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Effect of Organic and Bio N-fertilization on Growth, Productivity of Fig Tree (*Ficus Carica,* L.).

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Abstract: The present investigation was carried out during 2007 and 2008 seasons to study the effect of organic and bio N-fertilization on growth, productivity of fig trees grown in Ras – Elhekma, Matrouh Governorate. The aim of the present study was to investigate the combined effects of organic manure and bio N-fertilization on growth, productivity of fig tree. Applying poultry manure + azotobacter and poultry manure + azospirillum gave the highest number of new shoot, shoot length, leaf area, total chlorophyll, number of fruit per shoot, yield, fruit volume and fruit length in the two seasons. Also, the same treatments gave the highest TSS, acidity, total and reducing sugars content and leaf minerals content (N, P, K, Ca and Mg %) in the two seasons. The results clarified that poultry manure + azotobacter and poultry manure + azospirillum treatments gained best vegetative growth, productivity and fruit quality under this condition.

Key words: Organic manure, biofertilization, shoots, Sultani fig, azotobacter and azospirillum.

INTRODUCTION

In the north costal zone of Egypt along the Mediterranean litteral west of Alexandria, there are about 70.000 feddans cultivated with fig trees (*Ficus carica,* L.). Most of the trees planted in this area depending on rainfall as a main source of irrigation. The low production of fig trees in this region is apparently due to many factors such as low irrigation and unsuitable pruning, fertilization and bests. Organic manures are considered a source of essential nutrients for plant growth, Yagodin,[1]. They are safe for human, animal and environmental and using them was accompanied with reducing the great pollination occurred on our environment as well as for producing organic foods exports Subba-Rao,[2] and Subba-Rao *et al* [3]. Biofertilizers are microbial inoculation which enhance production by improved the nutrient supplies and their crop availability. Biofertilization is considered an important tool to enhance the yield and fruit quality of fig and it become appositive alternative to chemical fertilizer Wani and Lee[4]. Also, provide an alternative to agricultural chemicals as more sustainable and ecologically sound practice to increase crop productivity. Recent investigations revealed that the applications of organic and / or biofertilizers to the soil can promote nutrients availability and plant uptake, increase crop yield, reduce inputs of chemical fertilization and minimizing environmental risks. Using organic and bio fertilizers istead of the chemical forms could be the way to produce the natural clear fruits. In this respect, the organic fertilization improved vegetative growth, nutritional status and reduce the residuals of nitrate and nitrite in fruit and be continuous fertilization with organic fertilizer is promising in the long run for tree Farag[5], Kassem and Marzouk[6]. The aim of the present investigation was to study to select the best nitrogen source (bio-or organic) fertilization, and it effect on growth, productivity and fruit quality for fig tree under the prevailing conditions of the area.

MATERIAL AND METHODS

This study was conducted at Ras – Elhekma, Matrouh Governorate, Egypt for two successive seasons, 2007 and 2008 on 66 Sultani fig variety, of about 20 years old grown on sandy loam calcareous soil. The experimental fig trees were healthy, as they were uniform in growth, vigor and fruiting capacity in the preceding years.

Soil and water used irrigation were analyzed according to the method of Chapman and Pratt[7] and the data are presented in Table (1).

The eleven treatments involved in this study were summarized as follows:

.Control trees received the organic fertilization without any bio-fertilization.

1. Application of the sheep manure at 450g actual N / tree/ year (A).
2. Application of the poultry manure at 450g actual N / tree/ year (B).

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3. Application of the inoculation Azotobacter bacteria (C).
4. Application of the inoculation Azospirillum bacteria (D).
5. Application of the sheep manure at 450g actual N / tree/ year (A) + Application of the poultry manure at 450g actual N / tree/ year (B).
6. Application of the sheep manure at 450g actual N / tree/ year (A) + Application of the inoculation Azotobacter bacteria (C).
7. Application of the sheep manure at 450g actual N / tree/ year (A) + Application of the inoculation Azospirillum bacteria (D).
8. Application of the poultry manure at 450g actual N / tree/ year (B) + Application of the inoculation Azotobacter bacteria (C).
9. Application of the poultry manure at 450g actual N / tree/ year (B) + Application of the inoculation Azospirillum bacteria (D).
10. Application of the inoculation Azotobacter bacteria (C) + Application of the inoculation Azospirillum bacteria (D).

The experiment was set in a Completely Randomized Block Design with Eleven treatments each content three replicates and the replicate contain two tree (Tree received the recommended rate of irrigation with rain full rate). The organic manure (sheep manure – poultry manure) treatments was applied at rate 450g actual N/tree yearly, and was added once at the last week of January in both seasons, and was placed in a hole about 50 cm from tree trunk. Some chemical compositions of those organic manurs are presented in Table (2). Inoculation with biofertilizers (Azotobacter – Azospirillum) was applied at the first in the second week of February in both seasons (was addition organic manure or biofertilizer alone, and was addition organic and bio mixed), 2 liter mixed bacteria (Azotobacter and/or Azospirillum) + 20 liter distilled water) and added 2 liter/tree and was directly irrigated. The biofertilizer produced by microbiological unit in the desert research center (azospirillum 2.5 $x10^6$ cell/ml and azotobacter 0.6 X 10^6 cell/ml). Four branches, one year old were chosen on each tree, on toward each direction and labeled to estimate growth parameters. Growth measurements were made on each replicate as follows:

1- The average number of new shoots
2- The Average length of new shoot

At the end of the growing season the length of ten shoots distributed around the tree were measured and the average was recorded.

Average leaf area (cm)2: twenty leaves per tree were picked per tree; leaf area was estimated according to the following equation, Sourial *et al.*,[8]:

$$\text{Leaf area (cm)}^2 = \frac{(\text{diameter})^2 \times 3.14}{4}$$

2- Average total chlorophyll contents:

Total chlorophyll content (in fresh leaves) was measured in field by using Minolta chlorophyll meter SP AD-502.

3- Yield (kg/tree):

The total yield per tree was recorded in kg at harvest time.

4- Fruit number per shoot was counted and recorded.
5- Fruit weight, length and diameter were determined.
6- Total soluble solids. Was tested TSS content by using a hand refractometer.
7- Total acidity was estimated of fruit as percentage of tartaric acid and total sugars in fresh weight according to (A.O.A.C., [9]) method.

Also, five mature leaves were collected from each tree on August to determined the nutrient elements, the collected leaves samples were washed and dried (leaf samples were randomly from the previously labeled shoots per each replicate / tree.) and then grounded for determination the following nutrient elements:

1- %N, using the modified micro-kjeldahl method according to Pregl[10].
2- %P, percentage as dry weight was estimated as described by Chapman and Pratt [7].
3- %K and %Ca, by flamphotometrically determined according to Brown and Lilleland[11].
4- %Mg were determined by atomic absorption according to Jackson[12].

All collected data were subjected to statistical analysis according to Snedecor and Cochran[13]. Treatment means were compared using the Duncan multiple range test at the 5 percent level of probability in both seasons of experimentation.

RESULTS AND DISCUSSION

(A)Data presented in table (3) show the average number of new shoot, shoot length, leaf area, total chlorophyll, number of fruit per tree and yield per tree.

1-average Number of New Shoots: Data indicated that the average numbers of new shoots were significantly affected by organic and bio N-fertilization for fig trees in the two seasons. Poultry manure + azotobacter treatment gave the highest average number of new shoots in the first seasons and followed poultry manure + azospirillum treatment in the second seasons as compared with the control and other fertilization treatments in both seasons.

These results in agreement with those reported by Abed El-Naby and Gomaa,[14] on banana, Maksoud,[15]

on olive, Abed El-Naby *et al*.,[16] on banana and Hegazi *et al*.,[17] on picual olive trees.

2- Average Length of New Shoot (cm): Regarding the effect of organic and bio N-fertilization on average length of new shoot, results showed that was significantly effect between fertilization treatment. Poultry manure + azospirillum treatment gave higher values of average length of new shoot followed by poultry manure + azotobacter treatment than the control and the other fertilization treatment s in the two seasons.

3- Leaf Area (cm): Results of leaf area in the two seasons showed that was significantly affected by organic and bio N-fertilization. Where poultry manure + azospirillum followed by poultry manure + azotobacter gave the highest leaf area in the first seasons. While in the second seasons, poultry manure + azotobacter followed by poultry manure + azospirillum gave the highest leaf area. The positive effects of organic manure on the vegetative characteristics could be attributed to their effects on supplying the trees with their requirements of various nutrients as a relatively long times, as well as, their effect on lowering soil ph which could aid in facilitating the availability of some nutrients in the soil and improving physical characters of soil in favor of root development, Gamal and Ragab,[18]. However Abou El-Khashab,[19] reported that, the enhancement of plant growth due to inoculation with N-fixing bacteria could be attributed to the capability of these organisms to produce growth regulators such as auxine, cytokinines and gibberellins which affect production of root biomass and nutrients uptake.

These results in agreement with those reported by Abed El-Naby and Gomaa,[14] on banana, Maksoud,[15] on olive, Abed El-Naby *et al.,* [16] on banana and Hegazi *et al*.,[17] on picual olive trees.

4- Total Clorophyll: Regarding the effect of organic and bio N-fertilization on total chlorophyll, results showed that was significantly effect between fertilization treatment. Poultry manure + azotobacter gave the higher values of total chlorophyll as compared with the control and other fertilization treatment in the two seasons.

These results are in harmony with report of Ezz and Nawar, [20] which concluded that inoculation of sour orange seedlings with mycorrhizal fungi increased total chlorophyll and chlorophyll p concentration in the first season of the trail, and chlorophyll a concentration in the second. Also, Ibrahim *et al*., [21] contended that biofertilization increased leaf chlorophyll content of Canino apricot. So we can attribute the superiority of microbial biofertilization treatments in increasing Anna apple chlorophyll leaf content to the influence of nitrogen fixer's bacteria.

5- Number of Fruit per Shoot: Significant effect was found on number of fruit per shoot of fig trees due to the organic and bio N-fertilization in both seasons. Poultry manure + azospirillum followed by poultry manure +azotobacter gave the highest number of fruit per shoot than the control and the other fertilization treatments in the two seasons of investigation.

6- Yield Per Tree (kg): Concerning the fruit yield per tree , the results obtained indicated that ,there were significant differences between fertilization treatments in both seasons.Poultry manure + azotobacter and poultry manure + azospirillum gave the higher yield compared with the unfertilized (control) and other fertilization treatments in the first and second seasons ,respectively. These data are in partial agreement with those reported by Mansour and Shabana,[22] on Washington navel orange tree, reported that the target was selecting the best mineral N sources applied with orange and biofertilizers for gaining the best results with regard to yield and fruit quality.

These results are in agreement with those obtained by Gogoi *et al.* [23] and Mia *et al*.[24], they indicated that yield and its components increased with 50% or 33% recommended dose of nitrogen plus azospirillum + phosphate solubilizing bacteria (PSB) or plus plant growth promoting rhizobacterium (PGR) on banana plants.

(B) Data presented in Table (4) show the average fruit weight, fruit volume, fruit dimensions (length & diameter) and fruit shape index.

1- Fruit Weight (gm): Regarding the effect of organic and bio N-fertilization on fruit weight, results showed that was significantly effect between fertilization treatments. Treatment sheep manure + poultry manure gave the highest fruit weight as compared with the control and other fertilization treatments in the two seasons. These results are in harmony with those obtained by Ebrahim and Mohamed[25], Abo El-Komsan *et al*.,[26], Fouad –Amera *et al*.,[27] and Sharawg[28].

2 - Fruit Volume (cm^3): The obtained indicated that, the fruit volume was significantly affected by organic and bio-fertilization. Treatment poultry manure + azospirillum followed by treatment poultry manure + azotobacter gave the highest fruit volume as compared with the control and other treatments in both seasons. Khattari and Shatat[29] in partial agreement with those reported these results.

3 - Fruit Dimensions (cm):

3 .1- Fruit length (cm): Regarding the effect of organic and bio – fertilization on fruit length, results showed that was significantly effect between fertilization treatments. Treatment poultry manure + azotobacter followed by poultry manure + azospirillum treatment gave the highest fruit length as compared with the control and other fertilization on treatments in the two seasons.

3. 2 – Fruit Diameter (cm): Data indicated that the fruit diameter was significantly affected by different of fertilization treatments for fig variety in both seasons. Results showed higher effect of poultry manure + azospirillum and poultry manure + azotobacter during in the first and second seasons, respectively than the control and other fertilization treatments.

Increasing the values of fruit physical properties as a result of organic manure may be due to its effect in manure improving nutrients uptake which enhanced the formation of carbohydrates as well as cell enlargement, Khattari and Shatat,[29].

3. 3 – Fruit Shape Index: Regarding fruit shape index in the fig, it was significantly affected by fertilization treatments in both seasons. Treatment poultry manure + azotobacter followed by treatment azotobacter + azospirillum gave the highest values compared with control and other fertilization treatments in the first and second seasons, respectively.

(C) Data concerning the chemical properties of the fruit fig in both seasons is presented in Table (5).

1 – Total Soluble Solids (TSS %): Total soluble solids percentage of fruit was significantly affected by organic manure and bio N-fertilization for fig variety in both seasons. Treatments, poultry manure + azospirillum followed by poultry manure + azotobacter gave the highest values of total soluble solids for sultani fig variety compared with the control and other treatments in the first and second seasons, respectively. These results are in harmony with those obtained by Fouad. Amera *et al*. [27] and Sharawy[28].

These results agreed with those obtained by Umesh *et al*., [30] studied the effects of N (50 and 100% of the recommendation rate) and phosphorus (50 and 100%), combined with azospirillum and phosphobacterin inoculation on Suckers, on Cavendish banana he found that azospirillum inoculation coupled with 50% N resulted in the most pronounced fruits. The combined inoculation of azospirillum and phosphobacterin considerably improved the total soluble solids (TSS %) content when supplied with N and K at 100%.

2 – Total Acidity (%): Significant effect was found on total acidity of fig variety due to the organic manure and bio N-fertilization treatments in the two seasons. Poultry manure + azospirillum treatments gave the highest values as compared with the control and other fertilization treatments in both seasons. Inoculation with either azospirillum or phosphorin had no effect on acidity and ascorbic acid content of fruits, Umesh *et al*. [30].

3 – Total Sugars (%): Concerning the total sugars, data showed that it was significantly affected by organic manure and bio N-fertilization in the first and second seasons. Treatments, poultry manure + azospirillum and poultry manure + azotobacter gave the highest values of the total sugars content for fig variety compared with the control and other fertilization treatment in both seasons.

These results agreed with those obtained by Umesh *et al.,* [30] studied the effects of N (50 and 100% of the recommendation rate) and phosphorus (50 and 100%), combined with azospirillum and phosphobacterin inoculation on Suckers, on Cavendish banana. They indicated that azospirillum inoculation coupled with 50% N resulted in the most pronounced fruits. The combined inoculation of azospirillum and phosphobacterin considerably improved the total sugar content when supplied with N and K at 100%.

4 – Reducing Sugars (%): The obtained results indicated that, the reducing sugars percentage showes similar trend as the total sugars percentage.

5 – Non Reducing Sugars (%): Treatments, of poultry manure only and azotobacter + azospirillum gave significantly increased non-reducing sugars than those of the control and the other fertilization treatments in the first and second seasons, respectively.

These results are harmony with those obtained by Mansour and Shaaban[22] of Washington navel orange trees, showed that, combined application of N through mineral sources at 50% out of the recommended rate of N plus compost EL – Neel and biogen each at 25% was effective in improving fruit quality. Also, Gaber and Nour EL-Dein[31] on Apple tree and Saleh *et al*., [32].

Generally, all treatments received mixed fertilization (organic manure and bio) gave the highest total, reducing and non reducing sugars percentage compared with addition organic manure or biofertilization alone in both studied seasons.

(C) Results presented in Table (6) show the average N, P, K, Ca and Mg percentage concentration of leaf fig tree during 2007 and 2008 seasons.

1 – Leaf Nitrogen Content (%): Nitrogen concentration in leaf fig tree was significantly affected by organic and bio –fertilization in both seasons. In addition, sheep manure + azospirillum, poultry manure + azotobacter and poultry manure + azospirillum increased leaf content of N compared with control and other fertilization treatments in both seasons.

Table 1: Analysis of irrigation water and soil sample from the experimental orchard (as average of two years).

Water analysis:							
Ec (M.mohs)	pH	K^{+}(meq/L)	Ca^{++}(meq/L)	Mg^{++}(meq/L)	Na^{+}(meq/L)	Cl^{-}(meq/L)	B^{-}(ppm)
1.20	7.65	0.77	4.30	6.17	1.33	8.87	1.38
Soil analysis:							
pH	Ec (M.mohs)	Na^{+}(meq-L)	K^{+}(meq/L)	Ca^{++}(meq/L	Mg^{++}(meq/L)	Cl^{-}(meq/L)	$CaCo_3$
7.45	1.33	3.26	0.90	6.75	3.25	6.25	57

Table 2: Some chemical analysis of the organic manure the north costal zone:

Character	Poultry manure	Sheep manure
Weight of m3(kg)	530	
pH	10.25	9.6
Ec (mm cm-1)	15.50	11.10
Organic matter%	28.56	37.00
Organic carbon	27.90	21.00
C/N ratio	13.95	16.00
Total N %	2.8	1.37
Total P%	1.12	0.68
Total K %	1.21	1.6
Fe (ppm)	38.50	6.5
Mn(ppm)	37.55	10.77
Cu(ppm)	1740	4.14
Zn(ppm)	43.22	12.5

Table 3: Effect of organic and bio-fertilization on vegetative growth, no. of fruit/shoot and yield/tree (kg) of fig fruits during 2007 and 2008 seasons.

Treatments	No. of new shoot	Shoot length (cm)	Leaf area (cm^2)	Total chlorophyll	No.of Fruit / tree	Yield/tree(kg)
			2007 seasons			
control	50.10 e	17.90 f	390.0 d	33.87 d	203.3 e	10.54 e
Sheep manure	58.34 d	25.96 c	404.7 cd	41.23 c	240.8 d	14.82 c
Poultry manure	59.12 d	26.84 c	426.0 bc	44.80 ab	278.3 abc	16.19 bc
Azotobacter	57.01 d	23.14 e	407.0 cd	39.63 c	231.0 d	12.76 d
Azospirillum	57.30 d	23.35 de	401.7 cd	39.63 c	221.8 de	12.08 de
Sheep manure + poultry manure	63.56 b	26.65 c	466.3 b	45.90 a	285.8 ab	19.12 a
Sheep manure +azotobacter	60.77 c	24.85 cde	460.7 b	46.03 a	268.5 bc	16.84 b
Sheep manure + azospirillum	59.84 d	25.98 c	466.7 b	40.67 c	270.8 bc	16.70 b
Poultry manure + azotobacter	67.51 a	29.80 b	522.3 a	47.77 a	296.7 a	19.62 a
Poultry manure + azospirillum	66.34 a	33.91 a	540.0 a	41.80 bc	299.2 a	19.28 a
Azotobacter + azospirillum	58.50 cd	25.70 cd	426.3 bc	39.20 c	261.7 c	15.34 bc
			2008 seasons			
control	50.87e	21.23f	384.3f	33.70f	217.5e	11.29d
Sheep manure	59.50d	28.11e	426.0de	42.67cd	243.3d	14.98c

Table 3: Continue

Poultry manure	61.47c	30.77d	438.0d	43.90bc	281.7bc	16.61b
Azotobacter	59.23d	26.23e	420.7e	40.43de	230.0de	12.76d
Azospirillum	59.70d	25.96e	419.7e	39.67e	232.5de	12.87d
Sheep manure +poultry manure	65.00b	37.20b	471.0c	45.47ab	290.8ab	19.49a
Sheep manure+azotobacter	62.32c	37.16b	482.7bc	47.53a	274.2bc	17.00b
Sheep manure +azospirillum	65.47b	34.92c	487.0b	42.97bcd	280.0bc	17.04b
Poultry manure + azotobacter	68.07a	40.63a	549.0a	47.83a	304.2a	19.45a
Poultry manure + azospirillum	69.53a	41.63a	543.0a	47.07a	305.0a	20.85a
Azotobacter + azospirillum	62.40c	30.92d	428.3de	40.00e	265.0c	16.29bc

Table 4: Effect of organic and bio-fertilization on physical characteristics of fig fruits during 2007 and 2008 seasons.

Treatments	Frweit weight (gm)	Fruit volume (cm))	Fruit length (cm)	Fruit diameter (cm)	Fruit shape index
			2007 seasons		
control	51.39 e	39.40 e	3.39 e	3.89 e	0.95 a
Sheep manure	61.53 bc	56.73 cd	4.05 c	4.42 abc	0.91 b
Poultry manure	58.18 cd	49.70 bc	3.83 d	4.39 bcd	0.87 c
Azotobacter	55.26 de	43.23de	3.78 d	4.02 de	0.88 c
Azospirillum	54.52 de	42.73de	3.76 d	4.01 de	0.94 ab
Sheep manure +poultry manure	66.86 a	53.73 ab	4.25 bc	4.61 abc	0.92 b
Sheep manure +azotobacter	62.83 ab	51.20 bc	4.14 c	4.79 ab	0.86 c
Sheep manure + azospirillum	61.62 bc	53.93 ab	4.15 c	4.42 abc	0.94 ab
Poultry manure + azotobacter	65.83 a	58.03 a	4.50 a	4.76 ab	0.94 ab
Poultry manure + azospirillum	64.44 ab	58.33 a	4.43 ab	4.81 a	0.92 b
Azotobacter + azospirillum	58.59 cd	50.33 bc	4.04 c	4.35 cd	0.91 b
			2008 seasons		
control	51.89 f	41.73 d	3.05 c	3.85 de	0.79 c
Sheep manure	62.41 abc	47.60 c	3.79 b	4.42 abc	0.93 ab
Poultry manure	58.98 cde	47.40 c	3.98 b	4.45 abc	0.89 bc
Azotobacter	55.13 ef	44.87 cd	3.84 b	4.10 cde	0.94 ab
Azospirillum	55.38 ef	42.83 d	3.95 b	4.01 cde	0.93 b
Sheep manure +poultry manure	66.99 a	54.87 ab	3.95 b	4.65 ab	0.93 b
Sheep manure+azotobacter	62.11 abc	53.37 b	4.26 ab	4.34 abc	0.99 ab
Sheep manure +azospirillum	60.88 bcd	55.03 ab	4.20 ab	4.30 bcd	0.98 ab
Poultry manure + azotobacter	63.93 abc	58.10 a	4.52 a	4.86 a	0.95 ab
Poultry manure + azospirillum	65.07 ab	58.76 a	4.31 ab	4.82 ab	0.89 bc
Azotobacter + azospirillum	57.68 de	47.67 c	4.00 b	3.73 e	1.07 a

Table 5: Effect of organic and bio-fertilization on TSS (%) , Acidity (%) ,Total sugar (%),Reducing sugar (%)t and Non-Reducing sugar of fig fruits during 2007 and 2008 seasons.

reatments	TSS (%)	Acidity (%)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
			2007 seasons		
control	16.06 f	0.14 d	9.83 c	9.33 c	0.50 cd
Sheep manure	17.28 de	0.17 abc	10.89 b	10.42 b	0.47 d
Poultry manure	16.93 ef	0.18 ab	11.50 b	10.74 b	0.76 a
Azotobacter	16.93 ef	0.15 cd	10.16 c	9.50 c	0.48 d
Azospirillum	17.02 ef	0.17 bc	9.83 c	9.36 c	0.39 de
Sheep manure + poultry manure	18.18 cd	0.19 a	11.11 b	10.65 b	0.42 de
Sheep manure +azotobacter	18.16 cd	0.18 ab	11.28 b	10.67 b	0.62 bc
Sheep manure + azospirillum	18.53 bc	0.17 ab	11.08 b	10.64 b	0.45 de
Poultry manure + azotobacter	19.25 ab	0.19 a	12.32 a	11.70 a	0.61 bc
Poultry manure + azospirillum	19.53 a	0.19 a	12.43 a	11.71 a	0.72 ab
Azotobacter + azospirillum	17.28 de	0.16 bc	11.20 b	10.88 b	0.32 e
			2008 seasons		
control	15.78 e	0.14 f	10.29 d	9.88e	0.40 d
Sheep manure	17.40 cd	0.16 cde	10.87 c	10.56 cd	0.31 e
Poultry manure	17.03 d	0.17 cde	12.12 b	11.57 ab	0.54 bc
Azotobacter	17.01 d	0.15 ef	10.72 cd	10.32 de	0.40 d
Azospirillum	16.88 d	0.16 def	10.47 cd	9.94 e	0.54 bc
Sheep manure +poultry manure	18.24 b	0.19 a	11.84 b	11.06 bc	0.78 a
Sheep manure+azotobacter	18.14 bc	0.18 ab	12.22 b	11.38 b	0.51 c
Sheep manure +azospirillum	18.60 ab	0.18 ab	11.82 b	11.09 bc	0.73 ab
Poultry manure + azotobacter	19.25 a	0.19 a	12.82 a	12.11 a	0.72 ab
Poultry manure + azospirillum	19.21 a	0.19 a	12.86 a	12.09 a	0.77 a
Azotobacter + azospirillum	17.01 d	0.17 bcd	11.78 b	10.99 bc	0.79 a

Table 6: Effect of organic and bio-fertilization on N (%) , P (%) , K(%) , Ca (%) and Mg (%) concentration of leaf fig tree during 2007 and 2008 seasons.

Treatments	N ((%)	P (%)	K (%)	Ca (%)	Mg (%)
			2007 seasons		
control	1.13 f	0.106 e	1.31 e	1.94 e	0.280 h
Sheep manure	1.65 cde	0.166 d	1.47 d	2.26 d	0.396 g
Poultry manure	1.86 abc	0.190 c	1.53 cd	2.34 c	0.496 e
Azotobacter	1.56 de	0.170 d	1.50 d	1.98 e	0.450 f
Azospirillum	1.44 e	0.170 d	1.49 d	1.98 e	0.450 f
Sheep manure + poultry manure	1.88 ab	0.226 b	1.74 b	2.59 a	0.586 b
Sheep manure +azotobacter	1.87 ab	0.223 b	1.65 bc	2.40 bc	0.520 d

Table 6: Continue

Sheep manure + azospirillum	1.90 a	0.223 b	1.66 bc	2.48 b	0.560 cb
Poultry manure + azotobacter	2.02 a	0.286 a	1.87 a	2.63 a	0.610 a
Poultry manure + azospirillum	2.03 a	0.293 a	1.87 a	2.64 a	0.606 a
Azotobacter + azospirillum	1.67b cd	0.200 c	1.59 cd	2.42 b	0.516 d
			2008 seasons		
control	0.95 6d	0.113 f	1.36 f	1.95 f	0.293 e
Sheep manure	1.67 c	0.183 e	1.52 e	2.29 d	0.426 d
Poultry manure	1.90 ab	0.220 cd	1.56 cde	2.35 cd	0.516b c
Azotobacter	1.54 c	0.180 e	1.53 de	2.11 e	0.523 bc
Azospirillum	1.59 c	0.173 e	1.51 e	21.09 e	0.480 cd
Sheep manure +poultry manure	1.89 ab	0.236 bc	1.65 bc	2.61 a	0.600 a
Sheep manure+azotobacter	1.81 b	0.233 bc	1.63 cd	2.42 bc	0.540 b
Sheep manure +azospirillum	2.00 a	0.240 b	1.63 cd	2.59 a	0.573 ab
Poultry manure + azotobacter	1.99 a	0.303 a	1.74 b	2.63 a	0.616 a
Poultry manure + azospirillum	1.95 ab	0.303 a	1.88 a	2.62 a	0.616 a
Azotobacter + azospirillum	1.62 c	0.203 d	1.61 cde	2.46 b	0.540 b

2 - Leaf Phosphorus Content (%): Significant effect was found on phosphorus content in leaf of fig tree due to the organic and bio –fertilization treatments in both seasons. Treatments, poultry manure + azotobacter and poultry manure + azospirillum gave the highest values of leaf phosphorus content than the control and the other fertilization treatments in the two seasons of investigation.

3 - Leaf Potassium Content (%): The obtained results indicated that, the potassium content in leaf of fig tree were significantly affected by organic and bio fertilization in both seasons. Treatments, poultry manure + azotobacter and poultry manure + azospirillum gave the highest K concentration as compared with the control and other fertilization treatments.

4 - Leaf Calcium Content (%): Regarding the effect of organic and biofertilization on leaf calcium content, results showed that was significantly effect between fertilization treatments. Treatments, poultry manure + azotobacter and poultry manure + azospirillum gave the higher values of leaf content as compared with control and other fertilization treatments in both seasons.

5 - Leaf Magnesium Content (%): Data presented showed that, leaf content of Mg was significantly affected by organic manure and bio-fertilization treatments in both seasons , the highest leaf content of Mg in the two seasons were obtained with poultry manure + azotobacter and poultry manure + azospirillum as compared with the control and other fertilization treatments. These results are in agreement with those obtained by Marshaniya and Mikeladze[33] and EL-Sayed[34]. Also, Kassem and Marzouk[6] found that, adding organic manure increase leaf mineral content due to availability of nutrients in the soil. However, E- Kramany[35] found that, biofertilizer helps in availability of mineral and their forms in the composted material and increase levels of extractable N, P, K, Fe, Zn and Mn.

In conclusion, organic and bio an-fertilization treatments of poultry or sheep manure + bio (azotobacter or azospirillum) were the most effective fertilization treatments for Sultani fig variety under north coastal zone, Matrouh Governorate conditions in improving the fruit quality, productivity and leaf mineral content than did the control and the other fertilization treatments.

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