with the control (100 NPK recommended) followed by the 25 % and 50 % of the recommended mineral fertilizers. Chicken manure at 15 m³ / fed plus biofertilizers significantly increased early and total yield comparing with 100 % NPK mineral fertilizer.

Fruit dry matter %, reduced and total sugars contents, N, P content of fruits were increased by applying chicken manure plus biofertilizers followed by 25 % and 50 % from the recommended minerals plus biofertilizers. Thus, it can be recommended that, the 15 m³ / fed chicken manure plus biofertilizers produced high total yield with the best quality of tomato fruits. Similar positive results were achieved by using 25 % and 50 % from the recommended NPK plus biofertilizers.

INTRODUCTION

Increasing plant productivity and improving fruit quality are important aims for tomato growers and consumers. To achieve high harvests, most farmers are applying intensive and non-rational rate of mineral fertilizers. Most of these fertilizer elements are either fixed in the soil or leached to pollute the environment.

The present work aims to evaluate the use of biofertilizers (as a biological technique) and organic chicken manure for reducing the rates of mineral fertilizers applied for tomato.

With respect to the effect of biofertilizer in single application or in the presence of mineral fertilizer on tomato plant composition, it was found that application of biofertilizer strains in the presence of one-third of the basal dose of NPK increased nitrogen and phosphorus content (Gomaa, 1989).

In addition, Awad (1998) working on tomato using 50 % and Hewedy (1999b) using 75 % of NPK recommended fertilizer and enriching tomato transplants with multi biofertilizers obtained the highest N-P contents in tomato organs comparing with the recommended NPK rate.

Concerning the effect of biofertilizers on tomato fruit yield, Radwan (1983) and Bashan *et al.* (1989) obtained significant increment from the plants inoculated with *Azospirillum* combined with *Bacillus megatherium*.

Radwan (1983) reported also that the dry matter as well as contents of tomato fruits increased significantly as a result of biofertilization. Some reports indicated that the highest fruit yield was obtained from tomato plants inoculated with biofertilizer and fertilized by 50 % of the recommended N rate (Subbiah, 1990; Shahaby *et al.*, 1993).

Moreover, Awad (1998) reported that all biofertilized treatments on tomato plants in the presence of 50 % from the recommended NPK produced the highest number of fruits as well as the highest fruit yield, contained significant increment from dry matter, N-P contents comparing with non-biofertilized and receiving NPK fertilizer only. Hewedy (1999a) reported that the highest number of fruit per plant and the heaviest fruits as well as early and total fruit yield and fruit characters, i.e. total soluble solids, fresh thickness, fruit dry matter content were obtained as a result of inoculated tomato transplants with phosphorein, Hewedy (1999b) showed that the highest values of number of fruits per plant, average fruit weight, early and total yield as well as fruit dry matter, TSS, flesh thickness were recorded from plants inoculated with dual or multi biofertilizers when plants were treated with 75 % of recommended NPK chemical fertilizer comparing with the control treatment which received 100 % of NPK recommendation, while fruit firmness and vit. C content were not affected.

Applying organic manure to different soil types led to an increase of NPK concentration in plant organs and was considered as good source of plant nutrients supply. In this respect, Manishi *et al.* (1996) working on tomato found an increase in concentration and uptake of N, P and K in different plant organs.

Concerning organic manuring and interaction between nitrogen fixing bacteria and phosphobacteria on chemical composition of tomato, Kostov *et al.* (1991) and Awad (1998) found that biofertilized tomato plants plus compost or chicken manure application increased N-P contents in plant organs as well as nutrients uptake. On peanut, El-Saadany and Abdel-Rassoul (1999) found significant increase in phosphorus uptake by plants due to phosphorein and organic manure application.

Several investigators showed that adding organic manure as a single application or combined with biofertilizers induced significant increment on yield and its quality of tomato (Montassar, 1987; Kostov *et al.*, 1991; Awad, 1998).

MATERIALS AND METHODS

Two field experiments were carried out at Kaha Vegetable Research Station, Horticultural Research Institute, during summer seasons of 1997 and 1998. It aimed to study the effect of some different sources of fertilizers, i.e. mineral, organic and biological, in single or combined application on chemical composition, yield and fruit quality of tomato.

Tomato seeds cv. Castle Rock were sown in the nursery on 8th and 10th of January and transplanting took place on 2nd and 4th of March in both 1997 and 1998 seasons, respectively. The treatments of the experiment were arranged in a complete randomized block design with four replications. The

plot area was 12 m² and contained 3 rows (each row was 4 m in length and 1 m in width),.

The experiment included 21 treatments as the following:

- 1- 25 % NPK recommended + biofertilizer (1)^{1*}
- 2- 50 % NPK recommended + biofertilizer (1)
- 3- 75 % NPK recommended + biofertilizer (1)
- 4- 25 % NPK recommended + biofertilizer (2)*
- 5- 50 % NPK recommended + biofertilizer (2)
- 6- 75 % NPK recommended + biofertilizer (2)
- 7- 25 % NPK recommended + biofertilizer (3)*
- 8- 50 % NPK recommended + biofertilizer (3)
- 9- 75 % NPK recommended + biofertilizer (3)
- 10- 10m³ Organic manure + biofertilizer (1)
- 11- 15m³ Organic manure + biofertilizer (1)
- 12- 10m³ Organic manure + biofertilizer (2)
- 13- 15m³ Organic manure + biofertilizer (2)
- 14- 10m³ Organic manure + biofertilizer (3)
- 15- 15m³ Organic manure + biofertilizer (3)
- 16- 10m³ Organic manure only
- 17- 15m³ Organic manure only
- 18- Biofertilizer (1) only
- 19- Biofertilizer (2) only
- 20- Biofertilizer (3) only
- 21- 100 % NPK recommender chemical fertilizer (control)

The amount of mineral fertilizers and the time of applications are shown in Table (1).

Concerning the biological fertilizer a mixture of "*Bacillus megaterium*" phosphate dissolving bacteria under the commercial name of "phosphorein", *Azotobacter inoculum* nitrogen fixing bacteria under the commercial name of "rhizobacterin" and a mixture of P dissolving and nitrogen fixing bacteria under the commercial name of "microbien" at the three rates i.e. each at 1 kg, 2 kg and 3 kg / fed were mixed with moist sand and added in site transplanting holes, then the transplants were planted and directly irrigated after covering the holes. Other cultural practices were carried out according to the recommendations of Ministry of Agriculture.

¹ * Biofertilizer(1): mixture of 1kg phosphorein+1kg microbien+1kg rhizobacterin
Biofertilizer(2): mixture of 2kg phosphorein+2kg microbien+2kg rhizobacterin
Biofertilizer(3): mixture of 3kg phosphorein+3kg microbien+3kg rhizobacterin

Table (1) : Amount of mineral fertilizers (kg/fed.) during one season at rates of 25%, 50%, 75% and 100% of the recommended mineral fertilizers for tomato.

Fertilizers type	Fertilizer rate	Amount of fertilizers (kg/fed)			Total amount (kg/fed)
		After 20 days from transplanting	After 45 days from transplanting	After 65 days from transplanting	
Ammonium sulphate 20.5% N	25 %	48.78	48.78		97.56
	50 %	97.56	97.56		195.12
	75 %	146.39	146.34		292.68
	100 %	195.12	195.12		390.24
Ammonium nitrate 33 % N	25 %			30.30	30.30
	50 %			60.61	60.61
	75 %			90.91	90.91
	100 %			121.21	121.21
* Calcium super-Phosphate 15.5% P ₂ O ₅	25 %				75.58
	50 %				145.16
	75 %				217.74
	100 %				290.32
Potassium sulphate 48% K ₂ O	25 %	25	25		50
	50 %	50	50		100
	75 %	75	75		150
	100 %	100	100		200

* Calcium superphosphate was added during soil preparation.

The organic manure was applied per plot during soil preparation. The chemical analysis of the chicken manure are shown in Table (2).

Table (2): The chemical properties of the chicken manure during 1997 and 1998 seasons.

Analysis fraction	1997	1998
pH	5.35	5.41
Available nitrogen ppm	8033	7833
Available K ₂ O ppm	792	754
Available P ₂ O ₅ ppm	1794	1677

Plant chemical composition

The fine powder of leaves, branches and stems from 4 plants chosen randomly from each plot 75 days from transplanting was wet digested for the nitrogen, phosphorus and potassium analysis. Nitrogen was estimated according to the method described by modified micro-kjeldahl (Jackson, 1973). Phosphorus was determined colorimetrically as described by Jackson

(1973), while potassium was determined using flame photometer according to Brown and Lillaland (1946).

Fruit yield and its components

Early yield was calculated as yield of the first two pickings; mid-season yield as yield of the third and fourth pickings; late yield as yield of the two last picking, i.e. fifth and sixth pickings and total yield as the total yield of the six pickings .

Fruit physical characters

Ten fruits at the red ripe stage from the second picking were randomly chosen from each plot and the following data were recorded:

- a) Average fruit weight.
- b) Fruit length and diameter were measured by using a caliper.
- c) Fruit shape "fruit length / fruit diameter" L/D.
- d) Fruit firmness, using portable pressure tester.
- e) Fruit flesh thickness was measured by using a caliper.

Fruit chemical composition

Random samples of 10 fruits at the red ripe stage from each plot of the second picking were chosen and the following data were recorded:

- a) Ascorbic acid: It was determined using 2,6-dichloro-phenol indophenol (fruit juice as mg/100 ml. juice) method as described in A.O.A.C. (1990).
- b) Titratable acidity: Titratable acidity was determined by titration against NaOH using phenolphthalein as indicator according to the method described in A.O.A.C. (1990).
- c) Fruit TSS "total soluble solids" percent was measured using a hand refractometer.
- d) Dry matter percentage: It was determined by allowing 100 gm fresh fruits to dry in a hot air oven at 70 °C until constant weight.
- e) Fruit N, P and K contents: The fine powder fruit dry matter was digested for the available nitrogen, phosphorus and potassium analyses as mentioned in plant chemical composition determination.
- f) Reducing, non-reducing and total sugars of tomato fruits in gm/100 gm dry weight were determined using the methods described by Dubois *et al.* (1956).

Data were statistically analyzed according to Snedecor and Cochran (1980). The differences between treatment means were tested using Duncan's multiple range test, (Duncan, 1955).

RESULTS AND DISCUSSION

Plant chemical composition

The effects of mineral and organic fertilizers in individual application or combined with the biofertilizers and biofertilizers alone on NPK content of tomato plants are shown in Table (3). Results show that there were significant differences among the fertilizers treatments in the concentrations of N,P and K in plant tissues.

Table (3): Effect of mineral, organic and biofertilizers on NPK plant contents as percent of dry matter at summer seasons of 1997 and 1998.

Treatments	Characters	Season 1997			Season 1998		
		N %	P %	K %	N %	P %	K %
25% NPK recommended + biofertilizer (1)*		2.683 k	0.2717 g-i	1.431 bc	2.780 fg	0.2500 ef	1.333 a
50% NPK recommended + biofertilizer (1)		3.063 g-i	0.2845 f-h	1.427 bc	3.203 b-e	0.2717 cd	1.222 bc
75% NPK recommended + biofertilizer (1)		3.059 g-i	0.2760 g-i	1.399 b-d	2.996 d-f	0.2502 ef	1.155 de
25% NPK recommended + biofertilizer (2)*		3.297 c-h	0.2587 i	1.594 a	3.061 c-f	0.2203 g	1.344 a
50% NPK recommended + biofertilizer (2)		3.403 b-e	0.3230 b-d	1.472 ab	3.223 b-e	0.2974 ab	1.240 b
75% NPK recommended + biofertilizer (2)		2.803 i-k	0.3273 bc	1.368 b-f	2.896 e-g	0.2888 bc	1.138ef
25% NPK recommended + biofertilizer (3)*		3.183 d-h	0.2760 g-i	1.32 b-g	3.003 d-f	0.2589 de	1.227 bc
50% NPK recommended + biofertilizer (3)		3.488 a-d	0.2760 g-i	1.372 b-e	3.143 e-g	0.2459 ef	1.202 b-d
75% NPK recommended + biofertilizer (3)		3.083 f-i	0.2931 e-g	1.287 c-h	3.297 a-d	0.2845 bc	1.173 c-e
10m ³ organic manure + biofertilizer (1)		3.383 b-f	0.3102 c-e	1.293 c-h	3.387 a-c	0.2760 cd	0.9723 hi
15m ³ organic manure + biofertilizer (1)		3.524 a-c	0.3359 b	1.288 c-h	3.263 a-e	0.2974 ab	1.072 g
10m ³ organic manure + biofertilizer (2)		3.041 h-j	0.3017 d-f	1.081 ij	3.277 a-d	0.2717 cd	0.9964 h
15m ³ organic manure + biofertilizer (2)		3.610 ab	0.3744 a	1.197 f-j	3.550 ab	0.3102 a	0.9730 hi
10m ³ organic manure + biofertilizer (3)		3.103 e-i	0.2845 f-h	1.125 h-j	3.323 a-d	0.2717 cd	1.001h
15m ³ organic manure + biofertilizer (3)		3.764 a	0.3273 bc	1.246 d-i	3.614 a	0.3102 a	1.061 g
10m ³ organic manure only		3.297 c-h	0.2330 j	1.046 j	3.283 a-d	0.1861 h	0.8807 j
15m ³ organic manure only		3.223 c-h	0.2589 i	1.185 g-j	3.383 a-c	0.2203 g	0.9335 ij
biofertilizer (1) only		2.763 jk	0.2803 f-i	1.205 e-j	3.643 g	0.2502 ef	1.022 gh
biofertilizer (2) only		2.863 i-k	0.2717 g-i	1.187 g-j	3.243 a-e	0.2459 ef	1.082 fg
biofertilizer (3) only		3.303 c-h	0.2632 hi	1.134 h-j	3.290 a-d	0.2329 fg	1.083 fg
100% of recommended chemical fertilizer (control)		3.363 b-g	0.2589 i	1.399 b-d	3.212 b-e	0.2410 ef	1.238 b
F test		* *	* *	* *	* *	* *	* *

* Biofertilizer (1): mixture of 1kg phosphoren + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphoren + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphoren + 3kg microbien + 3kg rhizobacterin / fed.

It is clear that tomato plants received chicken manure at a rate of 15 m³/fed and inoculated with the mixture of phosphorein, rhizobacterin and microbien at the three rates used contained the highest concentrations of N and P comparing with other treatments followed by 10 m³ manure fertilizer plus biofertilizer as well as manure only at 15 m³/fed. It is obvious from Table (3) also that there were insignificant differences among 25 %, 50 % or 75 % of NPK plus biofertilizers except 25 % NPK plus biofertilizer at the lowest rate on N content as well as biofertilizers only in the concentration of N and P plant contents.

On the contrary, the highest concentration of K was found in the plants fertilized by mineral NPK at different percentages used plus biofertilizers at the three rates, while the lowest values of K contents were found in the plants fertilized by chicken manure and biofertilizers whether separately or in combination.

The increment in N, P concentration in tomato plants might be due to the increases in the available N, P and K soil composition (Dawa *et al.*, 2000) which facilitate plant uptake of these elements. For the effect of organic manure, several investigators found that more nitrogen uptake by plants occurred with organic matter addition to soil (Antoun *et al.*, 1992). Increased solubility of phosphorus as well as micro nutrients was found also (Ali, 1993).

Concerning the effect of organic manure plus biofertilizers on plant chemical composition, the results showed that plant N and P contents were increased by organic fertilizer application. Meanwhile the plants treated with the biofertilizers showed significant increases in N-P content than the untreated plants. These results could explain the role of phosphate dissolving bacteria in converting P fixed form to be soluble ready available for plant nutrition. The highest N content was obtained with the highest dose of organic fertilizer plus inoculation with biofertilizers, this result may be due to the N supplementary effect of N fixing bacteria and the role of the bacteria in the production of auxins (Zahir *et al.*, 1997) and gibberellic like substances that promoted the plant root growth which absorbed more N as reported by Strzelezyk and Pokojaska-Burdziej (1984). Moreover, application of combined N has been reported to increase the microbial production of PGR_s (El-Essaway *et al.*, 1984). Obtained results are in agreement with those reported by Gomaa (1989), Kostov *et al.* (1991), Manishi *et al.* (1996), Awad (1998) and Hewedy (1999b).

Fruit yield and its components

Data in Table (4 a, b & c) revealed that adding chicken manure or 25 %, 50 % from the recommended NPK of tomato in the presence of biofertilizers phosphorein, rhizobacterin and microbienes as well as the recommended NPK mineral fertilizer or chicken manure only at the high rate, i.e. 15 m³/fed, exerted a marked effect on tomato yield determined as early mid, late and total yield.

It is obvious that, data obtained on fruit yield, early, mid, late and total yield per plant, per plot and per feddan as effected by chicken manure at rate of 15 m³/fed followed by 10 m³ per feddan as well as 25 % and 50 % from the

recommended NPK in the presence of biofertilizers used in this experiment showed the same pattern to that obtained on plant N, P and K chemical composition. However, the increment in early yield by adding the previous favourable treatments did not reach to the significant level comparing with the recommended NPK alone. However, 15 m³ chicken manure in the presence of biofertilizers, i.e. mixture of phosphorein, rhizobacterin and microbien at the three rates used produced significant increment in the late and total fruit yield.

The obtained data indicate also that, as in general, there were non-significant increments between using 25 %, 50 % plus biofertilizers or 10 m³ chicken manure plus biofertilizers as well as 15 m³ manure only comparing with the recommended mineral fertilizer (control) in the forms i.e. early, mid-season, late and the total.

The lowest significant yields, i.e. early, mid, late and total per plot or per feddan, were recorded under the treatments of biofertilizers alone as well as 75 % NPK in the presence of biofertilizers. In this regard, several investigators reported that applying biofertilizers alone without stimulative rates from mineral fertilizers (25 %, 33 % or 50 %) from the recommended chemical fertilizers or organic manures was less effective than using recommended rates from NPK (Gomaa, 1989; Awad, 1998).

The total yield of tomato plants was increased by 14.62 % and 21.01 % in 1997 and 1998 seasons respectively by adding chicken manure at rate 15 m³/fed and enriching tomato seedlings with the phosphorein, rhizobacterin and microbien mixtures at a rate of 3 kg for each /fed comparing with the control, i.e. received the recommended NPK only.

The favourable effect of 15 m³ chicken manure treatments in presence of biofertilizers and 10 m³ as well as 25 % or 50 % from the normal NPK rate in the presence of biofertilizers also might be attributed to the stimulative effect of these treatments on increasing N, P and K concentration in tomato plant tissues as shown in Table (3) and the best flowering characters, i.e. number of clusters per plant, number of flowers and fruits per plant as well as the increment of fruit set percentage as mentioned by Dawa *et al.* (2000) since the increments in all these characters were positively reflected on tomato yields, i.e. early, mid-season, late and the total.

The obtained results are in harmony with those reported by Montasser (1987) and Awad (1998) on tomato using high rates from organic manure. El-Saadany, 1999 on peanuts using organic manures plus biofertilizers and also by (Radwan (1983), Bashan *et al.*, 1989a), Awad (1998) and Hewedy (1999a) using biofertilizer in the presence of different percentages from mineral fertilizers.

Fruit quality

5- Fruit physical characters:

Data in Tables (4 a&b) revealed that the heaviest fruit were produced from plants received chicken manure at level of 15 m³/ fed or 10 m³/fed and inoculated with the mixture of phosphorein, rhizobacterin and microbien followed by manure fertilizer only then 25 % or 50 %, from the normal level of NPK in the presence of biofertilizers.

However, there were non-significant differences in fruit weight between the control (recommended mineral fertilizer) and manure treatments only as well as 25 % or 50 % NPK in the presence of biofertilizers. Biofertilizer treatments only as well as 75 % NPK level in the presence of the biofertilizers were the lowest significant comparing with all the positive treatments.

Concerning fruit flesh thickness, it was similar to the response of average fruit weight to the same treatments.

The increment in average fruit weight as well as flesh thickness might be attributed to the stimulative effect of the mentioned treatments on plant growth, i.e. number of leaves, leaf area, dry matter content (Dawa *et al.*, 2000) and the highest concentrations of N, P and K in tomato plants (Table 3) which reflected on fruit growth and weight.

Regarding to the other fruit physical characters, i.e. fruit length, width as well as fruit shape and firmness, it is obvious from data in Tables (4 a&b) that the studied fertilizer treatments did not reflect any significant effect on these characters. This finding might be attributed to the hereditary characters of castle rock tomato cultivar.

The obtained results are in agreement with those reported by Kostov *et al.* (1991) and Awad (1998) on tomato, using manure fertilizers and biofertilizers and also by Subbiah (1990), Shahaby *et al.* (1993), Awad (1998) and Hewedy (1999a) on tomato using different NPK percentage in the presence of biofertilizers.

2- Fruit chemical composition:

Data in Table (6 a&b) revealed that fertilized tomato plants with organic chicken manure with inoculation of tomato transplants by mixture of the biofertilizers or added it alone, mineral NPK fertilizer at normal rate alone or 25 %, 50 % from the normal rate of NPK in the presence of biofertilizers increased fruit dry matter content as well as reducing and total sugars at the second pickings, but they did not induce significant effect on Vit. C content, total acidity and total soluble solids. However, there were non-significant differences between the superior mentioned treatments and the control in fruit dry matter content and both reducing and total sugars. The lowest values of dry matter content as well as reducing and total sugars were recorded from the fruits produced from plants fertilized by biofertilizers alone or 75 % from the recommended NPK in the presence of biofertilizers. It was noticed also from data in Tables (6 a&b) that there were non-significant differences between biofertilizer rates used under 25 % or 50 % NPK and 15 m³ chicken manure or 10 m³ manure and under using them alone.

The favourable effect of chicken manure fertilizer and 25 % or 50 % NPK treatments under the presence of biofertilizers on some chemical composition of tomato fruits are in agreement with those reported by Awad (1998) and Hewedy (1999a) on tomato fruits.⁷⁴

Fruit N, P and K composition

Data in Table (7) showed that tomato fruit nitrogen content increased significantly by adding chicken manure at 15 m³/fed and enriching tomato transplants with biofertilizers comparing with the recommended NPK treatment.

Regarding phosphorus content in tomato fruits as affected by the different fertilizer from treatments was similar to nitrogen pattern as affected by the same treatments, as, the fruits produced from plants received chicken manure at 15 m³/fed in the presence of biofertilizers and sometimes 25 % NPK treatment plus biofertilizers contained the highest phosphorus concentration and the lowest one was from the plants inoculated by phosphorein, rihizobacterin and microbien mixtures only.

Concerning potassium concentration in tomato fruits, data in Table (7) indicated that, there was non-significant differences between the recommended NPK fertilizer treatment (control) and favourable chicken manure treatment plus biofertilizers and also 25 % or 50 % NPK treatments plus biofertilizers.

Generally, the fruits produced from plants received chicken manure at a rate of 15 m³/fed plus biofertilizers as well as 50 % or 25 % NPK treatments plus biofertilizers followed by 15 m³ chicken manure only or the recommended mineral fertilizer alone, contained the superior concentrations from N, P and K and this might be attributed to the stimulative effect of these treatments on NPK plant contents as shown in Table (3) which increased by using these treatments. The obtained results are in harmony with those reported by Awad (1998) on tomato and El-Saadany and Abdel-Rasoul (1999) on peanuts, by using organic manures and biofertilizers and also by El-Shal *et al.* (1986) on bean, by using different rates from mineral fertilizer in the presence of different strains from biofertilizers.

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دراسة تأثير الأسمدة العضوية والحيوية على المحتوى الكيميائي والمحصول وصفاته في البسلة مقارنة بالأسمدة الكيميائية

٢- المحتوى الكيميائي والمحصول ونوعية الثمار في نباتات الطماطم

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أجريت تجربتان حقليتان بالموسم الصيفي لعام ١٩٩٧/١٩٩٨ بمحطة بحوث الخضار بقها - معهد بحوث البساتين لدراسة تأثير كل من السماد العضوي والحيوي والمعدني على المحتوى الكيميائي لنباتات الطماطم وكذلك على المحصول الثمري وصفات الثمار الطبيعية والكيميائية وتضمن التسميد الحيوي مخلوط من مركبات الفوسفورين والميكروبيين والريزوباكترين بمعدلات ١ كجم ، ٢ كجم ، ٣ كجم / فدان لكل منهم وتم إضافتها اما منفردة أو مقرونة مع السماد العضوي والمعدني. والسماد العضوي المستخدم هو سماد الدواجن بمعدلين هما ١٠ م^٣ ، ١٥ م^٣ / فدان ، أما السماد المعدني الأزوتي والفوسفور والبوتاسيوم فقد استخدم بأربع مستويات ١٠٠ % وهو المستوى الموصى به (١٢٠ وحدة أزوت + ٤٥ وحدة فوسفور + ٩٦ وحدة بوتاسيوم) كعامل للمقارنة ، أما المستويات الأخرى فكانت ٢٥ % ، ٥٠ % ، ٧٥ % من المستوى الموصى به.

وقد أوضحت النتائج المتحصل عليها أن معاملة السماد العضوي بمعدل ١٥ م^٣ / فدان في وجود مخلوط المركبات الحيوية بمعدل ٣ كجم / فدان لكل منها أدت إلى زيادة محتوى النبات من عناصر الأزوت والفوسفور وأدت إلى زيادة معنوية في محصول الثمار وجودته (وزن الثمار ومحتواها من المادة الجافة والسكريات المختزلة والكلية والنيتروجين والفوسفور ، يلي ذلك معاملة ١٠ م^٣ سماد عضوي في وجود مخلوط المركبات الحيوية ثم معاملة ٥٠ % ، ٢٥ % من من توصية السماد المعدني في وجود مخلوط المركبات الحيوية.

وعليه يمكن التوصية باستخدام معاملة ١٥ م^٣ / فدان في وجود مخلوط مركبات الفوسفورين والميكروبيين والريزوباكترين بمعدل ٣ كجم / فدان لكل منهما لإنتاج أعلى محصول من الطماطم وبنوعية جيدة يلي ذلك معاملات ٥٠ % ، ٢٥ % من توصية السماد المعدني للطماطم في وجود نفس المركبات الحيوية ونفس المعدل المشار إليه.

Table (4a): Effect of mineral, organic and biofertilizers on early and mid fruit yield at summer seasons of 1997 and 1998.

Characters	Early yield				Mid-season yield			
	Per Plot		Per Fed.		Per Plot		Per Fed.	
	1997	1998	1997	1998	1997	1998	1997	1998
Treatments								
25% NPK recommended + biofertilizer (1)*	7.867 a-c	5.967 a-d	3.933 a-c	2.983 a-d	22.30 a-b	16.20 c-f	11.15 a-d	8.10 c-f
50% NPK recommended + biofertilizer (1)	7.067 cd	5.067 de	3.533 c-d	2.533 de	20.57 de	15.07 d-g	10.28 de	7.533 d-g
75% NPK recommended + biofertilizer (1)	4.467 f-h	3.800 e-g	2.233 f-h	1.90 e-g	17.60 fg	12.83 g	8.800 fg	6.417 g
25% NPK recommended + biofertilizer (2)*	5.767 ef	3.083 g	2.883 ef	1.542 g	21.03 de	17.27 b-e	10.52 de	8.633 b-e
50% NPK recommended + biofertilizer (2)	6.100 de	3.133 g	3.050 d-e	1.567 g	20.00 de	17.17 b-e	10.00 de	8.583 b-e
75% NPK recommended + biofertilizer (2)	4.233 gh	2.333 g	2.117 gh	1.167 g	16.33 g	14.67 e-g	8.167 g	7.333 e-g
25% NPK recommended + biofertilizer (3)*	5.433 e-g	3.467 f-g	2.717 e-g	1.733 fg	21.13 de	17.33 b-e	10.57de	8.667 b-e
50% NPK recommended + biofertilizer (3)	5.333 e-h	3.767 e-g	2.667 e-h	1.883 e-g	20.33 d-e	20.10 ab	10.17 de	10.05 ab
75% NPK recommended + biofertilizer (3)	4.067 h	2.767 g	2.033 h	1.383 g	16.97 fg	15.03 d-g	8.483 fg	7.517 d-g
10m ³ organic manure + biofertilizer (1)	7.567 bc	5.333 cd	3.783 bc	2.667 cd	22.30 a-d	16.43 c-e	11.15 a-d	8.217 c-e
15m ³ organic manure + biofertilizer (1)	8.467 ab	5.733 cd	4.233 ab	2.867 cd	23.78 ab	18.07 b-d	11.87 ab	9.033 b-d
10m ³ organic manure + biofertilizer (2)	7.333 b-d	4.900 d-f	3.667 b-d	2.450 d-f	22.13 a-d	17.20 b-e	11.07 a-d	8.60 b-ew
15m ³ organic manure + biofertilizer (2)	9.100 a	7.300 ab	4.550 a	3.650 ab	23.60 a-c	18.07 b-d	11.80 a-c	9.033 b-d
10m ³ organic manure + biofertilizer (3)	8.433 ab	5.833 b-d	4.217 ab	2.917 b-d	21.77b-d	19.03 bc	10.88 b-d	9.517 bc
15m ³ organic manure + biofertilizer (3)	9.067 a	7.400 a	4.533 a	3.700 a	24.17 a	21.80 a	12.08 a	10.90 a
10m ³ organic manure only	5.667 ef	4.867 d-f	2.833 e-f	2.433 d-f	19.13 ef	15.70 d-g	9.567 ef	7.850 d-g
15m ³ organic manure only	6.633 c-e	6.233 a-d	3.317 c-e	3.117 a-d	21.40 c-e	18.07 b-d	10.70 c-e	9.033 b-d
Biofertilizer (1) only	4.20 gh	2.232 g	2.100 gh	1.117 g	17.63 fg	13.23 g	8.817 fg	6.617 g
biofertilizer (2) only	4.200 gh	2.233 g	2.100 gh	1.167 g	17.10 fg	12.80 g	8.550 fg	6.40 g
biofertilizer (3) only	4.60 f-h	2.900 g	2.300 f-h	1.450 g	17.37 fg	13.40 f-g	8.680 fg	6.70 fg
100% of recommended chemical fertilizer(control)	7.933 a-c	6.650 a-c	3.967 a-c	3.325 a-c	21.53 b-d	17.87 b-d	10.77 b-d	8.933 b-d
F test	* *	**	* *	* *	* *	* *	* *	* *

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.

Table (4b): Effect of mineral, organic and biofertilizers on late and total fruit yield at summer season of 1997.

Treatments	Characters	Late yield		Total yield		
		Weight/plot (kg)	Weight /fed (Ton)	Weight/plant (kg)	Weight/plot (kg)	Weight /fed (Ton)
25% NPK recommended + biofertilizer (1)*		8.60 d-g	4.350 d-f	1.338 c-e	38.77 cd	19.433 cd
50% NPK recommended + biofertilizer (1)		8.70 d-f	4.350 d-f	1.297 de	36.337 de	18.163 de
75% NPK recommended + biofertilizer (1)		7.133 h	3.567 h	1.043 gh	29.20 gh	14.60 gh
25% NPK recommended + biofertilizer (2)*		8.333 e-h	4.167 e-h	1.255 ef	35.13 ef	17.57 ef
50% NPK recommended + biofertilizer (2)		8.300 e-h	4.150 e-h	1.229 ef	34.40 ef	17.20 ef
75% NPK recommended + biofertilizer (2)		7.233 gh	3.617 gh	0.993 h	27.79 h	13.90 h
25% NPK recommended + biofertilizer (3)*		8.367 e-h	4.183 e-h	1.248 ef	34.93 ef	17.47ef
50% NPK recommended + biofertilizer (3)		8.567 d-g	4.283 d-g	1.223 ef	34.23 ef	17.12ef
75% NPK recommended + biofertilizer (3)		7.267 gh	3.633 gh	1.011 h	28.30 h	14.149 h
10m ³ organic manure + biofertilizer (1)		9.467 c-e	4.733 c-e	1.405 cd	39.33 cd	19.666 cd
15m ³ organic manure + biofertilizer (1)		10.57 a-c	5.283 a-c	1.527 ab	42.77 ab	21.38 ab
10m ³ organic manure + biofertilizer (2)		3.333 i	4.933 b-d	1.405 cd	32.796 f-g	19.67 cd
15m ³ organic manure + biofertilizer (2)		11.50 a	5.750 a	1.579 a	44.20 a	22.10 a
10m ³ organic manure + biofertilizer (3)		9.933 b-d	4.967 b-d	1.433 bc	40.13 bc	20.064 bc
15m ³ organic manure + biofertilizer (3)		11.00 ab	5.500 ab	1.580 a	44.23 a	22.113 a
10m ³ organic manure only		7.40 f-h	3.700 f-h	1.150 fg	32.197 f-g	16.10 fg
15m ³ organic manure only		8.60 d-g	4.300 d-g	1.308 de	36.63 de	18.317 de
Biofertilizer (1) only		7.033 h	3.517 h	1.031 h	28.863 h	14.43 h
Biofertilizer (2) only		7.367 f-h	3.683 f-h	1.024 h	28.66 h	14.333 h
Biofertilizer (3) only		7.30 f-h	3.650 f-h	1.045 gh	29.26 gh	14.63 gh
100% of recommended chemical fertilizer(control)		9.233 de	4.617 c-e	1.382 cd	38.696 cd	19.354cd
F test		* *	* *	* *	* *	* *

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.

Table (4c): Effect of mineral, organic and biofertilizers on late and total fruit yield at summer season of 1998.

Treatments	Late yield			Total yield	
	Weight/plot (kg)	Weight /fed (Ton)	Weight/plant (kg)	Weight/plot(kg)	Weight /fed (Ton)
25% NPK recommended + biofertilizer (1)*	6.80 e-g	3.40 e-g	1.035 e-g	28.967 f-h	14.483 e-g
50% NPK recommended + biofertilizer (1)	7.30 c-g	3.650 c-g	0.980 g	27.437 h	13.716 g
75% NPK recommended + biofertilizer (1)	5.933 g	2.967 g	0.806 h	22.563 i	11.284h
25% NPK recommended + biofertilizer (2)*	8.033 b-e	4.017 b-e	1.014 fg	28.386 gh	14.192 f-g
50% NPK recommended + biofertilizer (2)	8.233 b-e	4.117 b-e	1.019 fg	28.536 gh	14.267f-g
75% NPK recommended + biofertilizer (2)	6.20 fg	3.10 fg	0.829 h	23.203 i	11.60 h
25% NPK recommended + biofertilizer (3)*	8.667 bc	4.333 bc	1.052 d-g	29.464d-h	14.733 c-g
50% NPK recommended + biofertilizer (3)	8.367 b-d	4.183 b-d	1.151 b-e	32.234 b-f	16.116 b-e
75% NPK recommended + biofertilizer (3)	6.167 fg	3.083 fg	0.856 h	23.964 i	11.983 h
10m ³ organic manure + biofertilizer (1)	7.367 c-g	3.683 c-g	1.041 d-g	29.13 e-h	14.567d-g
15m ³ organic manure + biofertilizer (1)	8.767 bc	4.383 bc	1.163 b-d	32.473 b-e	16.283 b-d
10m ³ organic manure + biofertilizer (2)	7.967 b-e	3.983 b-e	1.074 c-g	30.067 c-h	15.033 c-g
15m ³ organic manure + biofertilizer (2)	9.100 b	4.550 b	1.231 b	34.47 b	17.23 b
10m ³ organic manure + biofertilizer (3)	8.767 bc	4.383 bc	1.201 b	33.63 bc	16.817 b
15m ³ organic manure + biofertilizer (3)	10.63 a	5.317 a	1.423 a	39.83 a	19.917 a
10m ³ organic manure only	6.933 d-g	3.467 d-g	0.982 g	27.50 h	13.75 g
15m ³ organic manure only	7.533 c-f	3.767 c-f	1.137 b-f	31.836 b-g	15.917 b-f
biofertilizer (1) only	5.867 g	2.933 g	0.762 h	21.33 i	10.667 h
biofertilizer (2) only	6.167 f-g	3.083 fg	0.761 h	21.20 i	10.65 h
biofertilizer (3) only	6.467 fg	3.233 fg	0.813 h	22.767 i	11.383 h
100% of recommended chemical fertilizer(control)	8.04 b-e	4.20 b-d	1.176 bc	32.56 b-d	16.458 bc
F test	**	**	**	**	**

* Biofertilizer (1): mixture of 1kg phosphoren + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphoren + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphoren + 3kg microbien + 3kg rhizobacterin / fed.

Table (5a): Effect of mineral, organic and biofertilizers on fruit physical characters at second picking during summer season of 1997.

Treatments	Characters	Fruit weight (gm.)	Fruit length(cm.)	Fruit diameter(cm.)	Fruit shape (L/D)	Fruit firmness	Fruit flesh thickness(cm.)
25% NPK recommended + biofertilizer (1)*		84.0 e-g	5.40	5.03	1.1079	7.73	0.52 cd
50% NPK recommended + biofertilizer (1)		85.5 d-f	5.33	5.07	1.0535	7.17	0.58 a
75% NPK recommended + biofertilizer (1)		73.00 hi	5.17	4.87	1.0619	7.70	0.52 cd
25% NPK recommended + biofertilizer (2)*		85.30 d-f	5.43	5.07	1.0728	7.67	0.53 b-d
50% NPK recommended + biofertilizer (2)		83.00 e-g	5.37	5.10	1.0529	7.37	0.54 a-i
75% NPK recommended + biofertilizer (2)		76.00 f-h	5.27	4.87	1.0868	7.20	0.51 d
25% NPK recommended + biofertilizer (3)*		85.00 d-f	5.50	5.20	1.0601	7.23	0.53 b-d
50% NPK recommended + biofertilizer (3)		85.30 d-f	5.43	5.17	1.0527	7.50	0.58 a
75% NPK recommended + biofertilizer (3)		77.70 f-h	5.23	5.00	1.0467	7.47	0.53 b-d
10m ³ organic manure + biofertilizer (1)		88.70 b-e	5.33	5.17	1.0325	7.57	0.57 ab
15m ³ organic manure + biofertilizer (1)		96.30 a-c	5.53	5.10	1.0868	7.73	0.58 a
10m ³ organic manure + biofertilizer (2)		90.30 a-e	5.27	5.20	1.0131	7.63	0.55 a-d
15m ³ organic manure + biofertilizer (2)		97.70 ab	5.47	5.23	1.0448	7.50	0.57 ab
10m ³ organic manure + biofertilizer (3)		93.70 a-d	5.33	5.07	1.0460	7.90	0.54 a-i
15m ³ organic manure + biofertilizer (3)		99.00 a	5.37	5.50	0.9787	7.63	0.58a
10m ³ organic manure only		91.70 a-e	5.30	5.10	1.0426	7.30	0.55 a-i
15m ³ organic manure only		95.30 a-c	5.43	5.27	1.0317	7.83	0.56 a-c
biofertilizer (1) only		65.00 i	5.33	5.10	1.0482	7.60	0.54 a-i
biofertilizer (2) only		75.70 gh	5.23	4.97	1.0568	7.33	0.52 cd
biofertilizer (3) only		73.70 h	5.07	4.93	1.0268	7.37	0.55 a-d
100% of recommended chemical fertilizer(control)		87.30 c-e	5.33	5.07	1.0546	7.33	0.53b-d
F test		* *	N.S	N.S	N.S	N.S	* *

* Biofertilizer (1): mixture of 1kg phosphoren + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphoren + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphoren + 3kg microbien + 3kg rhizobacterin / fed.

Table (5b): Effect of mineral, organic and biofertilizers on fruit physical characters at second picking during summer season of 1998.

Treatments	Characters	Fruit weight (gm.)	Fruit length(cm.)	Fruit diameter(cm.)	Fruit shape (L/D)	Fruit firmness	Fruit flesh thickness(cm.)
25% NPK recommended + biofertilizer (1)*		88.70 c-e	5.63	5.10	1.105	7.333	0.52 f
50% NPK recommended + biofertilizer (1)		88.00 de	5.67	5.13	1.084	7.667	0.57 a-e
75% NPK recommended + biofertilizer (1)		38.30 e	5.33	5.00	1.067	7.400	0.53 ef
25% NPK recommended + biofertilizer (2)*		94.30 b-d	5.53	5.10	1.086	7.233	0.59 a-c
50% NPK recommended + biofertilizer (2)		88.70 c-e	5.37	5.13	1.046	7.500	0.55 c-f
75% NPK recommended + biofertilizer (2)		82.70 e	5.43	4.87	1.117	7.100	0.55 c-f
25% NPK recommended + biofertilizer (3)*		93.70 b-d	5.50	5.17	1.065	7.500	0.57 a-e
50% NPK recommended + biofertilizer (3)		94.70 b-d	5.50	5.10	1.078	7.067	0.54 d-f
75% NPK recommended + biofertilizer (3)		83.00 e	5.40	5.17	1.046	7.800	0.55 c-f
10m ³ organic manure + biofertilizer (1)		97.70 b	5.77	5.23	1.102	7.733	0.58 a-c
15m ³ organic manure + biofertilizer (1)		98.00 b	5.60	5.30	1.056	7.767	0.60 ab
10m ³ organic manure + biofertilizer (2)		94.30 b-d	5.43	5.13	1.059	7.600	0.61 a
15m ³ organic manure + biofertilizer (2)		97.00 bc	5.30	5.40	0.9810	7.733	0.60 ab
10m ³ organic manure + biofertilizer (3)		92.70 b-d	5.23	5.13	1.019	7.667	0.57 a-e
15m ³ organic manure + biofertilizer (3)		111.0 a	5.33	5.20	1.026	8.000	0.60 ab
10m ³ organic manure only		93.00 b-d	5.37	5.13	1.045	7.800	0.56 b-f
15m ³ organic manure only		97.30 b	5.30	5.27	1.007	7.500	0.60 ab
biofertilizer (1) only		90.70 b-e	5.33	5.07	1.053	7.567	0.53 ef
biofertilizer (2) only		88.70 c-e	5.43	5.10	1.666	7.200	0.59 a-c
biofertilizer (3) only		89.70 b-e	5.33	5.00	1.067	7.600	0.55 c-f
100% of recommended chemical fertilizer(control)		94.70 b-d	5.80	5.23	1.108	7.700	0.55 c-f
F test		* *	N.S	N.S	N.S	N.S	* *

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.

Table (6a): Effect of mineral, organic and biofertilizers on fruit chemical composition at second picking during summer season of 1997.

Treatments	Characters	Dry matter %	Vit. C mg/100ml	Total acidity %	T.S.S (%)	Sugar percentage (% of dry weight)		
						Reducing	Non-reducing	Total sugar
25% NPK recommended + biofertilizer (1)*		6.972 a-c	9.22	0.44	5.37	35.87 g-i	0.93	36.80 h-j
50% NPK recommended + biofertilizer (1)		7.263 a	9.58	0.44	6.0	43.73 a	0.97	44.70 a
75% NPK recommended + biofertilizer (1)		6.302 b-g	9.48	0.43	5.73	41.63 a-c	1.03	42.66 a-c
25% NPK recommended + biofertilizer (2)*		6.825 a-c	9.35	0.46	5.53	40.70 b-d	0.93	41.63 b-e
50% NPK recommended + biofertilizer (2)		6.618 a-d	9.11	0.44	5.50	37.30 e-g	1.00	38.30 f-h
75% NPK recommended + biofertilizer (2)		5.619 e-i	9.63	0.45	5.67	37.80 e-g	1.03	38.83 e-h
25% NPK recommended + biofertilizer (3)*		6.525 a-e	9.41	0.46	6.03	39.33 c-f	1.00	40.33 c-g
50% NPK recommended + biofertilizer (3)		5.858 d-h	10.63	0.44	5.63	33.47 i	0.90	34.37 j
75% NPK recommended + biofertilizer (3)		5.497 g-i	9.89	0.45	5.27	35.83 g-i	1.00	36.83 h-j
10m ³ organic manure + biofertilizer (1)		6.067 c-g	9.91	0.44	5.47	38.60 d-g	1.00	39.60 d-h
15m ³ organic manure + biofertilizer (1)		7.039 ab	10.26	0.44	5.73	41.07 a-d	0.90	41.97 a-d
10m ³ organic manure + biofertilizer (2)		6.225 b-g	9.33	0.45	5.60	39.80 e-g	1.20	41.0 c-f
15m ³ organic manure + biofertilizer (2)		6.423 a-f	9.78	0.44	5.50	36.73 f-h	1.03	37.76 g-l
10m ³ organic manure + biofertilizer (3)		6.374 a-g	9.52	0.45	5.50	43.40 ab	1.00	44.40 ab
15m ³ organic manure + biofertilizer (3)		6.312 b-g	10.19	0.45	5.40	39.97 c-e	1.07	41.04 c-f
10m ³ organic manure only		6.297 b-g	9.29	0.46	5.80	38.27 d-g	1.00	39.27 d-h
15m ³ organic manure only		6.421 a-f	9.74	0.46	5.60	41.77 a-c	0.93	42.70 a-c
biofertilizer (1) only		5.036 hi	9.45	0.48	5.57	34.17 hi	1.00	35.17 ij
biofertilizer (2) only		5.587 f-i	9.46	0.44	5.63	37.73 e-g	1.03	38.76 e-h
biofertilizer (3) only		4.852 l	9.07	0.43	5.87	36.27 g-i	0.93	37.20 hi
100% of recommended chemical fertilizer (control)		6.478 a-f	9.50	0.46	5.70	37.03 e-h	0.93	37.96 g-i
F test		* *	N.S	N.S	N.S	* *	N.S	* *

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.

Table (6b): Effect of mineral, organic and biofertilizers on fruit chemical composition at second picking during summer season of 1998.

Treatments	Characters	Dry Matter %	Vit. C mg/100ml	Total acidity %	T.S.S (%)	Sugar percentage (% of dry weight)		
						Reducing	Non- reducing	Total sugar
25% NPK recommended + biofertilizer (1)*		6.921 a	16.27	0.45	5.70	34.80 e-g	1.07	35.87 e-h
50% NPK recommended + biofertilizer (1)		6.227 a-e	16.48	0.41	5.40	39.37 bc	1.07	40.44 bc
75% NPK recommended + biofertilizer (1)		4.977 g	16.81	0.41	5.33	31.93 hi	1.07	33.00 ij
25% NPK recommended + biofertilizer (2)*		5.621 e-g	16.57	0.45	5.30	35.77 e	1.03	36.80 e-g
50% NPK recommended + biofertilizer (2)		6.020 b-f	16.55	0.45	5.80	34.43 e-g	1.00	35.43 e-h
75% NPK recommended + biofertilizer (2)		5.363 fg	16.67	0.43	5.33	32.93 gi	1.00	33.93 h-j
25% NPK recommended + biofertilizer (3)*		5.813 d-f	16.69	0.46	5.53	34.27 e-g	1.03	35.30 f-h
50% NPK recommended + biofertilizer (3)		6.261 a-e	16.43	0.44	5.80	31.10 i	1.03	32.13 j
75% NPK recommended + biofertilizer (3)		5.442 f-g	16.44	0.45	5.37	31.87 hi	1.03	32.90 ij
10m ³ organic manure + biofertilizer (1)		5.807 d-f	16.56	0.42	5.13	36.33 de	1.03	37.36 de
15m ³ organic manure + biofertilizer (1)		5.854 d-f	16.82	0.43	5.33	40.93 b	1.00	41.93 b
10m ³ organic manure + biofertilizer (2)		6.312 a-e	16.48	0.45	5.27	36.30 de	1.00	37.30 de
15m ³ organic manure + biofertilizer (2)		5.832 d-f	16.24	0.44	5.60	34.50 e-g	0.93	35.43 e-h
10m ³ organic manure + biofertilizer (3)		5.986 b-f	16.28	0.39	5.33	35.63 e	0.97	36.60 ef
15m ³ organic manure + biofertilizer (3)		6.699 a-c	16.65	0.47	5.37	45.00 a	0.97	45.97 a
10m ³ organic manure only		6.348 a-e	16.55	0.44	5.50	34.43 e-g	1.00	35.43 e-h
15m ³ organic manure only		6.030 b-f	16.40	0.45	5.53	34.73 e-g	0.97	35.70 e-h
biofertilizer (1) only		6.557 a-d	16.64	0.43	5.47	35.33 ef	0.93	36.26 e-g
biofertilizer (2) only		5.955 c-f	16.27	0.46	5.23	31.93 hi	0.97	32.90 ij
biofertilizer (3) only		6.750 ab	16.58	0.45	5.27	37.90 cd	1.03	38.93 cd
100% of recommended chemical fertilizer (control)		5.620 e-g	16.68	0.44	5.37	33.47 f-h	1.00	34.47 g-i
F test		* *	N.S	N.S	N.S	* *	N.S	* *

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.

Table (7): Effect of mineral, organic and biofertilizers on NPK fruit contents in the second picking at summer seasons of 1997 and 1998.

Treatments	Characters	1997			1998		
		N %	P %	K %	N %	P %	K %
25% NPK recommended + biofertilizer (1)*		2.783 gh	0.5712 c-e	4.384 a-c	2.763 j	0.4514 ij	4.167 a-e
50% NPK recommended + biofertilizer (1)		3.183 d-f	0.5413 f-i	4.266 a-c	3.143 c-g	0.5541 b-d	4.502 a-d
75% NPK recommended + biofertilizer (1)		2.863 f-h	0.5028 k	4.172 a-c	2.783 ij	0.5712 b	3.854 c-e
25% NPK recommended + biofertilizer (2)*		3.203 d-f	0.5156 ik	4.615 a	2.843 h-j	0.4685 f-j	3.557 ef
50% NPK recommended + biofertilizer (2)		3.283 c-e	0.5499 e-h	4.213 a-c	3.243 b-f	0.4642 g-j	4.577 a-c
75% NPK recommended + biofertilizer (2)		2.543 h	0.5242 h-k	4.142 a-c	3.123 d-g	0.4814 e-i	3.692 d-f
25% NPK recommended + biofertilizer (3)*		3.043 d-g	0.5842 b-d	4.524 ab	3.288 b-e	0.4257 j	4.842 ab
50% NPK recommended + biofertilizer (3)		3.183 d-f	0.5028 k	4.037 bc	3.350 b-d	0.6483 a	4.383 a-e
75% NPK recommended + biofertilizer (3)		2.783 g-h	0.4642 L	4.456 ab	3.049 e-i	0.5028 d-i	3.849 c-e
10m ³ organic manure + biofertilizer (1)		3.243 d-f	0.5028 k	3.915 c	3.170 c-g	0.4172 j	3.704 d-f
15m ³ organic manure + biofertilizer (1)		3.303 cd	0.5926 bc	4.567 a	3.477 b	0.6568 a	4.159 a-e
10m ³ organic manure + biofertilizer (2)		3.290 cd	0.5413 f-i	4.427 a-c	3.070 e-h	0.5199 b-f	2.942 f
15m ³ organic manure + biofertilizer (2)		3.864 ab	0.6055 ab	4.561 a	3.403 bc	0.5584 bc	4.884 a
10m ³ organic manure + biofertilizer (3)		3.203 d-f	0.5284 g-k	4.205 a-c	2.990 f-j	0.4557 h-i	3.735 d-f
15m ³ organic manure + biofertilizer (3)		4.024 a	0.6311 a	4.648 a	3.904 a	0.6568 a	4.471 a-d
10m ³ organic manure only		2.783 gh	0.5028 k	4.177 a-c	2.983 f-j	0.5028 d-i	4.044 b-e
15m ³ organic manure only		2.883 e-h	0.5541 e-g	4.589 a	3.103 d-h	0.5156 c-g	4.109 a-e
biofertilizer (1) only		3.157 d-g	0.5584 d-f	4.461 ab	3.303 b-e	0.5285 b-e	4.144 a-e
biofertilizer (2) only		3.016 d-g	0.4514 L	4.013 bc	2.903 g-j	0.5071 c-h	3.683 d-f
biofertilizer (3) only		3.149 c-g	0.5071 jk	4.438 ab	3.317 b-e	0.5456 b-d	3.901 c-e
100% of recommended chemical fertilizer(control)		3.624 bc	0.5327 f-k	4.148 a-c	3.056 e-h	0.5156 c-g	4.495 a-d
F test		**	**	**	**	**	**

* Biofertilizer (1): mixture of 1kg phosphorene + 1kg microbien + 1kg rhizobacterin / fed.

* Biofertilizer (2): mixture of 2kg phosphorene + 2kg microbien + 2kg rhizobacterin / fed.

* Biofertilizer (3): mixture of 3kg phosphorene + 3kg microbien + 3kg rhizobacterin / fed.