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EFFECT OF DIFFERENT FERTILIZER SOURCES ON YIELD AND SOME NUTRIENT CONTENTS OF SPINACH PLANT (*Spinacia oleracea* L.)

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ABSTRACT

Two field experiments (the first one started on 3/11/2010 and the second was on 3/1/2011) were carried out to investigate the. yield and quality of spinach as influenced by organic (two levels: 0.0 and 15 m^3 compost fed^{-1}), Bio. (0.0 , Microbine and Nitrobine) and chemical fertilization (Four levels; 0.0 , 50.0 , 100.0 and 150 % of recommended dose) at EL-Gawashna village, EL- Sharkia Governorate, Egypt. The possible combination between the studied factors levels represented 24 treatments

The obtained results can be summarized in

Increasing mineral fertilizations from 0 – 50% led to a progressive increase in yield weight amounted by 20.649 % , while rising mineral fertilizations from 50.0 – 100% led to a slight increase in that trait (0.856 %). 3.651 % increase in yield weight was noticed due to inoculation with both nitrobine and microbine.

Using organic fertilization decreased plant nitrate by 14 %**.** Spinach plant nitrate was decreased from 279.087 to 241.700 ppm as a result of Nitrobine fertilization and from 279.087 to 241.977 ppm as a result of microbine fertilization.

Increasing in spinach plant spinach nitrate was found concomitant with a constant increase in NPK mineral fertilization dose.

spinach plant nitrite was statistically responded to both compost application and bio- fertilization where statistically decreased in it's value compared with unfertilized treatment.

Organic fertilization tended to increase N content of spinach plant under any studied mineral fertilization level (50, 100 and 150 % of recommended dose)

Inoculation of spinach seeds before planting by nitrobine and microbine increased N content of spinach plant by 5 % and 5%, respectively.

No evidence for superiority of any inoculation than the other regarding to increasing the nitrogen content of spinach plant.

Compost effects did not appear on P content of spinach plant, whenever N P K fertilization have done .

Inoculation maximized phosphorus content of spinach plant where neither organic nor NPK mineral fertilization were added than that under another conditions .

No difference in Phosphorus content between nitrobine and microbine treatment means was found .

8- Phosphorus concentration was significantly increased with increasing N P K fertilization level till 100 % then decreased after that (150 % of N P K) .

A slightly increase was found in K content due to both organic fertilizer and bio – fertilizer addition compared with no addition of each .

INTRODUCTION

Leafy vegetables are an important source of nutrition in the human diet. In Egypt, farmers consume large amounts of mineral fertilizers to increase the

yield without any care of the adverse residual effects on the quality of these crops as well the quality of agricultural ecosystem.

Takebe *et al*., (1995); Elia *et al*., (1998); Ramadan (2004) and Wang *et al*., (2009). reported that nitrate-N contents in spinach plant increased with increasing the N application rate. Hill (1990) found that when nitrate is digested, it is converted to nitrite and N-nitrose compounds which may generate infants methaemoglobinaemia and cancer. So, human body nitrites in adults can react with amines to be nitrosamines which cause cancer, (Whitney *et al*., 1990) . The current acceptable daily intake for nitrate for man according to the European scientific community is set at 3.7 mg NO_3^-. kg body weight. day^{-1} while the same of NO_2^- was 0.06 mg NO_2^- . kg^{-1} body weight day^{-1} (Hirondel and I'Hirondel 2001) .

Nowadays many countries enhance organic farming by creating new methods to produce organic (from organic wastes) and bio fertilizers to produce safe food and clean environment

The aim of this investigation is to produce spinach with low nitrate and nitrite content as we can without any deteriorate of the nutrition value (N, P and K) or yield by using integrated fertilization system .

MATERIALS AND METHODS

Two field experiments were carried out in EL-Gawashna village EL-Sharkia Governorate, Egypt. during two successive lugs of winter season of 2010-2011, to investigate the spinach *(Spinacia oleracea* L.) yield and quality as influenced by organic (Compost), Bio (Nitrobine and Microbine) and chemical fertilization (N P K).

Materials :

The Experimental soil was clayey in texture (Sand 19.84, Silt 26.5 and Clay 53.66%) with an organic matter content of 1.98 and 2.07%, pH value was 8.02 . Available N, P , K and Fe (ppm) were 49.5, 11.8, 359 and 3.9 ppm in the first lug, The values in the second lug were 38.8, 10.5, 377 and 3 ppm, respectively for the above mentioned elements.

Soil was plowed twice with an orthogonal way, then it was flatten. Compost was added to the appropriate areas and plowed again by a small tractors, after that ridges were hold . Each plot was 2m ×2m .

The compost was brought from Bahnia village, Dakahlia Governorate. C/ N ratio of the added compost was 14:1 in the first lug, whenever it was 16:1 in the second one. N, P , K % and Fe ppm content of the used compost were 1.15, 0.54, 2.27 and 833 in the first lug , Corresponding values of the second lug were 1.34, 0.63, 2.11and 942 ppm.

The studied factors were organic fertilization (two levels: 0.0 and 15 m^3 compost fed^{-1}), Bio-fertilization (0.0, Microbine and Nitrobine) and mineral fertilization (Four levels; 0.0 , 50.0 , 100.0 and 150 % of recommended dose; 45 Kg N which were in urea form, 150 Kg ordinary super-phosphate and 50 Kg potassium sulphate fed^{-1}. The simple possible combination between the studied factors levels represent 24 treatments. These treatments were arranged in a split split block design with four replicates.

All organic fertilizers were completely added for the appropriate unites before sowing. The bio fertilizers were added as seeds inoculation of the appropriate unites. Mineral fertilization (N, P and K fertilizers) treatments dose of each unite was divided into two equal portions, The first was added after 20 days from sowing and the second two weeks later.

The first lug was started in 3/11/2010 and the second one was in 3/1/2011, Spinach seeds were soaked for 24 hours and left for eight hours in wetted textile, then 2 litter of sugarcane honey solution was added (½ kg sugarcane honey was dissolved in 2 litter of water and gently mixed until completely homogenized) . The amount of seeds that are of Microbine or Nitrobine treatments (which was moistened with the sugarcane honey solution) was speared on a clean plastic sheet. The bag which contains Microbine or Nitrobine was opened and it's contents were spread on seeds and mixed well and left for half hour in a shadowy place. Then the seeds of each unite were spread and the soil was flatten with a piece of wood to transfer the dust above the seeds and after that the irrigation was done immediately.

Harvesting was done at marketing stage of spinach plant . two samples of spinach plant were taken randomly from each unite , the first for Nitrate and nitrite determination and the second one was dried (70°) and ground for other analyses .

Method of analysis :

Mechanical analysis was done by pipette method as described by Piper (1950).

Available N was extracted by Potassium sulphate 2 N and measured using the conventional method of Kjeldahl as described by Bremner and Mulvany (1982).

Available P was extracted with 0.5 M ($NaHCO_3$) adjusted at pH 8.5 and determined by a spectrophotometer as described by Olsen and Sommers (1982).

Soil reaction (pH) was determined in soil paste and available K were determined according to Black (1965).

Available iron was extracted using DTPA and determined by an Atomic Absorption Spectrophotometer as described by Chapman and Pratt (1961).

Nitrate and nitrite determination in fresh samples were done according to the method described by Singh (1988) .

0.4 gm of plant samples (oven dry basis) were digested in a mixture of $HClO_4$ and H_2SO_4 according to the procedure of Chapman and Pratt (1961).

Nitrogen, Phosphorus and Potassium in plant digestion product and soil organic matter using Walkely's rapid titration method were determined according to Jackson,(1967).

Collected data were subjected to the combined statistical analysis between lugs, the technique of analysis variance (ANOVA) was used under CoStat (Version 6.303, CoHort, USA, 1998-2004).

RESULTS AND DISCUSSION

Spinach yield as affected by compost and bio-fertilizers along with or without NPK as mineral fertilizers are presented in Table 1.

Data showed a significant increase in yield weight of Spinach plant as affected by compost addition . These results can be attributed to the effect of compost for improving chemical and physical properties and nutritional status due to compost content of macro and micronutrients. These results are in agreement with Gairola *et al.,* (2009). They stated that the application of FYM along with NPK fertilizers increased spinach yield weight.

Increasing mineral fertilizations from 0 – 50% led to a progressive increase in yield weight amounted by 18.988 % , while rising mineral fertilizations from 50.0 –100% led to a slight increase in that trail (0.304 %) but adding 150% of N P K as mineral fertilization reduced yield weight of spinach plant (0.934 %) compared with 100% of NPK as mineral fertilization treatment.

Table 1 : Organic, bio. , mineral fertilizations and their interaction effects on spinach yield weight (ton fed^{-1}) .

Treatments		Spinach plant yield weight					
		0.0	50%	100%	150%	Organic treat. means	LSD at 5%
Without Organic	Non	6.157	7.590	7.807	7.720	**7.508**	**0.018**
	Nitrobine	6.643	7.950	7.897	7.827		
	Microbine	6.840	7.930	7.907	7.823		
With Organic	Non	6.430	7.813	7.890	7.860	**7.653**	
	Nitrobine	6.887	8.067	8.030	7.950		
	Microbine	6.887	8.063	8.023	7.930		
Mineral treat. means		**6.641**	**7.902**	**7.926**	**7.852**		
LSD at 5%		**0.017**					
Means of B.tr.		**0.0**		**Nitrobine**		**Microbine**	
		7.408		**7.656**		**7.675**	
LSD at 5%		**0.019**					
LSD interaction		**0.055**					

Inoculation spinach seeds with nitrobine or microbine significantly increased yield weight (3.348 % and 3.604% increase was noticed due to inoculation with nitrobine and microbine). This effect of bio-fertilizers may be resulted in it's production of phyto-hormones or it's improving the availability and acquisition of nutrients or by both. These results and findings agree with many authors such as Hosseny and Ahmed (2009) . They revealed that bio-fertilization lead to decrease the need of the chemical fertilizer level.

A significant interaction between the factors regarding to yield of spinach plants was found, whenever the highest value of spinach yield weight was 8.067 ton fed^{-1} was recorded at the treatment of compost + nitrobine + 50% mineral fertilization. On the other hand the lowest value (6.157 ton fed^{-1}.) was obtained with the treatment of control (0.0 organic + 0.0 bio + 0.0 mineral fertilization.

Data in Table 2 refer to spinach plant nitrate content as affected by Organic, bio., mineral fertilizations and their interaction.

Usage of organic fertilization decreased the content spinach plants from nitrate by 14%, where the whole mean of spinach plants nitrate value of treated plants is 234.925 (ppm) comparing to 273.584 (ppm) for untreated plant, respectively.

Spinach plant nitrate was decreased from 279.087 to 241.700 as a result of nitrobine fertilization and from 279.087 to 241.977 ppm as a result of

microbine fertilization. Using of bio-fertilizer decreased nitrate concentration value in both with and without compost compared with control (0.0 bio fertilization) in the same time, no significant difference was found as the result of using nitrobine compared with microbine on spinach plants nitrate value (37.387 and 37.110 decrease in spinach plant nitrate due to applying of nitrobine and microbine, respectively, compared with 0.0 bio fertilization).

Table 2:Organic, bio. , mineral fertilizations and their interaction effects on spinach plants nitrate content.

Treatments		spinach plants nitrate (ppm)					
		0.0	50 %	100 %	150 %	Organic treat. means	LSD at 5%
Without Organic	No n	127.413	240.847	349.333	481.083	273.584	3.851
	Nitrobine	100.533	194.667	299.150	446.333		
	Microbine	101.983	196.333	299.667	445.667		
With Organic	No n	119.533	199.650	298.000	416.833	234.925	
	Nitrobine	94.583	150.500	255.333	392.500		
	Microbine	94.667	150.500	254.500	392.500		
Mineral treat. means		106.452	188.749	292.664	429.152		
LSD at 5 %		18.894					
Bio. Treat. Means		0.0	Nitrobine	Microbine			
		279.087	241.700	241.977			
LSD at 5 %		0.68					
interaction LSD		1.97					

Data of Table 2 reveal also that raising NPK mineral fertilization rate from 0.0 to 50.0, 100.0 and 150 % of recommended dose significantly increased spinach plant nitrate from 106.452 to 188.749, 292.664 and 429.152 ppm, respectively. The increase in spinach plant nitrate was found concomitant with a constant increase in NPK mineral fertilization dose, where 82.297, 186.212 and 322.700 ppm increase in spinach plant nitrate were detectable resulted in increasing NPK mineral fertilization dose by 50 % of recommended dose for each time .

A significant Organic-bio.-mineral fertilizations interaction effect was found on nitrate content of Spinach plant, where the highest level of nitrate was found in plants treated with 0.0 organic + 0.0 Bio. + 150 % NPK mineral fertilization . Data also reveal that, compost and bio-fertilizers have a favorable effect on reducing nitrate concentrations compared with using NPK mineral fertilization. These results is similar to that obtained by Bakr and Ragaa (1997). They stated that fertilizing with farm yard manure (FYM) decreased nitrate contents of spinach plant. From data obtained using integrated fertilizations system including 50% NPK and bio – fertilizers with compost gave the highest quality of spinach plant. These findings is matched well with those obtained by Hosseny and Ahmed (2009) . They stated that Nitrate content of lettuce leaves was decreased from 395 ppm to 253 ppm with bio-fertilizer.

Data of Table 3 presented the content of spinach plant from nitrite ppm as influenced by compost, Bio and NPK mineral fertilization. Data in Table 3 show that, adding compost significantly reduced nitrite in spinach plants, compared with the untreated treatments. Also spinach plant nitrite was

statistically responded to bio-fertilization, where statistically decreased in it's value compared with unfertilized treatment . Concerning the effect of NPK fertilization on spinach plants, data of the Table reveal that rising the rate of NPK from 50 – 150% tend to significant increase in the means value of nitrate concentrations compared with control treatment. The interactions effect between the studied factors on spinach plant nitrite was insignificant.

Table 3 : Organic, bio, mineral fertilizations and their interaction effects on spinach plants nitrite content.

Treatments		spinach plants nitrite (ppm)					
		0.0 %	**50 %**	**100 %**	**150 %**	**Organic treat. means**	**LSD at 5%**
without organic	Non	2.337	3.490	5.313	6.703	**4.201**	**0.230**
	Nitrobine	2.000	3.040	4.907	6.167		
	Microbine	2.003	3.057	4.890	6.510		
With Organic	Non	2.167	3.767	4.567	5.920	**3.809**	
	Nitrobine	2.280	2.967	3.990	5.586		
	Microbine	1.943	2.953	3.993	5.573		
Mineral treat. means		**2.122**	**3.212**	**4.610**	**6.077**		
LSD at 5%		0.130					
Bio. Treat. Means		**0.0**		**Nitrobine**		**Microbine**	
		4.283		**3.867**		**3.865**	
LSD at 5%		0.121					
interaction LSD		**ns**					

It can be concluded that, adding compost and bio-fertilizers to spinach plants fertilized with NPK, caused a reduction of mineral fertilizers harmful effect.

This may attributed to the steady release of the nitrogen from mineral fertilizer and compost resulted in N absorption as ammonium (Kolbe *et al*., 1995)**.**

Data of Table 4 show the N content of spinach plant as affected by organic, Bio., Minerals and their interaction. Data of the Table illustrate that compost addition increased N content of spinach plants significantly compared with untreated plants (2.789 and 2.696% for treated and untreated plant respectively) . So organic fertilization tended to increase N % of spinach plant under any studied mineral fertilization level (50, 100 and 150 % of recommended dose) as it is shown in Fig 1 .

Inoculation of spinach seeds by nitrobine and microbine increased N percentages of spinach plant from 2.647 to 2.788 (5.327% increase) and 2.791 % (5.440% increase), respectively, compared with control (uninoculated treatment). This trend may be attributed to the importance of microbine strains as N atmospheric fixing bacteria.

No evidence for superiority of any inoculated than the other regarding to increase in nitrogen % of spinach plant, where the increase in the N% nearly the same due to the inoculation by both strains.

Table 4: Organic, bio. , mineral fertilizations and their interaction effects on Nitrogen percentage in spinach plants.

Treatments		N%					
		0.0	**50%**	**100%**	**150%**	**Organic treat. means**	**LSD at 5%**
without organic	No n	2.270	2.700	2.723	2.727	**2.696**	**0.024**
	Nitrobine	2.573	2.813	2.810	2.760		
	Microbine	2.580	2.803	2.807	2.780		
With Organic	No n	2.370	2.780	2.793	2.810	**2.789**	
	Nitrobine	2.657	2.927	2.900	2.867		
	Microbine	2.663	2.927	2.897	2.873		
Mineral treat. means		**2.519**	**2.825**	**2.822**	**2.803**		
LSD at 5 %		0.020					
Bio. Treat. Means		**0.0**		**Nitrobine**		**Microbine**	
		2.647		**2.788**		**2.791**	
LSD at 5 %		**0.016**					
interaction LSD		**ns**					

Nitrogen % of mineral fertilization treatment means were 2.519, 2.825, 2.822 and 2.803 % for control, 50, 100 and 150 % of recommended dose , respectively . The comparisons between tabulated data indicated that, rising NPK fertilization from 0.0 to 50% gave highly significant effect on N content of spinach plants, but adding 150% of NPK recommended gave a lowest value of N% compared with 50% NPK recommended dose .

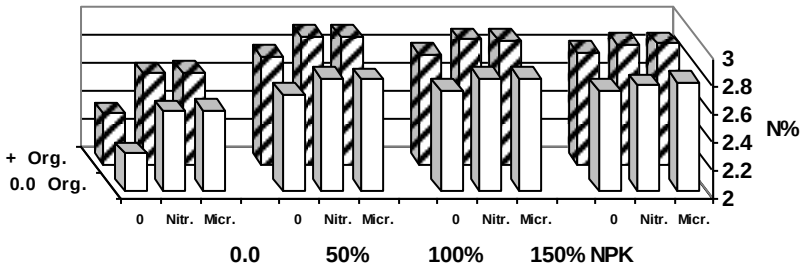

Fig 1: Organic, bio. , mineral fertilizations and their interaction effects on Nitrogen percentage in spinach plants.

It can be noticed that, there is no significant effect as the result of interaction between the studied factors or the studied factors levels.

Data of Table 5 show phosphorus concentration in spinach plant as affected by organic, Bio., Minerals fertilizations and their interaction . As shown from data recorded in the Table, phosphorus concentration did not varied between organic treated and untreated treatment means (0.407%) . It could be concluded from this trial that compost effects did not appear on P% of spinach plant whenever N P K fertilization have done .

It is worthy to identify that the inoculation maximized phosphoros % of spinach plant. It can be interpreted by the role of microorganisms in mobilization processes of nutrients and organic constitutes.

Phosphorus % of inoculated treatments (0.417%) was significantly higher than that of uninoculated treatments (0.358%).The beneficial effects of microbine and nitrobine, might be attributed to it's efficiency on P mineralization solubility then increase the availability of this nutrient in soil and becomes ready for absorption by plant roots. These results and findings agree with many authors results such as Wiqar *et al*., (2009).

Table 5: Organic, bio. , mineral fertilizations and their interaction effects on Phosphorus percentage in spinach plants.

Treatments		Phosphorus percentage					
		0.0	**50%**	**100%**	**150%**	**Organic treat. means**	**LSD at 5%**
without organic	Non	0.325	0.378	0.426	0.412	**0.407**	**ns**
	Nitrobine	0.364	0.420	0.459	0.430		
	Microbine	0.365	0.418	0.459	0.428		
With Organic	Non	0.355	0.394	0.410	0.399	**0.407**	
	Nitrobine	0.370	0.435	0.449	0.409		
	Microbine	0.367	0.435	0.452	0.409		
Mineral treat. means		**0.358**	**0.414**	**0.443**	**0.415**		
LSD at 5%		0.001					
Bio. Treat. Means		**0.0**		**Nitrobine**		**Microbine**	
		0.387		**0.417**		**0.417**	
LSD at 5%		0.001					
interaction LSD		0.003					

No difference in Phosphorus % between nitrobine and microbine treatment means was found .

Phosphorus concentration was increased significantly with increasing N P K % fertilization level till 100 % then decreased after that (150 % of N P K) .

There are a significant interaction effects between the studied factors on P content of spinach plant . The highest Phosphorus content (0.459 %) was recorded due to applying the treatment of 0.0 organic + nitrobine + 100 % NPK mineral fertilization or 0.0 organic + microbine + 100 % NPK mineral fertilization.

Effects of compost and bio-fertilizer usage along with N P K fertilizers on K percentages of spinach plants are shown in Table 6 .

A little increase (1.572 %) was found in K % due to organic fertilizer addition compared with no addition analysis.

Data reveal that significant slight increases in K % were found as a result of usage of nitrobine or microbine compared with 0.0 bio. Fertilizer addition .

significant decrease in K % values of spinach plants with increased N P K from 50- 150% of recommended dose, but it was increased significantly due to applying N P K mineral fertilization at a rate of 50.0 % of recommended dose compared with control 0.0 mineral fertilization treatments.

Data also declare that the interaction effect of factors under the study on K % in spinach plant was significant. The highest K% (3.187%) was obtained

due to applying organic fertilizer, microbine inoculations and NPK at 50% of recommended dose. While the lowest K% value (2.737%) was found under the treatment of zero organic+ no inoculation+ zero NPK dose.

Table 6 : Organic, bio. , mineral fertilizations and their interaction on Potassium percentage in spinach plants.

Treatments		Potassium percentage					
		0.0	**50%**	**100%**	**150%**	**Organic treat. means**	**LSD at 5%**
without organic	Non	2.737	3.040	2.977	2.907	**2.927**	**ns**
	Nitrobine	2.787	3.107	2.963	2.883		
	Microbine	2.780	3.093	2.967	2.877		
With Organic	Non	2.757	3.110	3.013	2.973	**2.973**	
	Nitrobine	2.827	3.153	2.967	2.957		
	Microbine	2.827	3.187	2.963	2.937		
Mineral treat. means		**2.786**	**3.115**	**2.975**	**2.922**		
LSD at 5%		0.011					
Bio. Treat. Means		**0.0**		**Nitrobine**		**Microbine**	
		2.939		**2.955**		**2.954**	
LSD at 5%		0.008					
interaction LSD		0.024					

Conclusion

The obvious data showed that adding compost + bio-fertilizers (nitrobine or microbine) + 50% of recommended NPK mineral fertilizers have a favorable effects on reducing total nitrate and nitrite of spanich plant , where it consider as very harmful for human. So, more research must be conducted across different location with varied ecology to validate that recommendation.

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تـأثير مصـادر مختلفـة مـن الأسـمدة علـى المحصـول وبعـض المحتويـات المغذيـة لمحصول السبانخ.

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أقيمت تجربتان حقليتان لدراسة تأثر كمية المحصول والجودة فى السبانخ بالتسميد العضوى والحيوى والمعدنى والتفاعل بينهما . حيث استخدم معدلين من السماد العضوى (بدون اضافة كمبوست – كمبوست بمعدل 15 م3 للفدان) وثلاث معاملات من التسميد الحيوى كمعاملات تحت رئيسية (صفر – نيتروبين – ميكروبين) وأربع معاملات من التسميد المعدني إضافة أرضية كمعاملات تحت تحت رئيسية بمعدلات (صفر، 50 , 100 , 150 % من الموصي به لنبات السبانخ من قبل وزارة الزراعة) لتكون 24معاملة وزعت فى تصميم تجريبى لقطع منشقة مرتين بأربع مكررات . وتم تنفيذ تلك التجارب بقرية الجواشنة بمحافظة الشرقية فى الموسم الشتوى للعام الزراعى 2011/2010 (عروتين , الأولى تمت زراعتها فى 2010/11/3 والثانية فى 2011/1/3) .

من أهم نتائج تلك الدراسة ما يلى :

1- زيادة التسميد المعدنى من 0.0 إلى 50.0 % من الموصى به أدى إلى زيادة كبيرة فى وزن المحصول لنبات السبانخ قدرت بـ 18.988% , بينما زيادتة من 50.0 إلى 100.0 % من الموصى به أدت إلى زيادة طفيفة فى وزن المحصول لنبات السبانخ قدرت بـ 0.304 % .
2- 3.348 % زيادة فى وزن محصول السبانخ نتيجة للتسميد الحيوى بالنيتروبين.
3- 3.604% زيادة فى وزن محصول السبانخ نتيجة للتسميد الحيوى بالميكروبين.
4- استخدام التسميد العضوى أدى إلى خفض محتوى السبانخ من النترات بما يعادل 14.131 %.
5- المحتوى النتراتى لنبات السبانخ انخفض من 279.087 إلى 241.700 جزء فى المليون نتيجة للتسميد الحيوى بالنيتروبين , و التسميد الحيوى بالميكروبين أيضا أدى إلى إنخفاض مماثل (من من 279.087 إلى 241.700 جزء فى المليون – على أساس الوزن الطازج) .
6- المحتوى النتراتى لنبات السنانخ زاد بمعدل متزايد نتيجة زيادة معدل التسميد المعدنى , النيتروجينى و الفوسفاتى والبوتاسى , بمعدل ثابت .
7- المحتوى النتريتى لنبات السبانخ تأثر معنويا بإضافة كل من التسميد العضوى والحيوى كل على حده , حيث قلت قيمة المحتوى النتريتى فى تلك المعاملات مقارنة بالمعاملات الغير مسمدة .
8- غاب أثر التفاعل بين مستويات العوامل المدروسة على المحتوى النتريتى لنبات السبانخ .
9- التسميد العضوى أدى إلى زيادة المحتوى النيتروجينى (على أساس الوزن الجاف) لنبات السبانخ تحت أى مستوى من مستويات التسميد المعدنى المدروسة (50.0 و 100.0 و 150.0 % من الموصى به).
10- تلقيح بذور نبات السبانخ بالنيتروبين والميكروبين أدى إلى زيادة قدرت بـ 5.326 و 5.440 % فى المحتوى النيتروجينى (على أساس الوزن الجاف) لنبات السبانخ .
11- ليس هناك دليل على أفضلية أى من النيتروبين أو الميكروبين على الآخر وذلك فيما يتعلق بزيادة المحتوى النيتروجينى للسبانخ (على أساس الوزن الجاف)
12- لم يظهر تأثير التسميد العضوى على المحتوى الفوسفورى (على أساس الوزن الجاف) لنبات السبانخ وذلك فى وجود التسميد المعدنى .
13- التسميد الحيوى بالنيتروبين أو الميكروبين يعظم المحتوى الفوسفورى لنبات السبانخ فى حالة عدم وجود كل من التسميد العضوى والمعدنى عنه فى حال وجودهما معا او وجود أى منهم .
14- لم يوجد فرق معنوى فى المحتوى الفوسفورى للسبانخ بين متوسط معاملات النيتروبين والميكروبين
15- تركيز الفوسفور فى نبات السبانخ زاد معنويا بزيادة مستوى التسميد المعدنى حتى 100 % من الموصى به ونقص هذا المحتوى الفوسفورى بزيادة مستوى التسميد المعدنى إلى 150.0% من الموصى به.
16- زيادة معنوية طفيفة فى محتوى السبانخ من البوتاسيوم نتيجة لكل من التسميد العضوى والحيوى مقارنة بحال عدم وجودهما .