Utilization of Dried Biogas Digester Residue as an Organic Fertilizer with Mineral and Bio-Fertilizer on Growth and Yield of Sweet Peppers

Yakout, T.R.; Doaa M. Mostafa and G.D.M.Youssef[1]

ABSTRACT

The effects of organic, mineral, and bio-N- fertilizers on growth and productivity of pepper plants (Capsicum annum) CV. (Dolman- 10191) grown in a modified green house under fertigation system were studied in two intervals experiments of 2013 and 2014. The results indicated that, applying organic fertilizer (as biogas digester residue or farm yard manure at rate 20m^3/fed) combined. with bio-N fertilizer (microbin at rate 4L/fed) and mineral – N fertilizers at rate of (19-19-19)N-P-K commercial liquid fertilizer gave the vigorous plants expressed as plant length, number of leaves and stems as well as shoots dry weight in both seasons. Moreover, it increased number of fruits and total fruit yield per plant as well as the best physical properties of fruits i.e., diameter and flesh thickness. In addition, it gave the best values of total acidity, vitamin C content, TSS percentage, dry matter and N, P, K, Fe, Mn, Zn, Cu, Ni and Pb contents of fruits. It could be noticed that organic, mineral, or bio N fertilizer applied alone has a little effect when compared with mixed application of two of them or combines application of all of them.

Key words: Biogas digester, organic fertilizer, bio-fertilizer, mineral fertilizer, sweet pepper yield, sweet pepper quality.

INTRODUCTION

Pepper is one of the most popular and widely grown vegetable crops in the world. Pepper crops are highly responsive to nitrogen (N) fertilizer application where N availability may be limited and time of the application is critical (Taber, 2001).

It is known that nitrogen fertilizers are lost via nitrate reduction denitrification and ammonia volatilization. Moreover, some nitrogenous fertilizer can be leached to the underground water causing environmental pollution. Pollutants are transferred through the plants to human and animals causes serious disease. Thus environmental pollution as a result of exaggeration in the application of chemical fertilizers is reported by Nijjar, 1985. Casale et al., 1995 and Ram Rao et al., 2007.

Therefore adding organic manures to soil would improve their physical – chemical and biological properties which increase soil organic matter, cation exchange capacity, available mineral nutrition (Mervat et al., 1995) and this in turn stimulate quantitative as well as qualitative characteristics of vegetable crops. The use of organic matters such as animal manures, human waste, food wastes, yard wastes, sewage sluge and composts has long been recognized in agriculture as beneficial for plant growth and yield, also, soil fertility. (Joshi and pal Vig 2010).

There is a great debate among scientists about the role played by microorganisms in promoting plant growth, while some other investigators directed their contribution to N_2 – fixation, solubilization, cellulose decoposition, etc, other went to production of plant growth modifying substances by such bio-fertilizers.

El- Sheekh (1997). Many investigators reported that bio-fertilizer affected plant growth and total yield.

Mean while, Bedaiwi et al., (1997), indicated that, microbin is considered bio-fertilizer of high performance as compared to some other bio-fertilizers, when applied in addition to soil application with 50, 70 or 80 kg N/ fed. For ald or new land. Moreover, Rizk and Shafeek (2000) stated that bio-N fertilizer has greater amounts of symbiotic and non-symbiotic bacteria, which were responsible for nitrogen fixation by atmosphere. Its application achieved the reduction of mineral – N by 25% and increasing the availability of various nutrients by plants as well as increasing the resistance of plants against root disease and reducing the environmental pollution by chemical fertilizer application.

Therefore, the present investigation was conducted to evaluate the effect of combined application of mineral N and farmyard manure (FYM) and dried biogas digester residue as organic N fertilizer with or without bio-fertilizer on vegetative growth, yield and fruit quality of pepper plants.

MATERIALIS AND METHODS

Two experiments in a modified controlled greenhouse under drip irrigation system were carried out in two intervals seasons of 2013 and 2014 at the experimental farm, Sabahia Horticultural Research Station, Alexandria Governorate. The physio- chemical characteristics of soil samples collected from green house was explained in table (1).

This research was carried out to investigate the effect of different N fertilizer sources, i.e., bio, organic and mineral – N on the growth and productivity of sweet

[1]Agricultural Research Center, Hort. Res. Inst. Veg. Dep., Dokki, Giza, Cairo.
Received November 25, 2014, Accepted December 31, 2014

pepper plants (Capsicum annum L.) CV. (Dolman-10191) which is high yielding and early in maturation, its origin is England. Chemical fertilizers (including mineral N) according to the recommended doses of page (328)NPK (19-19-19) commercial fertilizer, were added each month during the whole season under fertigation system forgreen houses. This experiment included eight treatments which were as follows:

T_1 : Mineral – N (control)

T_2 : Mineral + bio – N

T_3 : Farm yard manure (low rate of nitrogen), its symbol (FYM).

T_4 : Dried biogas digester residue (high rate of nitrogen).

T_5: Farm yard manure (low rate of N) + bio – N

T_6 : Dried biogas digester residue (high rate of N) + bio-N

T_7: Farm yard manure (low rate of N)+ bio – N + mineral – N.

T_8: Dried biogas digester residue (high rate of N) + bio – N + mineral – N.

The chemical analysis of farm yard manure and dried biogas digester residue which used in this study is shown in Table (2). Each experimental plot area was 9 m^2 (Three ridges each was 0.5 m in width and 2 m in length). The treatments were arranged in a completely randomized block design with three replicates – two types of organic fertilizers were used, i.e., farm yard manure which consist of low rate of nitrogen and dried biogas digester residue which consist of high rate of nitrogen according to chemical analysis in table(2), the two types of organic fertilizer was applied as one dose at the time of bed preparation at ($20m^3$/fed) , the different amounts of organic fertilizer depending on different treatment were mixed, the bio fertilizer (Microbin 4L/fed) was used as suspension added to the fertigation system for two times the 1st with transplanting, while the 2nd at the time of initiation of flowering.

Pepper transplanting was planted in the first week of Mars in both seasons.

At the vegetative growth stage, random samples of six plants from each plot were taken after 45 days from transplanting for determination of plant length (cm), number of branches and leaves per plant as well as dry weight of branches and leaves. At harvesting time (60 days from transplanting) pepper fruits were picked weekly through the harvesting period for estimation of yield parameters, i.e., number and weight of fruits per plant, total yield per m^2.

Table 1. Physical and chemical characteristics of soil sampled collected for greenhouse

Properties	Season 2013	Season 2014
Physical properties		
Clay %	45.2	39.5
Silt %	35.1	37.2
Sand %	21.8	23.4
Soil texture	Clay loam	Clay loam
Chemical properties		
*PH	8.5	8.3
**EC (dSm^{-1})	3.35	3.32
Soluble cations (meq ll):		
Ca^{++}	3.8	4.6
Mg^{+}	3.6	2.9
K^{+}	21	19
Na	7.2	7.4
Soluble anions:		
CO_3^{--}	3.1	3.3
HCO_3^{-}	1.7	1.9
Cl^{-}	5.5	5.6
SO_2^{--}	2.9	3.2
Total N%	0.19	0.18
Available phosphorus	30.9	30.7

* measured in 1:25 soil water suspension.

** measured in the water extract of saturation soil paste.

Table 2. Analysis of farm yard manure and dried biogas digester residue used in the experiment.

Element / Sample	N	P	K	Fe	Zn	Cu	Cd	Ni	Cr	Pb
		%					(meq/l)			
Farm yard manure	1.06	1.80	1.20	383.0	76.0	20.00	18.0	168.0	0.00	96.00
Dried biogas digester residue	2.01	2.60	6.70	868.0	74.0	60.0	16.0	184.0	0.00	54.00

For fruit quality determination, a random sample of 30 fruits from each were taken and the average fruit weight and diameter as well as flesh thickness were recorded and also chemical properties of fruits, i.e., nitrogen phosphorus and potassium contents, as corbic acid (vitamin C), total acidity and TSS %, N, Pand K were determined according Black, (1983), Watanab and Olsen, (1965) and Jackson, (1965), respectively. However ascorbic acid, total acidity and T55% were determined according to A.O.A.C, (1975). Fe, Mn, Zn, Cu, Ni, Cd and Pb were determined by using an atomic absorption spectrophotometer. The obtained data of experiments were subjected to the statistically analysis of variance procedure and means were compared using the LSD method at 5% level of significance according to Gomez and Gomez, (1984)

RESULTS AND DISCUSSION

Vegetative growth characters:

Generally, there was a significant treatment effect on plant growth by applying dried biogas digester residue combined with bio-N (Microbin) and mineral – N fertilizers which gave better plants expressed as plant length, number of leaves and stems as well as shoots dry weight in both seasons followed by application of dried biogas digester residue and bio- N fertilizer compared with other treatments. However, the lowest values were obtained from plants treated with only mineral – N fertilizer.

The difference within the two organic fertilizers (FYM and dried biogas digester residue) was not statistically significant. Moreover, there were no significant differences between (FYM) and (dried biogas digester residue) + bio – N fertilizer on most vegetative growth characters (Table 3). It could be notices that bio – N fertilizer enhanced most vegetative growth parameters. The noticed effect could be attributed to the role of bio – N fertilizer that converts organic – N form to mineral – N form, which is more preferred by plants. In this concern, El- Karamany et al., (2000) reported that the significant effect of bio – fertilizers may be due to the effect of different strain groups such as nitrogen fixers, nutrients mobilizing microorganisms which help in availability of metals and their forms in the composted material and increased levels of extractable N , P , K , Fe , Zn and Mn.

Yield and physical properties of fruits:

The obtained results explained that organic fertilizer (dried biogas digester residue) combined with mineral – N fertilizer and bio – N fertilizer significantly was the best treatment compared with other treatments. It gave the highest number of fruits and total fruit yield per plant as well as the best physical properties of fruits i.e.; diameter and flesh thickness in the two seasons followed by organic fertilizer (FYM) combined with mineral – N fertilizer and bio – N fertilizer (table 4). Generally applying organic, mineral and bio – N fertilizers increased the total fruit yield and enhanced its physical properties. This effect could be attributed to that organic fertilizer increased supply of P and K to the soil, which improves soil fertility. In addition organic fertilizer has much higher nitrogen, which gives strong plant growth and fruit yield.

Fruit chemical properties:

It is clear that the same trend was also obtained as previously mentioned for growth and fruit yield (Table 5). Applying organic plus mineral and bio- N fertilizers enhanced chemical properties of pepper fruits in general. It increased values of total acidity, vitamin C content, TSS percentage, dry matter and mineral content of fruits. Best results were obtained by organic fertilizer (dried biogas digester residue) combined with mineral – N fertilizer and bio – N fertilizer treatment followed by the organic fertilizer (FYM) combined with mineral – N fertilizer and bio – N fertilizer in both seasons. Meanwhile, the differences could not reach the level of 5% significance for vitamin C, TSS percentage and dry matter as well as Ni and Pb content (Table 5). Microorganisms convert the organic form of nutrients to mineral form, which increases its availability and uptake, in order to enhance chemical properties and mineral content of fruits. The results of Muniz and Silva (1989) and Nour (1999) confirming present results. It could be concluded that organic, mineral, or bio- N fertilizer applied alone had a little effect if compared with mixed application of two of them r combined application of all of them.

Table 3. Effect of bio, organic and inorganic nitrogen fertilizers on vegetative growth characters of pepper plants during 2013 and 2014 seasons

Seasons / Fertilizers	2013					2014				
	Plant length (cm)	No. of leaves	No. of branches	Leaves d.w. (g)	shoots d.w. (g)	Plant length (cm)	No. of leaves	No. of branches	Leaves d.w. (g)	shoots d.w. (g)
T_1	58.9	187.8	18.9	36.4	41.9	61.4	175.3	16.6	37.6	37.2
T_2	62.9	232.1	21.7	42.4	46.2	67.2	250.3	21.5	47.3	55.3
T_3	55.2	126.5	17.2	30.8	32.3	53.3	146.2	14.6	28.2	22.5
T_4	56.8	151.6	18.4	35.3	36.5	59.9	112.3	16.4	36.1	34.6
T_5	57.9	205.6	19.3	33.8	33.4	58.3	206.9	18.3	32.1	32.7
T_6	61.2	222.4	19.4	40.8	41.4	61.4	214.3	21.8	43.6	41.1
T_7	64.9	238.7	23.3	45.5	49.9	61.3	255.4	23.3	50.6	58.1
T_8	66.8	242.3	27.3	48.2	56.9	63.9	261.9	24.9	53.9	61.7
LSD (at 5% level)	5.0	46.1	1.9	11.0	9.9	5.9	49.1	1.8	8.5	7.9

T_1: Mineral – N (control) ; T_2: Mineral + bio; T_3: organic (FYM); T_4: organic (dried biogas digester residue); T_5: (FYM) + bio- N; T_6: (dried biogas digester residue) + bio – N; T_7: (FYM) + bio + mineral – N; T8: (dried biogas digester residue) + bio + mineral – N.

[328]Bulletin No.(902),2004. Agriculture Research Centre, Ministry of Agriculture Egypt.

Table 4. Effect of bio, organic and inorganic nitrogen fertilizers on yield and physical fruit quality of pepper plants during 2013 and 2014 seasons

Seasons / Fertilizers	2013					2014				
	No. of fruits/ plant	**Yield/ plant (kg)**	**Fruit yield (kg m^{-2})**	**Fruit diameter (cm)**	**Flesh thicknesss (cm)**	**No. of fruits/ plant**	**Yield/ plant (kg)**	**Fruity yield (kg m-2)**	**Fruit diameter (cm0**	**Flesh thickness 9cm)**
T_1	14.70	1.45	7.85	7.86	0.84	15.34	1.62	8.62	7.76	0.52
T_2	18.91	2.10	9.41	8.16	0.56	21.68	2.50	8.71	8.21	0.54
T_3	8.81	0.98	6.28	7.44	0.38	7.44	0.89	6.73	7.66	0.53
T_4	12.21	1.40	7.42	7.96	0.48	12.42	1.59	7.45	8.12	0.51
T_5	10.32	1.43	7.23	7.87	0.38	11.45	1.35	7.53	8.13	0.46
T_6	15.32	1.92	8.42	8.31	0.53	15.35	1.79	8.48	8.21	0.51
T_7	21.93	2.46	9.86	8.16	0.56	22.43	3.25	9.46	8.97	0.56
T_8	23.82	3.15	11.37	8.28	0.62	24.75	3.49	10.11	9.36	0.61
LSD (at 5% level)	2.71	0.21	0.98	NS	NS	2.76	0.27	0.79	NS	NS

T_1: Mineral – N (control); T_2: Mineral + bio; T_3: organic (FYM); T_4: organic (dried biogas digester residue); T_5: (FYM) + bio- N; T_6: (dried biogas digester residue) + bio – N; T_7: (FYM) + bio + mineral – N; T8: (dried biogas digester residue) + bio + mineral – N.

Table 5. Effect of bio, organic and inorganic nitrogen fertilizers on chemical quality of pepper fruits during 2013 season

Seasons / Fertilizers	2013												
	(mg g^{-1})				(%)			(ppm)					
	Acidity	Vitamin C	TSS	Dry matter	N	P	K	Fe	Mn	Zn	Cu	Ni	Pb
T_1	257.0	63.23	5.23	8.99	1.92	0.36	1.89	128.1	22.6	49.1	7.6	50.2	25.6
T_2	262.0	63.33	5.87	9.11	2.34	0.93	2.98	122.2	26.3	42.1	11.6	46.8	25.5
T_3	259.1	63.67	4.43	8.71	2.46	0.54	2.87	108.3	19.6	43.3	6.8	58.8	19.3
T_4	259.3	63.42	5.15	8.82	2.41	0.43	2.53	132.7	22.8	47.1	8.7	61.7	26.8
T_5	264.1	63.10	4.36	9.01	1.91	0.33	1.99	112.7	18.2	42.1	6.3	52.8	23.6
T_6	258.2	63.37	5.84	9.27	2.34	0.49	2.31	143.2	23.6	50.0	9.5	56.1	20.6
T_7	261.1	63.20	5.11	9.73	2.44	0.93	3.34	129.1	28.3	60.7	16.8	54.1	24.1
T_8	264.2	63.49	5.93	9.98	2.42	0.98	3.72	144.7	30.1	69.8	17.4	59.1	29.4
LSD (at 5% level)	2.3	NS	NS	NS	0.18	0.08	0.62	14.1	6.7	7.4	3.39	NS	NS

T_1: Mineral – N (control); T_2: Mineral + bio; T_3: organic (FYM); T_4: organic (dried biogas digester residue); T_5: (FYM) + bio- N; T_6: (dried biogas digester residue) + bio – N; T_7: (FYM) + bio + mineral – N; T8: (dried biogas digester residue) + bio + mineral – N.

Table 6. Effect of bio, organic and inorganic nitrogen fertilizers on chemical quality of pepper fruits during 2014 season.

Seasons / Fertilizers	2014												
	(mg g^{-1})				(%)			(ppm)					
	Acidity	Vitamin C	TSS	Dry matter	N	P	K	Fe	Mn	Zn	Cu	Ni	Pb
T_1	260.1	59.31	5.31	7.86	1.95	0.38	2.81	125.1	21.5	48.1	6.5	49.1	26.5
T_2	265.0	59.11	5.61	8.13	2.53	0.93	3.56	120.1	25.3	41.2	10.9	47.2	26.4
T_3	301.1	59.61	4.45	7.82	2.54	0.53	3.87	105.4	18.8	42.4	7.8	56.9	20.3
T_4	301.4	59.34	5.34	7.79	2.53	0.45	3.64	129.7	21.9	46.2	7.8	60.7	25.7
T_5	267.2	59.11	4.41	8.12	1.87	0.34	2.98	108.8	17.3	41.2	6.4	51.9	24.7
T_6	261.3	59.21	5.51	8.35	2.54	0.48	3.42	140.3	22.5	49.1	10.9	55.1	19.9
T_7	264.2	59.40	5.22	8.93	2.64	0.92	4.34	126.2	27.4	59.8	17.8	53.0	23.2
T_8	267.3	59.53	5.81	8.66	2.53	0.95	4.35	141.8	29.3	68.9	18.3	58.1	28.1
LSD (at 5% level)	2.3	NS	NS	NS	0.18	0.08	0.62	14.1	6.7	7.4	3.39	NS	NS

T_1: Mineral – N (control); T_2: Mineral + bio; T_3: organic (FYM); T_4: organic (dried biogas digester residue); T_5: (FYM) + bio- N; T_6: (dried biogas digester residue) + bio – N; T_7: (FYM) + bio + mineral – N; T8: (dried biogas digester residue) + bio + mineral – N.

REFERENCES

Abdalla, A.M., F.A. Rizk and S.M. Adam.(2001). The productivity of pepper plants as influenced by some bio fertilizer treatments under plastic house conditions. Bull – Fac. Agric. Cairo Univ. 52: 625 – 64.

Abdel Aty, S.A.H.(1997). Influence of some organic fertilizers on the growth and yield of pepper plants cultivated under plastic houses. M. Sc Thesis, Faculty of Agric. Ain shams Univ. Cairo, Egypt, pp: 93 – 98.

A.O.A.C.(1975). Association Agricultural chemist, Washington, D. C., 200. Official Method of Analysis 12th Edn., 44 : 94 – 117.

Bedaiwi, E.G., R.A. Mitkess, M. M. Eid, H.H. Iskandar, I.M.M. Sadek, A.M. Abo Warda and A.A. Hamafa.(1997). Effects of some Egyptian bio fertilizers on wheats. Egypt. J. Applied Sci., 12 : 57 – 67.

Black, C.A.(1983). Methods of Soil analysis pasts I and II Am. Soc. Agron –Inc. Publ. Madison. Wisconsin- USA.

Casale, W.L., V. Minassian, J.A. Menge, C.J. Lovatt, E. Johnason and F. Guillemet. (1995). Urban agricultural wastes for use as delivery of microbial bio control agents. J. Hort. Sci. 10 (2): 315 – 332.

El- KLaramany, M.F., M.K.A. Ahmed, A.A. Bahr and M.O. Kabesh.(2000). Utilization of bio fertilizers in field crop production. Egypt. J. Applied. Sci., 15 : 137.

El- Sheekh, H.M.(1997). Effect of bio and mineral phosphate fertilizers on growth, yield, quality and storability of onion. Egypt. J. Applied Sci., 12 : 213 – 231.

Gomez, K. A. and A.A. Gomez. (1984). Statislical procedures for Agricultural Research (2nd Edn) p. 680.

Hassanien, N.M.(1996). Studies on using animal manure for some vegetable crops. M. Sc. Thesis, Institute of Environmental studies and Research, Ain Shams Univ. Egypt, pp : 97 – 103.

Jackson, M.L.(1965). Soil chemical analysis advanced course. Wisconsin. USA.

KWON, J.B., J.R.K won. Shin. C.R. Kim and B.S. Choi. (1996). Effect of organic matters on horticultural characteristics and yield of potato in green house. J. Korean Soc. Hortic. Sci., 37: 758 – 760.

Mervat, A.T., T. Amara and M.S.A. Dahdoh.(1995). Effect of inoculation with plant growth promoting rhizobacteria on yield and uptake of nutrients by wheat grown on sandy soil. Fifth National Congress on Bio Agric. In relation to Environment. Nov., 20 – 21, Cairo, Egypt, pp : 327 – 331.

Muniz, J.O. and L.A.D Silva.(1989). Capsicum cultivars under organic and chemical fertilizers. Empresa de pesquisa Agropecuava Ceara, 25 : pp: 7 – 11.

Nijjar, G.S.(1985). Nutritional of fruit trees. Mrs. Usha. Ral. Kumar for Kalyani. Publishers. New Delhi. India PP. 10 – 52.

Nour, E.M.E. (1999). Effect of some agricultural treatments on pea under sandy soil conditions. M. Sc Thesis, Zagazig Univ., Egypt, 67 – 71.

Rakesh, J. and A. Pal Vig.(2010). Effect of vermicompost on growth, yield and quality of tomato. African Journal of Basic & Applied Sciences. 2 (3- 4): 117 – 123.

Ram Rai, D.M., Kodandaramaiah, J., Reddy, M.P., Katiyar, R.S. and Rahmathulla, V.K.(2007). Effect of AM fungi and bacterial bio fertilizer ers on mulberry leafquality and silk worm cocoon characters under semiarid conditions. Caspian. J. Env. Sci. 5 (2): 111 – 117.

Rizk, F.A. and M.R. Shafeek.(2000). Frowth and productivity of sweet pepper grown in plastic house as affected by organic, mineral and bio – fertilizers. Egypt J. Applied Sci. 15 : 562 – 670.

Sagiv, B., B.U. Kafkafi and A. Mini.(1978). Fertilization and manure on sprinkler irrigated fields on pepper with fertilization. Soil and water 763 : 48 – 52.

Shen, R.Z.(1997). Growth and productivity of tomato grown in greenhouse as effected by organic, mineral source of nitrogen. Acta Agriculture Shanghai, 13 : 89 – 96.

Taber, H. G. (2001). Petiole sap nitrate sufficiency values for fresh market Solanacenous crops production. J. Plant Nutr., 2 : 945 – 959.

Watanab, F.S. and S.R. Olsen.(1965). Test of an ascorbic acid method for determining phosphoress and Na HCO3 extracts for soil – Soil Sci. Soc. Am. Proc., 29 : 677 – 678.

الملخص العربي

استخدام المخلفات الصلبة لمخمرات البيوجاز كسماد عضوي مع نظم التسميد المعدني والحيوي لنباتات الفلفل لنامية داخل البيوت المحمية

طارق ياقوت رمضان، دعاء محمد مصطفي، جابر محمد داهش

تم إجراء هذا البحث خلال موسمي ٢٠١٣، ٢٠١٤ على نباتات الفلفل الرومي (صنف دولما ١٠٩١) النامي في صوب بلاستيكية متحكم فيها من حيث درجة الحرارة والرطوبة. في محطة بحوث الصبحية– معهد بحوث البساتين– مركز البحوث الزراعية– بالإسكندرية.

وتهدف هذه التجربة لتقييم بعض المعاملات المتداخلة بين الأسمدة النيتروجينية المعدنية الموصي باستخدامها، مع مصدرين من مصادر الأسمدة العضوية هي: سماد الماشية كمصدر حيواني(منخفض في نسبة عنصر النيتروجين مقارنة بالمصدر الثاني بمعدل ٢٠ م^{٣} /فدان) والمخلفات الصلبة الناتجة من مخمرات البيوجاز (مرتفع في نسيه عنصر النيتروجين بمعدل ٢٠ م^{٣} /فدان)، وكذلك استخدام سماد حيوي من مركب بكتيري مثبت للنيتروجين (ميكروبين بمعدل ٤ لتر/فدان)، وذلك للحد من استخدام المصادر المعدنية لعنصر النيتروجين.

وقد أظهرت النتائج أن كل المعاملات المستخدمة من السماد العضوي أو الحيوي كانت فعالة في تحسين النمو الخضري متمثلا في ارتفاع النبات وعدد الأوراق وعدد الأفرع للنبات والوزن الجاف للأوراق والأفرع، وكذلك زيادة محتوى الثمار من العناصر الكبرى، والصغرى، مع زيادة المحصول لكل نبات وكذلك المحصول الكلي، وأيضا تحسين صفات الجودة، ومحتواها من المادة الصلبة الذائبة الكلية(TSS)، وحامض الأسكوربيك، وذلك بالمقارنة بمعاملات السماد النيتروجين المعدني فقط.

وقد أوضحت النتائج أن استخدام المعاملة التي تشتمل على السماد المعدني، والحيوي، والعضوي قد تفوقت على باقي المعاملات في زيادة المحصول. وهذا يوضح أنه يمكن توفير الكميات المستخدمة من التسميد النيتروجيني المعدني واستبدالها بمصادر أخرى عضوية أوحيوية لما لهذه المصادر من فوائد في تقليل تلوث البيئة وتقليل تراكم العناصر الكبرى في الأرض والنبات والتي تؤدي لسمية النبات والإنسان معا، وكذلك يقلل نفقات الإنتاج الزراعي.