

Effect of Using Bio and Mineral Fertilizers on Growth, Yield and Fruit Quality of Guava Cv. Seedy Montkhab

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ABSTRACT

This work was conducted during 2007 & 2008 growing seasons on selected seedy guava trees (12 years old) grown in sandy soil in El-Maamoura zone in private farm. To study effect of mineral and bio nitrogen fertilizers comparing to traditional nitrogen fertilization on growth, flowering, fruit set %, productivity and leaf and fruit mineral, total carbohydrates content and leaf total chlorophyll.

Data revealed that T₃ (2¼ kg amonium Sulphate + 1 kg super phosphate + 2 kg potassium Sulphate + 150 gm nutrobine) significantly increased number of new shoots in both seasons of study while T₂ (3 kg amonium Sulphate + 1 kg super phosphate + 2 kg potassium Sulphate + 75 gm nutrobine), T₃ (2¼ kg amonium Sulphate + 1 kg super phosphate + 2 kg potassium Sulphate + 150 gm nutrobine) T₄ (1.5 kg amonium Sulphate + 1 kg super phosphate + 2 kg potassium Sulphate + 225 gm nutrobine) significant increased in average shoot length, leaf total chlorophyll, number of flowers, number of fruits and fruit set % in both seasons of study compared with control. T₄ gave the best result in yield of both seasons of study.

T₃, T₄ and T₅ (¾ kg amonium Sulphate + 1 kg super phosphate + 2 kg potassium Sulphate + 300 gm nutrobine) increased fruit weight in first season only, while all treatments did not effected the fruit length, width and firmness in both seasons of study T₃, T₄ improved pulp thickness, while T₃ caused a significant increase in fruit T.S.S. in first season.

Fruit acidity was not affected with all treatments in both seasons of study. T₄ significantly increased V.C. content in both seasons of study.

T₂, T₃ and T₄ gave the highest concentration of N content in leaves in both seasons while T₃ in first season and T₂, T₃ and T₄ in second season gave a significant increase in P leaf content. All treatments increased leaf K content in both seasons of study.

There was a significant increases in fruit nitrogen content with T₃, T₄ treatment due to application of biofertilizers in 2007 and 2008. While phosphorus and potassium contents were not affected with all treatments in both seasons of study.

Application of the combination of N.P.K. and nitrobin improved production and fruit quality of seedy guava. So, we can recommend using biofertilizers with decreasing mineral nitrogen 50-75% to save costs and keep environment unpolluted.

INTRODUCTION

The guava (*psidium guajava*, L.) trees grow well in most climates and in different kinds of soil and give good crops when the condition of soil is well (Bialy, 1960).

Guava is a vitamin C rich fruit and is very popular to the Egyptian consumer because of its suitable price.

The total guava area in A.R.E. is 39664 thousand feddans in 2007 and the annual production is approximately 330791 tons of guava fruits, according to statistics of the Ministry of Agriculture.

The efficiency of N fertilizer used in Egypt is very low due to the leaching of nitrate or ammonia volatilization from the nitrogen fertilizer (Soliman, 2001).

Moreover, using chemical fertilizer increased the environmental pollution.

Biofertilizers are biological preparation that contain primarily potent strains of microorganisms which are safe for human, animal and environment (Ahmed *et al.*, 1997). They are capable of nitrogen fixation (Ruiz-Lozano *et al.*, 1995) as well as enhancing availability of nutrients (Frankenberger and Arshad, 1995).

Using biofertilizers is one of the most particular interests to protect a agro system and to achieve the sustainable agriculture (Herridge *et al.*, 1994)

Biofertilizers application sharing with little amount of chemical fertilizers proved to be efficient for increasing available nutrients besides improving growth and yield of cultivated crops (Abd El-Mouty *et al.*, 2001 and Zaghoul, 2002).

The biofertilizer Nitrobine is produced by the Biofertilizers unit, ARC, Ministry of Agriculture and land Reclamation. Nitrobine contains *Azotobacter chroococcum* and *Azospirillum brasilense* on the same previous carrier (Shalan *et al.*, 2001).

Nitrobine has greater amounts of bacteria which were responsible for fixation of nitrogen by atmosphere. Application of nitrobine achieved the following merits, decreasing the amount of mineral N by 25% and increasing the availability of various nutrients by plant (Subba – Rao, 1984).

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Additionally, the use of biofertilizers increase growth and yield of several fruit trees (Haggag and Azzazy, 1996, Soliman, 2001, Abd El-Hameed, 2002, Osman, 2003, Youssif and Marzouk, 2005 and Abou El-khashab *et al.*, 2006).

This work was subjected to study the effect of nitrobin biofertilizers and different rates of nitrogen mineral fertilizer applied alone or in combinations on growth, leaf mineral content, yield and fruit quality of guava trees grown in sandy soil

MATERIALS AND METHODS

The present study was carried out during 2007 and 2008 seasons on 12 years old guava trees grown in sandy soil in El-Maamoura region east of Alexandria governorate in a private farm and spaced at 5x5 meters apart. Soil characters are listed in Table (1).

All trees in this orchard were annually fertilized with 20m³/ feddan of organic manure in December, 1.5kg/tree ammonium sulfate (20.5%N) in three equal doses in March, May and July, 1kg/tree calcium super phosphate (15.5% P₂O₅) in March and 2 kg/ tree potassium sulphate (48% K₂O) in three doses, 1, ½ and ½ kg, in March, May and July respectively. All trees received the same normal cultural practices commonly adopted in this orchard.

The selected trees were nearly similar in vigor and free from any pathogens. The trees received the different treatments in two seasons as follows:

T₁-control: 1½ kg ammonium sulphate + 1 kg super phosphate+ 2 kg potassium sulphate

T₂: 3 kg ammonium sulphate +1 kg super phosphate +2 kg potassium sulphate + 75gm Nitrobin

T₃: 2¼ kg ammonium sulphate + 1 kg super phosphate +2 kg potassium sulphate + 150gm Nitrobin

T₄: 1½ kg ammonium sulphate + 1 kg super phosphate + 2 kg potassium sulphate + 225gm Nitrobin

T₅: ¾ kg ammonium sulphate + 1 kg super phosphate + 2 kg potassium sulphate + 300gm Nitrobin

T₆: 0 kg ammonium sulphate + 1 kg super phosphate + 2 kg potassium sulphate + 450gm Nitrobin

Ammonium sulphate and Nitrobin divided into 3 equal doses were applied in March, May and July while super phosphate was applied in March. Potassium

sulphate was applied in three doses 1, ½ and ½ kg in March, May and July respectively.

Eighteen trees as uniform as possible were selected for the present study. The treatments were applied and arranged in a randomized complete block design with guard trees, each treatment included three replicates. The following parameters were determined in the two successive growth seasons including number of new shoots/ tree, average shoot length (cm.), average leaf area (cm²), total chlorophyll in leaf, number of flowers, number of fruits, fruits set % and yield (kg/ tree). Fruit and leaf NPK contents were determined.

At the middle of August of both seasons, sample of 20leaves per tree were taken at fixed position on shoots of each tree and washed with tap water and rinsed with distilled water and oven dried at 70°C to constant weight and then ground.

At the harvesting time, (first of September) fruit sample consisting of six fruits per replicate were taken at random for physical & chemical analysis.

Quality of guava fruit included, fruit weight, length, width, firmness, pulp thickness, total soluble solids, acidity, vitamin C and total carbohydrates.

Fruit firmness was determined by Magness and Taylor (1925) pressure tester using a5/16" plunger. Two readings were taken at two different positions on the flesh of each fruit after peeling.

Fruit juice acidity and vitamin C content were determined according to the (A.O.A.C. 1980), percentage of total soluble solids in juice was determined by a hand refractometer. The fresh material of each sample was prepared for determination of total carbohydrates according to Herbert *et al.* (1971).

The samples were washed with tap water and oven dried at 70°C to constant weight then ground. The ground samples of leaves and fruits were digested with sulphuric acid and hydrogen peroxide according to Evenhuis and Dewaard (1980).N and P leaf and fruit contents were colorimetrically determined according to Evenhuis (1976) and Murphy and Riley (1962), respectively. K content was determined against a standard by flame photometer.

At the end of experimental season the total chlorophyll was measured in leaves by using Minolta Chlorophyll

Table 1. Physical and Chemical analysis of the experimental soil

Soil depth	pH	E.C dS/m	Soluble cation mg/liter				Soluble anion Meq/litre			
			Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺	SO ₄ ⁻	CL ⁻	HCO ₃ ⁻	CO ₃ ⁻
0-30	7.74	1.09	3.91	0.31	3.2	1.8	2.9	7.00	1.00	-----
30-60	7.94	0.54	1.73	0.56	1.6	1.2	2.4	2.00	1.00	-----

Meter PAD-502 Minolta camera LTD, Japan according to the method described by Yadava (1988).

Data were statistically analyzed according to Snedecor and Cochran (1990) and L.S.D. test at 0.05 levels was used for comparison between treatments.

RESULTS AND DISCUSSIONS

A. Vegetative growth parameters:

A-1- Number of new shoots/ tree:

The data in (Table2) indicated that, all fertilizer treatments (mineral + biofertilizers), significantly increased the number of new shoots/tree as compared with control except T₆ in first season. This promoting effect on number of new shoots could be due to the increase in total nitrogen fixation and availability in the soil (Rodriguez and Fraga, 1999).

A-2- Average shoot length:

Concerning the effect of fertilization treatments on average shoot length, the obtained results in (Table 2) indicated that, T₂, T₃ and T₄ treatments gave a significant increase in average shoot length in both seasons 2007 and 2008. On the other hand T₅ and T₆ gave no significant effect in both seasons of study.

The increase in plant growth may be attributed to the capability of micro organisms in biofertilizers to produce growth regulators such as auxins, cytokinins and gibberellins which affect growth and nutrient uptake (Soliman, 2001).

These results are in agreement with those obtained by Abou-Taleb *et al.* (2004) on olive, Fatma- Mahmoud (1999) on peach and Abou El-Khashab *et al.* (2006) on guava.

A-3- Average leaf area:

The data presented in (Table 2) showed that, there were no significant differences in the average leaf area among all fertilization treatments in both seasons of study.

The present results are partially in line with those reported by Mahmoud and Mahmoud (1999) on peach, Reddy *et al.* (2003) on mulberry, El. Sayed (2002) on Flame seedless grape and El- Sharkawy and Mehaisen (2005) on guava. They all found that, the microbial fertilization led to improvement in plant vigor and they added nitrogen fixing bacterium led to great promotion in all measured vegetative parameters such as leaf area, plant height, leaf number, shoot growth and shoot length.

B. Total leaf chlorophyll:

Data in (Table2), showed that, the total leaf chlorophyll values in trees of the applied treatments were significantly increased when compared with the control in both seasons of study.

These results are in harmony with those report of Ezz and Nawar(1994) which concluded that, inoculation of sour orange seedlings with mycorrhizal fungi increased total chlorophyll in first season of trial and chlorophyll in the second season. Also Ibrahim *et al.* (2005) contended that, biofertilization increased leaf chlorophyll content of canino apricot. Moreover Reddy *et al.* (2003) on mulberry varieties, Abou El-Khashab (2003) in olive seedlings C.V. (picual) and (El.Naggar and Ramzy, 2005) on Narcissus tazetta (2005) came to the same findings

So, the superiority of microbial biofertilization treatments in increase chlorophyll leaf content could be attributed to the influence of nitrogen fixers bacteria Gabr and Nour El-Dein (2005).

C- Flowering and yield:

C-1- No. of flowers/ tree

The data in Table 3 showed that, all treatments significantly increased the number of flowers per tree in both seasons of study except the 6th treatment in the second season which cause a slight increase compared with control treatment.

The improvement of flowering measurements resulted by biofertilizers application may be attributed to the stimulating effect of the absorbed nutrients on photosynthesis process which certainly reflected positively on measurements of both flowering and fruiting

C-2-Fruit set %:

Fruit set % was not affected by any of the studied treatments in both seasons of study.

C-3- Yield/ tree:

The values of yield per tree either number of fruits or kg/ tree are shown in Table (3). The 4th treatment gave the highest values of yield in both seasons of study while the smallest values was observed in control (T₁). Similar results were consistent with (Youssef *et al.*, 2001), (Zaghloul, 2002), (Akl *et al.*, 1997) and (Mansour, 1998) they reported that biofertilizers such as phosphorien, active dry yeast and nitrobin were very effective in improving the yield.

Table 2. Effect of using chemical and bio fertilizers on Vegetative growth in 2007-2008

Treatments	No. of new shoots per tree		Average shoot length (cm)		Average leaf area cm ²		Total leaf chlorophyll (mg/ 100cm ²)	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	728.3	843.3	30.443	33.067	45.897	49.807	39.330	37.213
T ₂	1490.0	1780.0	39.800	52.090	49.920	47.470	44.410	43.283
T ₃	1891.7	2470.0	41.420	48.337	45.960	53.377	48.103	48.220
T ₄	1619.0	2220.0	38.957	47.047	46.253	51.733	49.683	45.597
T ₅	1438.7	1690.0	35.08	42.513	46.410	50.953	48.743	44.550
T ₆	1240.0	1512.0	30.767	41.287	45.013	41.997	46.670	43.167
L.S.D 0.05	672.46	520.54	8.497	10.297	7.831	12.729	4.291	5.944

Table 3. Effect of using chemical and bio fertilizers or number of fruit/ tree, number of flowers/ tree, fruit set% / tree and yield kg/ tree

Treatments	Number of flowers/tree		Fruit set %		Number of fruits/tree		Yield kg/tree	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	251.33	295.00	75.290	70.403	188.33	208.67	22.95	29.214
T ₂	340.00	375.00	76.15	78.953	259.00	295.33	31.227	42.232
T ₃	384.67	441.00	76.557	77.697	294.00	343.67	36.926	51.626
T ₄	412.67	488.67	82.303	82.373	339.67	385.00	48.402	66.732
T ₅	392.00	443.33	80.263	79.633	314.00	348.67	34.672	56.788
T ₆	367.33	317.67	71.157	76.713	291.33	243.67	32.603	40.157
L.S.D 0.05	35.3	77.606	6.1902	4.4075	29.141	54.975	11.387	8.2323

The improvement of flowering and fruit set % as affected by biofertilizers were noticed with Akl *et al.* (1997), Zaghoul (2002), Abou-Taleb *et al.* (2004) and Abou El-Kashab *et al.* (2006) in guava. They reported that, biofertilizers such as phosphorene and nitrobrein improved flowering and fruit set percentage of fruit trees.

The improving of the yield of guava fruits may be attributed to the increase in average fruit weight (Mansour, 1998) on apple and (Osman 2003) on zaghoul date palm, or may be due to the increase in amino acids content which are considered as a constituent of protein and other compounds that share in development of new tissues (Trawry *et al.*, 1999) and Smith (1998)

NPK+biofertilizers increased cell division and enlargement and consequently increased vegetative growth which reflected on yield (Abd El-Naby, 2000) and (Moustafa 2002).

Many investigators referred to the promotion which occurred in growth due to application of biofertilizers (N₂-fixers) as a result of its effect on increasing the availability of N-fixed and the higher N- uptaken by plants (Subbn Rao 1984).

These results are in agreement with those obtained by (Akl *et al.*, 1997) and (Mansour, 1998) who reported

that, biofertilizers as nitroben were very effective in improving the yield. In addition (Gomez and Munoz, 1998) stated that, biofertilizers did not totally replace mineral fertilization, but they significantly reduce their rates of application.

D- Fruit characteristics:

A- Physical characteristics:

Concerning the effect of treatments on fruit physical properties, the obtained data are listed in Table (5), indicated that the highest value of fruit weight (gm) was found in T₃ and T₄ in first and second seasons, without significant differences when compared with control.

In both seasons of study, all treatments did not significantly effect fruit length (cm), fruit width (cm) and fruit firmness. These results were in line with those obtained by (Yousif and Marzouk, 2005) on guava. They found that fruit length, diameter and firmness were not affected by mineral and biofertilizers.

B- Fruit pulp thickness:

Fruit pulp thickness increased in 3rd and 4th treatments in both seasons of study compared with control (Table 4). These results were in agreement with Abou EL-Kashab *et al.* (2006) on guava they reported that, nitroben + phosphorin increased significantly fruit pulp thickness.

Table 4. Fruit chemical properties in 2007 and 2008

Treatments	Fruit pulp thickness		T.S.S (%)		Acidity (%)		V.C. (mg/ 100 gm flesh)	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	0.905	1.103	5.700	6.1667	1.063	1.181	28.583	35.730
T ₂	1.083	1.396	6.200	6.500	0.922	0.872	39.410	45.777
T ₃	1.356	1.520	6.800	7.8667	0.922	0.927	37.227	53.977
T ₄	1.661	1.536	7.1667	7.700	0.998	1.014	40.340	59.240
T ₅	1.130	1.496	6.3667	6.7000	0.972	0.962	36.263	53.997
T ₆	1.033	1.370	6.300	6.9000	1.101	1.126	28.767	44.247
L.S.D 0.05	0.4044	0.4106	0.7978	0.932	0.430	0.349	4.6013	7.3568

Table 5. Effect of using bio and mineral fertilizers on fruit weight, length, width and fruit firmness in 2007 and 2008 seasons

Treatment per tree per year	Fruit weight (gm)		Fruit length (cm)		Fruit width (cm)		Fruit firmness (lb/in ²)	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	121.87	140.0	7.15	7.50	5.85	5.87	2.836	3.758
T ₂	120.57	143.00	7.83	8.85	6.52	5.86	2.220	3.110
T ₃	125.6	150.22	8.43	9.55	6.08	6.46	3.066	3.133
T ₄	142.50	173.33	8.06	9.04	5.52	6.29	2.766	4.010
T ₅	110.42	162.87	7.67	8.90	5.76	5.06	2.333	3.650
T ₆	111.91	164.80	7.85	8.83	5.86	6.57	2.766	4.660
L.S.D 0.05	28.288	25.069	1.594	2.0714	0.7515	0.7732	1.4478	2.140

E- Fruit chemical properties:**E-1- Total soluble solids (T.S.S):**

Total Soluble Solids content of juice was increased due to the treatment 3rd in first season and treatment 3rd and treatment 4th in second season comparing with control (Table 4).

Yousif and Marzouk (2005) on guava reported that applying 75% mineral fertilizer+ biofertilizers significantly increased T.S.S content. On the other hand Abou El-Kashab *et al.* (2006) reported that, nitroben+ phosphorien reduced significantly T.S.S content in guava and was positively affected by NPK+ Potaseine fertilization.

E-2- Acidity:

No significant differences were noticed for acidity between all treatments in both seasons of study (Table 4). However, Abo El-Kashab *et al.* (2006), found that combination of nitroben+ potaseine treatments on guava increased significantly the acidity%.

E-3- V.C content:

The data in Table (4) showed that, the T₄ gave the highest values of V.C (mg/100ml juice) in both seasons of study with significant differences comparing with control. These results are partially agreement with those obtained by Yousif and Marzouk (2005) on guava, Mansour (1998) on apple. They found that V.C content was significantly increased with biofertilizers. Meanwhile Abou El-Kashab *et al.* (2006) on guava

reported that vitamin C was not influenced with any treatment of mineral+ biofertilizers.

F- Leaf mineral contents:

The data representing the effect of mineral and bio-nitrogen fertilization on leaf mineral content of guava trees are shown in Table (6).

F-1- Nitrogen:

The results showed that T₂, T₃& T₄ significantly increased leaf nitrogen content in both seasons of study.

These results are in line with those obtained by El-Sayed (2002), Abd El-Hameed (2002), Abou-Taleb *et al.* (2004) on olive, Yousif and Marzouk (2005) on guava and Abou El-Khasab *et al.* (2006) on guava. They concluded that microbial biofertilizers increased leaf N content because nitrogen fixers rhizobacteria and AM fungi had a vital role in improving N₂ fixation processes.

Also T₅ & T₆ in both seasons of study did not show a significant effect on leaf nitrogen content. These results may be due to the lack of nitrogen which was applied in low amount in mineral form.

F-2- Phosphorus:

The results showed that T₄ in the first season and T₂, T₃, T₄ in the second season gave significant increase in leaf phosphorus content. These findings are in agreement with those found by Frankenberg and Arshad (1995), Abd El-Hameed (2002), Abou-Taleb *et al.* (2004), Abou El-Khasab *et al.* (2005) and Gaber and Nour El-Dien (2005). They reported that

Table 6. Effect of using bio and chemical fertilizers on guava leaf mineral content N, P, K and total carbohydrates in 2007 and 2008 seasons

Treatments	N %		P %		K %		Total carbohydrates	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	1.733	1.956	0.773	0.713	0.938	0.796	6.980	7.040
T ₂	2.200	2.2667	0.760	0.816	1.660	1.276	7.483	8.056
T ₃	1.933	2.220	0.823	0.906	2.560	2.446	8.320	8.006
T ₄	1.966	2.266	1.046	1.086	1.930	1.473	7.860	7.833
T ₅	1.890	2.137	0.873	0.866	1.640	2.133	8.246	7.843
T ₆	1.400	2.130	0.766	0.676	1.400	1.466	7.873	8.346
L.S.D 0.05	0.2086	0.2278	0.1193	0.0829	0.6977	0.3857	0.6713	0.4409

Table 7. Effect of using bio and chemical fertilizers on guava fruit mineral content N, P, K and total carbohydrates in 2007 and 2008 seasons

Treatments	N %		P %		K %		Total carbohydrate	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	1.433	1.666	0.656	0.683	1.017	1.076	11.626	11.660
T ₂	1.900	2.033	0.670	0.656	1.300	1.766	12.653	13.600
T ₃	1.766	2.00	0.686	0.816	1.160	1.386	13.256	14.980
T ₄	1.633	1.833	0.650	0.726	1.310	1.613	13.746	14.900
T ₅	1.166	1.730	0.760	0.670	1.410	1.326	14.043	14.063
T ₆	1.250	1.500	0.756	0.610	1.353	1.400	16.166	12.980
L.S.D 0.05	0.1778	0.2772	0.1073	0.087	0.3993	0.485	1.0764	1.2854

biofertilizer can increase phosphorous leaf content, this may be due to the bacteria present in the biofertilizers which secretes promoting substances or organic acid that enhance nutrient uptake. In addition, using rhizobacteria may have released phosphate ions which may be effectively taken up through the external arbuscular mycorrhiza mycelium.

F-3- Potassium:

It was appeared that all treatments significantly increased potassium content in leaf except T₆ in first season which gave the lowest value of K content.

These results are in line with those obtained by El-Sayed (2002), El-Sharkawy and Mehasen (2005) on guava, Abou El-Khasab (2005) on guava and Gabr and Nour El-Dien (2005) on Anna apple. They concluded that biofertilizers increased K content of leaves.

G- Fruit mineral content:

G-1-Nitrogen:

The data presented in Table 7 showed that T₂, T₃ and T₄ in both seasons of study significantly increased fruit nitrogen content.

G-2-Phosphorus:

The data showed that all treatments except T₃ in second season did not affect fruit phosphorus content.

G-3-potassium:

No significant differences were obtained in fruit potassium content in both seasons of study as compared with control.

We can attribute that increasing fruit mineral contents may be due to the increasing of nutrient uptake.

H-Total carbohydrates:

Data in Tables 6 and 7 indicated that all treatments except T₂ in the first season significantly increased the total carbohydrates of guava leaves and fruits in both seasons of study.

The obtained results are in agreement with those concluded by Ezz and Nawar (1994), they reported that mycorrhizal inoculation of sour orange seedlings increased leaf and root sugars and carbohydrates concentration in comparison with non infected control. Mycorrhizal colonization increased rate of photosynthesis of sour orange. Mostafa (2002) and Abd El-Monem and Radwan (2003) reported that the biofertilizer play a role in increasing the metabolism processes which reflects on carbohydrates and other compounds.

Gabr and Nour El-Dien (2005) on apple reported that biofertilizers significantly increased Anna apple leaf content of all studied carbohydrates determinations,

and this may be due to increasing the rate of photosynthesis process.

In conclusion, we can say that the combination between mineral nitrogen fertilizers and biofertilizer (nitroben) improved growth, flowering, and fruit set %, fruit quality and yield.

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الملخص العربي

تأثير استخدام الأسمدة الحيوية والمعدنية على نمو وإثمار أشجار الجوافة صنف بذرى منتخب

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الثمرة وقطرها وكذلك صلابة الثمار بالمعاملات في كلا الموسمين والمعاملة 3، 4 أعطت أعلى سمك للثمار في كلا الموسمين. بينما أعطت المعاملة 3 زيادة معنوية في محتوى الثمار من المواد الصلبة الكلية في الموسم الأزل. ولم يتأثر محتوى الثمار من الحموضة بالمعاملات خلال موسمي الدراسة. المعاملة 4 أعطت زيادة معنوية في محتوى الثمار من فيتامين C خلال الموسمين.

محتوى الأوراق والثمار من العناصر:

المعاملات 2، 3، 4 أعطت أعلى نسبة لعنصر النيتروجين في الأوراق خلال الموسمين. المعاملة 3 في الموسم الأول والمعاملة 2، 3، 4 في الموسم الثاني أعطت زيادة معنوية في محتوى الأوراق من الفوسفور بينما أعطت جميع المعاملات زيادة معنوية في محتوى الأوراق من البوتاسيوم في كلا الموسمين.

معاملة 3، 4 أعطت زيادة معنوية في محتوى النيتروجين في الثمار بينما لم يتأثر مستوى الفوسفور والبوتاسيوم في الثمار بجميع المعاملات خلال الموسمين.

محتوى الأوراق والثمار من الكربوهيدرات الكلية:

جميع المعاملات أدت إلى زيادة معنوية في ذلك المحتوى خلال الموسمين.

يمكن التوصية بتخفيض استخدام الأزوت المعدني بنسبة 50- مع استخدام الأزوت الحيوي للحصول على محصول جيد وجودة ثمار مرتفعة كما أنه يوفر المال ويحافظ على البيئة.

أجرى هذا البحث على أشجار جوافة بذرية صنف بذرى منتخب عامي 2007، 2008 عمر 12 سنة منزرعة في أرض رملية في مزرعة خاصة بهدف دراسة تأثير التسميد النيتروجيني بجانب التسميد الحيوي (النترولين) على النمو والتزهير وعقد الثمار والإنتاج من الثمار ومحتوى الثمار والأوراق من العناصر الغذائية والكربوهيدرات الكلية وكانت النتائج كالآتي:

معاملة 3 (2.25 جم كبريتات أمونيوم + 1 كجم سوبر فوسفات + 2 كجم كبريتات بوتاسيوم + 150 جم نيتروين) أعطت زيادة معنوية في عدد الأفرع الحديثة في كلا الموسمين، بينما معاملة 2 (3 كجم كبريتات أمونيوم + 1 كجم سوبر فوسفات + 2 كجم كبريتات بوتاسيوم + 75 جم نيتروين)، معاملة 3 (2.25 كجم كبريتات أمونيوم + 1 كجم سوبر فوسفات + 2 كجم كبريتات بوتاسيوم + 150 جم نيتروين)، معاملة 4 (1.5 كجم كبريتات أمونيوم + 1 كجم سوبر فوسفات + 2 كجم كبريتات بوتاسيوم + 225 جم نيتروين) أعطت زيادة معنوية في كل من متوسط طول الأفرع ومحتوى الأوراق من الكلوروفيل الكلي في كلا الموسمين بينما لم تتأثر المساحة الورقية بالمعاملات. وكذلك أعطت نفس المعاملات زيادة معنوية في عدد الأزهار وعدد الثمار ونسبة العقد في كلا الموسمين. ومعاملة 4 أعطت أعلى محصول في كلا الموسمين.

صفات الثمار:

المعاملات 3، 4، 5 أعطت أعلى وزن للثمرة في الموسم الأول فقط ولم يكون هناك أى تأثير في الموسم الثاني بينما لم تتأثر طول