# Producing Sweet Pepper Organically Using Different Sources of Organic Fertilizers under Plastic House Conditions

Shahein[1] M.M, S.F. El Sayed[1], H.A. Hassan[1], and S. Abou-El-Hassan[2]

***Abstract*—**Plastic house experiment was conducted during the two successive seasons of 2013/2014 and 2014/2015, at organic farm in El-Aiat district, Giza Governorate, Egypt. This study aims to evaluate the organic production of two hybrids of sweet (bell) pepper using different sources of organic fertilizers under plastic house conditions. Five sources of organic fertilizers (quail, turkey chicken, rabbit manures and compost) as recommended dose of nitrogen for sweet pepper were investigated on vegetative growth, nutritional content, yield component and fruit quality of two hybrids of sweet pepper (Bunjii red fruit and Shunghi yellow fruit). The experimental treatments were arranged in split plot design with three replicates, where two hybrids of sweet pepper treatments were adapted in the main plots while five types of organic fertilizers treatments were randomized in the subplots. Obtained results showed that using compost produced the highest values of plant height, N% of bell pepper plants, as well as the maximum early, total yield and fruit length. Applying compost and chicken manure produced the highest values of fruit weight, total soluble sold and vitamin C content of pepper fruits. Compost, chicken and turkey manure treatments gave the maximum number of leaves per plant and chlorophyll reading of pepper leaves, percent of P and K in plants, fruit diameter and number of fruits / plant. There were no significant differences among all organic fertilizer treatments in firmness of pepper fruits. Generally, Bunjii hybrid was superior in the most of tested parameters compared to Shunghi hybrid of pepper.

***Keywords*—**Sweet pepper, Manure, Compost, Organic production.

## I. Introduction

INTENSIVE synthetic fertilizer usage in agriculture caused so many health problems and environmental pollution. To reduce and eliminate the adverse effects of synthetic fertilizers and pesticides on human health and environment, new agricultural practices were developed in the so-called organic agriculture, ecological agriculture or sustainable agriculture [1]-[3].

Organic farming products are becoming very necessary in today's world to manage ecosystem health and to impart related human health benefits, world over there is growing demand for organic products. The organic areas in the whole world reached to 37.5 million hectares; whereas the cultivated organic area in Egypt is about 82000 hectares [4].

Sweet pepper (Capsicum annuum L) is a member of the solanaceous vegetables group. It is one of the most important, popular and favorite vegetable crops cultivated in Egypt for local market and exportation. The cultivated area from sweet and hot pepper for all seasons was about 95 thousand feddans (faddan = 0.4 hectare), produced about 651 thousand tons on annual basis with an average of 6.8 tons/feddan [5].

The organic fertilizers provide the nutritional requirements of plants. Additionally, they increase the microbial activity in soil, anion and cation exchange capacity, organic matter and carbon-content of soil. Organic fertilizers produce the yield and quality of agricultural crops in ways similar to inorganic fertilizers [6]-[8].

Organic manure can serve as alternative practice to mineral fertilizers [9] for improving soil structure [10] and microbial biomass [11]. Organic manure plays a direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization [12] and improves physical and chemical properties of soils [13]. Anant-Bahadur et al. [14] pointed that organic matter plays an important role in the chemical behavior of several metals in soils throughout its active groups (fulvic and humic acids) which have the ability to retain the metals in complex and chelate forms. Concerning organic fertilizers, many investigators found that, application of organic fertilizer had a major effect on vegetative growth characters of sweet pepper [15]-[17], total yield [18]-[21] and quality of sweet pepper plants [22]-[24].

The present work aimed to evaluate the organic production of two hybrids of bell pepper using different sources of organic fertilizers under plastic house conditions.

## II. Materials And Methods

### A. Experiment location

The experiment was conducted into plastic house during the two successive seasons of 2013/2014 and 2014/2015, at organic farm in El-Aiat district, Giza Governorate, Egypt, which was certified as an organically farm in conversion period.

### B. Plant material

Bell pepper seeds of two hybrids (Bunjii red fruit and Shunghi yellow fruit) were sown in the seedling trays, which were filled with peat moss and vermiculite 1:1 (v:v) under nursery of plastic house on 10 and 20 of August in first and second seasons, respectively. The seedlings were transplanted in the soil of plastic house on 1 and 10 of October in first and second seasons, respectively. The experimental soil was analyzed according to FAO [25] and presented in Table 1.

### C. Methods

The soil of plastic house (6 m width, 40 m length and 2.5 m height) was ploughed and divided into three ridges (1 m width

Mohamed M. Shahein, Vegetable Dept., Faculty of Agriculture, Cairo University, Egypt. (phone:+2 01004638787 ; e-mail: shahein97@yahoo.com).
Sayed F. El Sayed, Vegetable Dept., Faculty of Agriculture, Cairo University, Egypt. (e-mail: sayedfathey2000@yahoo.com).
Hassan A. Hassan, Vegetable Dept., Faculty of Agriculture, Cairo University, Egypt. (e-mail: ).
Saad Abou-El-Hassan, Central Lab of Organic Agriculture, Agricultural Research Center, Egypt. (e-mail: saad0777@yahoo.com ).

x 40 m length). Each ridge was divided into two equal divisions (1 m width x 20 m length) as main plots for both hybrids of pepper. Each ridge of main plots was divided into five equal divisions (1 m width x 4 m length) as sub main plots for organic manure treatments. Five organic fertilizers of quail, turkey chicken, rabbit manures and compost as recommended dose of nitrogen for sweet pepper (300 kg/feddan) in sandy soil under greenhouse conditions [26] were investigated for organic production of two hybrids of sweet pepper. All different manures were obtained from Faculty of Agriculture Farm, Cairo University, these manures were composted aerially for three weeks. Commercial compost was used. The chemical analyses of different organic fertilizers are illustrated in Table 2. All quantities of different organic fertilizers (2.024, 1.868, 2.208, 2.617 and 7.440 kg/$m^2$ from quail, turkey chicken, rabbit manures and compost respectively) as recommended dose of nitrogen were incorporated into ridges at once before one week of transplanting.

D. *Treatmentsand experimental design*

Split-plot design with three replicates was used in plastic house trails, where the two hybrids were adapted in the main plots and the five organic fertilizer treatments (quail, turkey, chicken, rabbit manures and compost) were randomized in the sub main plots. The plot area was 4 m2 (1 x 4 m) on form ridge included 16 plants in 2 rows; the space within plants and between rows was 50 cm, the space between ridges was 75 cm. The plants were irrigated by drip irrigation (4 L/hr) daily according to water rations program for tomato plants under plastic houses at Giza Governorate [27].

*E. Measurements*

After 90 days from transplanting, three plants per replicate were randomly chosen to measure plant height and number of leaves/plant. Chlorophyll reading in the fourth upper leaf was measured by using Minolta Chlorophyll Meter Spad 501. The percentage of nitrogen, phosphorous and potassium were determined in the dry matter of fourth upper leaf according to Cottenie*et al.*[28].Nitrogen percent was determined by Kjeldahl method according to the procedure described by FAO [25]. Phosphorus percent was determined using spectrophotometer according to Watanabe and Olsen [29]. Potassium percent was determined spectrometrically using Phillips Unicum Atomic Absorption Spectrometer as described by Chapman and Pratt [30].Harvesting of mature pepper fruits was at full color stage, which began on 1 and 15 January and finished on 15 and 30 May in the first and second seasons respectively. Early yield was recorded during the first two harvests. Total yield per meter square, number of fruits per plant were recorded after each harvesting accumulatively. Average of weight, diameter, firmness, TSS and vitamin C of mature fruits (fully color stage) were measured, as well. Fruit firmness was measured by Pressure Tester. TSS was measured by using Digital Refractometer. Vitamin C in fruit was determined as described in FAO [25].

*F. Statistical analysis*

Data of the two seasons were arranged and statistically analyzed by the analysis of variances according to Snedecor and Cochran [31] with SAS software, version 2004. Comparison of treatment means was done using Tukey test at significance level 0.05.

## III. Results And Discussion

*A. Vegetative growth*

Data on vegetative growth parameters, i.e. plant height, leaf number/plant and chlorophyll reading in leaves for the studied hybrids under different organic fertilizers were presented in Table 3. Such data reveal that there were no significant differences between two hybrids of bell pepper in plant height and leaf number. Chlorophyll reading in leaves of Bunjii hybrid was higher than Shunghihybrid

Effect organic fertilizers gave significant differences on vegetative growth characteristics. However, compost treatment gave the highest value of plant height; chicken and turkey manure treatments came in the second order, then rabbit manure treatment; whereas the lowest plant height was recorded by quail manure. The maximum leaf number/plant was obtained by compost, chicken and turkey manures; rabbit manure treatment came in the second order, finally quail manure gave the lowest leaf number. The highest reading of chlorophyll in pepper leaves was observed in plants treated with compost, chicken and turkey manures. While the lowest reading of chlorophyll was obtained by quail and rabbit manure treatments. These results were true in the two seasons. A promotion effect of compost on vegetative growth and chlorophyll reading might be attributed to that compost has advantages more than other manures because it contain on essential nutrients on balance form [32], [33], decompose and stable organic matters; compost is usually applied at greater rate cause it contain low N% (Table 2). All these advantages led to compost came more effect than other manures on improving the soil fertility and ability of sandy soil to hold water and nutrients for plant absorb. Thus applying compost increased of plant growth and chlorophyll reading of bell pepper plants. Similar results were reported by Abdel-El-Moez*et al.*, Arancon *et al.* and Ewulo *et al.*[15]-[17] respectively.

The interaction between organic fertilizers and hybrids had significant effect on vegetative growth characteristics and chlorophyll reading of bell pepper in the two seasons. However, the highest values of all vegetative growth parameters were recorded by using compost and chicken manure with both hybrids. Meanwhile, the lowest values were obtained by quail and rabbit manure with two hybrids.

*B. Nutritional status*

Data recorded in Table 4 show clearly that percentage of NPK in the Bunjii hybrid was significantly higher than Shunghi hybrid in the both seasons except K percent there was no significant different between both hybrids in the second season. These results might be correlated with the gene action of the tested hybrids.. These results are agreed with those obtained by Geleta*et al.* [34] and Deepaa*et al.* [35].

Organic fertilizers showed significant effect on nutritional status of bell pepper plants. However, the highest percent of N in plants was preceded by compost treatment. The treatments of chicken and turkey manure came in the second order, then

rabbit manure treatment. The lowest percent of N was obtained by quail manure. The highest percent of P in bell pepper plants were resulted by compost, chicken and turkey manures; while quail and rabbit manures gave the lowest percent of P. Using compost, chicken and turkey manures produced the highest percent of K in bell pepper plants, quail manure treatment came in the second order, finally rabbit manure gave the lowest percent of K.The superiority of NPK content in bell pepper plants by compost treatment may be due to that compost is usually applied at much greater rates; therefore, it can have a significant cumulative effect on nutrient availability. The great rate of compost also increases activity of beneficial microorganisms in soil, which help in promotion of nutrient availability by atmospheric nitrogen fixation, phosphate dissolving and potassium releasing [36]-[38]. All these led to increment NPK content of bell pepper plants. On the other hand, increase P and K content of chicken manure treatment may be due to increase percentage these nutrients in chicken manure (Table 2). Harmony results were observed by Alabi[39] and Dawa *et al.* [40], they reported that N, P and K% increased in sweet pepper leaves when plants were fertilized by chicken manure.

The interaction between organic fertilizers and hybrids had significant effect on NPK percent of bell pepper plants during in the two seasons. However, the highest N% was recorded by using compost with both hybrids. Meanwhile, the lowest N% was obtained by quail manure with two hybrids. The highest P and K% was recorded by using compost, chicken and turkey manure with both hybrids. On the contrary, the lowest P and K% was obtained by quail manure and rabbit manure respectively with both hybrids.

*C.Yield component*

It is evident from the data in Table 5 that there were significant differences among the various investigated entries with regard to yield component of bell pepper. In both seasons, Bunjii hybrid gave the highest values of early, total yield, number and weight of bell pepper fruits compared with Shunghi hybrid. This result was in harmony with previous findings of Geleta*et al.* [34] and Deepaa *et al.* [35] they reported that the observed differences in yield component of sweet pepper cultivars are mainly due to the genotype of each cultivar.

Organic fertilizers had significant effect on yield component. However, the highest values of early and total yield of bell pepper plants were produced by compost treatment; chicken manure treatment came in the second order, turkey manure treatment came in the third order, then rabbit manure treatment, finally the lowest values of early and total yield were recorded by quail manure. Using compost and chicken manures produced the highest number and weight of fruit, turkey manure treatment came in the second order, then rabbit manure treatment, finally quail manure produced the lowest number and weight of fruit. The positive effect of these treatments on yield component may be due to increase uptake of N, P and K by these plants as shown in Table 4 which resulted in increased plant growth characteristics as shown in Table 3. The improving of plant growth led to better carbohydrate build up which increased the early, total yield number and weight fruit of bell pepper. In this concern, Suge*et al.*[41] reported similar results and explained that addition of suitable organic matter in the soil improves the soil physical and chemical properties which encourages better root development, increased nutrient uptake and water holding capacity which led to higher yield component of eggplant. Obtained results agreed with those obtained by previous studies [18]-[21], [42].

The interaction between organic fertilizers and hybrids had significant effect on early, total yield/$m^2$ and fruit number/plant of bell pepper during in the two seasons. However, the highest value of early yield was recorded by using compost with Bunjiihybrid. On the contrary, the lowest value was obtained by quail manure with Shunghihybrid. The highest values of total yield and fruit number were produced by using compost and chicken manure with Bunjiihybrid. Conversely, the lowest values were obtained by quail manure with Shunghihybrid. Meanwhile, the interaction between organic fertilizers and hybrids had no significant effect on fruit weight of bell pepper.

*D.Fruit quality*

*Physical properties of fruit*

Data on fruit quality, i.e. fruit diameter, fruit length and fruit firmness for the studied cultivars under different nitrogen levels were presented in Table 6. Such data reveal that there were significant differences in most studied fruit quality among red fruit hybrid and yellow fruit hybrid. In this respect, Bunjii hybrid gave fruits of pepper more diameter and length than fruits of Shunghi hybrid. These results might be correlated with the gene action of the tested hybrids. These results are agreed with those obtained by Geleta*et al.* [33] and Deepaa*et al.* [35].

Organic fertilizers showedsignificant effect on diameter and length of bell pepper fruits in the two seasons. Applying compost, chicken and turkey manures increased the fruit diameter of bell pepper compared with using rabbit and quail manures. Using compost produced the highest fruit length; chicken and turkey manure treatments came in the second order, finally rabbit and quail manures gave the lowest values of fruit length. There were no significant differences among all organic fertilizer treatments concerning fruit firmness of bell pepper. The superiority of these treatments on diameter and length of bell pepper fruits might be due to increase vegetative growth of these plants as shown in Table 3, which led to better carbohydrate build up, thus increased diameter and length of bell pepper fruits. These results are in harmony with previous studies [22]-[24] on pepper and [41] on eggplant.

The interaction between organic fertilizers and hybrids had significant effect on diameter and length of bell pepper fruits during in the two seasons. However, the highest fruit diameter was recorded by using compost chicken and turkey manures with both hybrids compared to rabbit and quail manures with both hybrids. Meanwhile, the interaction between organic fertilizers and hybrids had no significant effect on fruit firmness of bell pepper in both seasons.

*Chemical properties of fruit*

Data in Table 7 showed that there were no significant

differences between two hybrids in percentage of TSS in bell pepper fruits. Vitamin C content of pepper fruits was higher in Shunghi hybrid than Bunjii hybrid. The superiority of Shunghi hybrid on vitamin C content of fruit might be due to the genotype of this hybrid

Organic fertilizers had significant effect on TSS and vitamin C content of bell pepper fruits in the two seasons. Using compost and chicken manure gave the highest values of TSS and vitamin C in fruits compared to other organic fertilizers. These results were true in the both seasons.These results are in harmony with previous studies [22]-[24]

The interaction between organic fertilizers and hybrids had no significant effect on TSS percent of bell pepper fruits in both seasons. Meanwhile, compost and chicken manure treatments gave the highest value of vitamin C in bell pepper fruits in both hybrids. On the other hand, quail manure and rabbit manure treatments produced the lowest value with two hybrids in both seasons.

## IV. Conclusion

In conclusion, this work showed that satisfactory bell pepper yield and quality, could be obtained in organic production systems under plastic house conditions using compost or chicken manure as a recommended rate of nitrogen to reduce environment pollution caused by application of mineral fertilizers and sustain soil fertility.

## Acknowledgment

This work has been supported by Science Technology Development Fund (STDF),Egypt under Project number 2076.

## References

[1] U. Aksoy, Ecological Farming. II. Ecological Farming Symposium in Turkey. 14-16 December. Antalya, 2001.

[2] R. Chowdhury, "Effects of chemical fertilizers on the surrounding environment and the alternative to the chemical fertilizers," IES-ENVIS NEWSLETTER, vol. 7, no. 3, pp. 4-5, 2004.

[3] B. Malgorzata and K.Georgios, "Physiological response and yield of pepper plants to organic fertilization," Journal of Central European Agriculture, vol. 9, no. 4, pp. 715-722, 2008.

[4] FiBL and IFOAM, The World of Organic Agriculture, Statistics and Emerging Trends, 2014.

[5] Ministry of Agriculture and Land Reclamation, Economic Affairs Sector (EAS), Bulletin of The Agriculture Statistics, 2013.

[6] A. Heeb, B. Lundegardh, G.P. Savage and T. Ericsson, "Impact of organic and inorganic fertilizers on yield, taste, and nutritional quality of tomatoes," J. Plant Nut. Soil Sci., vol. 16, pp. 535-541, 2006.

[7] B. Liu, M.L. Gumpertz, S. Hu and J.B. Ristaino, "Long-term effects of organic and synthetic soil fertility amendments on soil microbial communities and the development of southern blight," Soil Biol. Biochem., vol. 39, pp. 2302-2316, 2007. http://dx.doi.org/10.1016/j.soilbio.2007.04.001

[8] L.B. Tonfack, A. Bernadac, E. Youmbi, V.P. Mbouapouognigni, M. Ngueguim and A. Akoa, "Impact of organic and inorganic fertilizers on tomato vigor, yield and fruit composition under tropical andosol soil conditions," Fruits, vol. 64, pp. 167-177, 2009. http://dx.doi.org/10.1051/fruits/2009012

[9] M. Naeem, J. Iqbal and M.A.A. Bakhsh, "Comparative study of inorganic fertilizers and organic manures on yield and yield components of Mungbean," J. Agric. Soc. Sci., vol. 2, pp. 227-239, 2006.

[10] S.N. Dauda, F.A. Ajayi and E. Ndor, "Growth and yield of water melon as affected by poultry manure application," J. Agric. Soc. Sci., vol. 4, pp. 121-140, 2008.

[11] K.D. Suresh, G. Sneh, K.K. Krishn and C.M. Mool, "Microbial biomass carbon and microbial activities of soils receiving chemical fertilizers and organic amendments," Archives Agron. Soil Sci., vol. 5, pp. 641-647, 2004.

[12] I.A. Nweke, S.I. Ijearu and D.N. Igili, "Effect of different sources of animal wastes on the growth and yield of Okra in ustoxicdystropept at Enugu South Eastern, Nigeria," International Journal of Scientific and Technology Research, vol. , no. 3, pp. 135-137, 2013.

[13] B. Chaterjee, P. Ghanti, U. Thapa and P. Tripathy, "Effect of organic nutrition in sport broccoli," Vegetable Science, vol. 33, no. 1, pp. 51-54, 2005.

[14] Anant-Bahadur, Jagdish-Singh, K.P., Singh, A.K Upadhyan and Mathura-Rai, Effect of organic amendments and biofertilizers on growth, yield and quality attributes of Chinese cabbage," Indian J. of Agric. Sci., vol. 76, no. 10, pp. 596- 598, 2006.

[15] M.R. Abdel-El-Moez, N. Gad and S.A. Wanas, "Impact of banana compost added with or without elemental sulphur on nutrients uptake, yield, soil moisture depletion and water use efficiency of pepper plants," Annals of Agricultural Science, Moshtohor, vol. 39, no. 2, pp. 1355-1372, 2001.

[16] N.Q. Arancon, C.A. Edwards, P. Bierman, J.D. Metzger and C. Lucht, "Effects of vermicomposts produced from cattle manure, food waste and paper waste on the growth and yield of peppers in the field," Pedobiologia, vol. 49, no. 4, pp. 297-306, 2005. http://dx.doi.org/10.1016/j.pedobi.2005.02.001

[17] B.S. Ewulo, K.O. Hassan and S.O. Ojeniyi, "Comparative effect of cow dung manure on soil and leaf nutrient and yield of pepper," International Journal of Agricultural Research, vol. 2, no. 12, p. 1043-1048, 2007. http://dx.doi.org/10.3923/ijar.2007.1043.1048

[18] G.M. Salama and M.H. Zake, "Fertilization with manures and their influence on sweet pepper of plastic-houses," Annals of Agricultural Science, Moshtohor, vol. 38, no. 2, pp. 1075-1085, 2000.

[19] S.A. Shehata, A.G. Behairy and Z.F. Fawzy, "Effect of some organic manures on growth and chemical composition of sweet pepper grown in a sandy soil," Egyptian Journal of Agricultural Research, vol. 82, no. 2, pp. 57-71, 2004.

[20] M.A. Awodun, L.I. Omonijo and S.O. Ojeniyi, "Effect of goat dung and NPK fertilizer on soil and leaf nutrient content, growth and yield of pepper," International Journal of Soil Science, vol. 2, no. 2, pp. 142-147, 2007. http://dx.doi.org/10.3923/ijss.2007.142.147

[21] M.A. Huez-Lopez, A.L. Ulery, Z. Samani, G. Picchioni and R.P. Flynn, "Response of chile pepper to salt stress and organic and inorganic nitrogen sources: Growth and yield," Tropical and Subtropical Agroecosystems, vol. 14, no. 1, pp. 137-147, 2011.

[22] F. Amor and M. Del, "Yield and fruit quality response of sweet pepper to organic and mineral fertilization," Renewable Agriculture and Food Systems, vol. 22, no. 3, pp. 233-238, 2007. http://dx.doi.org/10.1017/S1742170507001792

[23] M.M. Arafa and O.E. Shalabey, "Effect of zinc and organic manures on yield and fruit chemical composition of pepper plants grown on newly reclaimed soils," Annals of Agricultural Science (Cairo). vol. 52, no. 2, pp. 441-450, 2007.

[24] A. Szafirowska and K. Elkner, "Yielding and fruit quality of three sweet pepper cultivars from organic and conventional cultivation," Vegetable Crops Research Bulletin, vol. 69, pp. 135-143, 2008. http://dx.doi.org/10.2478/v10032-008-0028-x

[25] FAO (Food and Agriculture Organization), Soil and Plant Analysis. Soils Bulletin 38/2, 250, 1980.

[26] S.F. El-Sayed, Technology of Vegetable Production in Greenhouse and Low Tunnels. Egyptian Book Store, Cairo, Egypt, 2006.

[27] Ministry of Agriculture and Land Reclamation, Infrastructure and Irrigation Systems for Protected Crops. Bulletin No. 2, pp. 51-57, 1988.

[28] A. Cottenie, M. Verloo, L. Kiekers, G. Velghe and R. Camrbynek, Chemical Analysis of Plants and Soils. Hand Book, pp. 1-63, Ghent, Belgium, 1982.

[29] F.S. Watanabe and S.R. Olsen, "Test of an ascorbic acid method for determining phosphorus in water and Na HCO3 extracts from soil," Soil Sci. Soc. Amer. Proc., vol. 29, pp. 677- 678, 1965. http://dx.doi.org/10.2136/sssaj1965.03615995002900060025x

[30] H.D. Chapman and P.F. Pratt, Methods of Analysis for Soil, Plant and Water Division of Agric. Sci., Calif. Univ., 1961.

[31] G.W. Snedecor and W.G. Cochran, Statistical methods. Sixth Edition, Iowa state university press, Ames., Iowa, USA, 1980.

[32] M.T. Masarirambi, M.M. Hlawe, O.T. Oseni and T.E. Sibiya, "Effects of organic fertilizers on growth, yield, quality and sensory evaluation of red

lettuce VenezaRoxa," Agric. Biol. J. N. America, vol. 1, no. 6, pp.1319-1324, 2010.
http://dx.doi.org/10.5251/abjna.2010.1.6.1319.1324

[33] S. Abou-El-Hassan and A.H. Desoky, "Effect of compost and compost tea on organic production of head lettuce," J. Appl. Sci. Res., vol. 9, no. 11, pp. 5650-5655, 2013.

[34] L.F. Geleta, M.T. Labuschagne and C.D. Viljoen, "Genetic variability in pepper (Capsicum annuum L.) estimated by morphological data and amplified fragment length polymorphism markers," Biodiversity and Conservation, vol. 14, no. 10, pp. 2361-2375, 2005.
http://dx.doi.org/10.1007/s10531-004-1669-9

[35] N. Deepaa, C. Kaura, B. Singhb and H.C. Kapoorc, "Antioxidant activity in some red sweet pepper cultivars," Journal of Food Composition and Analysis., vol. 19, no. 6-7, pp. 572-578, 2006.
http://dx.doi.org/10.1016/j.jfca.2005.03.005

[36] S. Miyasaka, Y. Nakamura, H. Okamoto, "Yield and nutrient absorption by lettuce by liming and fertilization mineral and organic soil," Brazilian Horticulture, vol. 8, no. 2, pp. 6-9, 1997.

[37] R. Ahmad, S.M. Shehzad, A. Khalid, M. Arshad and M.H. Mahmood, "Growth and yield response of wheat and maize to nitrogen and L tryptophan enriched compost," Pak. J. Bot., vol. 39, no. 2, pp. 541-549, 2008.

[38] N. Fiorentino and M. Fagnano, "Soil fertilization with composted solid waste: short term effects on lettuce production and mineral N availability," Geophysical Research Abstracts, Vol. 13, pp. 10520, 2011.

[39] D.A. Alabi, "Effects of fertilizer phosphorus and poultry droppings treatments on growth and nutrient components of pepper," Afric. J. Biotech., vol. 5, no. 8, pp. 671-677, 2006.

[40] K.K. Dawa, H.M.E. Abd El-Nabi and W.M.E. Swelam, "Response of sweet pepper plants (vegetative growth and leaf chemical constituents) to organic, biofertilizers and some foliar application treatments," J. Plant Production, Mansoura Univ., Vol. 3, no. 9, pp. 2465-2478, 2012.

[41] J.K. Suge, M.E. Omunyin and E.N. Omami, "Effect of organic and inorganic sources of fertilizer on growth, yield and fruit quality of eggplant (SolanumMelongena L)," Arch. Appl. Sci. Res., vol. 3, no. 6, pp. 470-479, 2011.

[42] M.S. Zayed, M.K.K. Hassanein, N.H. Esa and M.M.F. Abdallah, "Productivity of pepper crop as affected by organic fertilizer, soil solarization, and endomycorrhizae," Annals of Agricultural Science vol. 58, no. 2, pp. 131–137, 2013.
http://dx.doi.org/10.1016/j.aoas.2013.07.011

[43] Z.F. Fawzy, A.M. El-Bassiony, Li Yunsheng, Ouyang Zhu and A.A., Ghoname, "Effect of mineral, organic and bio-N Fertilizers on growth, yield and fruit quality of sweet pepper" J. Appl. Sci. Res., vol. 8 No. 8, pp. 3921-3933, 2012.

TABLE I PHSICAL AND CHEMICAL ANALYSES OF THE EXPERIMENTAL SOIL

| Sand % | Silt % | Clay % | Texture | pH | EC dS/m | Cationsmeq/l | | | | Anions meq/l | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | $Ca^{++}$ | $Mg^{++}$ | $K^{+}$ | $Na^{+}$ | $Co_3^{=}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{=}$ |
| 55.60 | 30.56 | 13.84 | Sandy | 7.59 | 6.45 | 21.20 | 6.80 | 1.82 | 32.35 | - | 2.02 | 35.00 | 25.10 |

TABLE II CHEMICAL ANALYSES OF THE DIFFERENT ORGANIC FERTILIZERS

| Type | Hum % | pH 1:10 | EC 1:10 | OM % | Macro elements (%) | | | Micro elements (ppm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | N | P | K | Fe | Zn | Mn | Cu |
| Quail | 2.0 | 6.5 | 17.3 | 57.7 | 3.6 | 1.0 | 1.4 | 1130 | 871 | 337 | 33 |
| Turkey | 2.0 | 7.7 | 25.6 | 57.4 | 3.9 | 1.8 | 1.3 | 1712 | 535 | 293 | 64 |
| Chicken | 2.0 | 8.1 | 25.1 | 632 | 3.3 | 1.8 | 1.6 | 1030 | 189 | 183 | 19 |
| Rabbit | 2.6 | 7.6 | 14.4 | 32.2 | 2.8 | 0.8 | 1.2 | 3335 | 195 | 185 | 33 |
| Compost | 25.0 | 7.5 | 5.9 | 32.4 | 1.2 | 0.7 | 1.4 | 2650 | 96 | 238 | 46 |

TABLE III
EFFECT OF DIFFERENT ORGANIC FERTILIZERS ON GROWTH CHARACTERS OF BELL PEPPER PLANTS DURING TWO SEASONS

| Characters | | 2013/2014 season | | | 2014/2015 season | | |
|---|---|---|---|---|---|---|---|
| | | P. height cm | Leaf NO/plant | Chloro. spad | P. height cm | Leaf NO/plant | Chloro. spad |
| Treatments | | Effect of hybrids | | | | | |
| Bunjii | | 54.87 a | 60.60 a | 58.60 a | 58.97 a | 63.80 a | 61.40 a |
| Shunghi | | 53.40 a | 58.00 a | 57.13 b | 57.50 a | 61.20 a | 59.93 b |
| | | Effect of organic fertilizers | | | | | |
| Quail | | 45.00 d | 51.17 c | 55.00 b | 48.00 e | 53.17 c | 57.00 c |
| Turkey | | 56.17 b | 60.67 ab | 58.50 a | 59.57 c | 64.67 a | 60.50 b |
| Chicken | | 57.83 b | 63.00 a | 59.50 a | 63.13 b | 67.00 a | 63.50 a |
| Rabbit | | 50.00 c | 57.17 b | 56.50 b | 54.00 b | 59.17 b | 58.50 c |
| Compost | | 61.67 a | 64.50 a | 59.83 a | 66.67 a | 68.50 a | 63.83 a |
| | | Effect of the interaction | | | | | |
| Bunjii | Quail | 46.67 cd | 51.67 d | 55.67 cd | 49.67 ef | 53.67 e | 57.67 de |
| | Turkey | 56.67 ab | 62.00 ab | 59.33 ab | 59.67 bc | 66.00 abc | 61.33 bc |
| | Chicken | 58.67 a | 64.67 ab | 60.33 ab | 63.67 ab | 68.67 ab | 64.33 a |
| | Rabbit | 50.67 bc | 58.67 bc | 57.00 bc | 54.67 cde | 60.67 cd | 59.00 cd |
| | Compost | 61.67 a | 66.00 a | 60.67 a | 66.67 a | 70.00 a | 64.67 a |
| Shunghi | Quail | 43.33 d | 50.67 d | 54.33 d | 46.33 f | 52.67 e | 56.33 e |
| | Turkey | 55.67 ab | 59.33 bc | 57.67 bc | 58.67 bcd | 63.33 bcd | 59.67 cd |
| | Chicken | 57.00 a | 61.33 abc | 58.67 ab | 62.00 ab | 65.33 abc | 62.67 ab |
| | Rabbit | 49.33 cd | 55.67 cd | 56.00 cd | 53.33de | 57.67 de | 58.00 de |
| | Compost | 61.67 a | 63.00 ab | 59.00 ab | 66.67 a | 67.00 ab | 63.00 ab |

Means in same column by similar letters are not statistically different at 0.05 level according to Tukey test.

TABLE IV
EFFECT OF DIFFERENT ORGANIC FERTILIZERS ON NPK PERCENT OF BELL PEPPER PLANTS DURING TWO SEASONS

| Characters | | 2013/2014 season | | | 2014/2015 season | | |
|---|---|---|---|---|---|---|---|
| | | N % | P % | K % | N % | P % | K % |
| Treatments | | Effect of hybrids | | | | | |
| Bunjii | | 4.27 a | 0.377 a | 4.27 a | 4.267 a | 0.390 a | 4.29 a |
| Shunghi | | 4.20 b | 0.350 b | 4.20 b | 4.202 b | 0.367 b | 4.28 a |
| | | Effect of organic fertilizers | | | | | |
| Quail | | 3.62 d | 0.303 c | 4.14 b | 3.62 d | 0.330 c | 4.18 b |
| Turkey | | 4.45 b | 0.363 abc | 4.39 a | 4.45 b | 0.373 b | 4.42 a |
| Chicken | | 4.49 b | 0.390 abc | 4.43 a | 4.49 b | 0.417 a | 4.47 a |
| Rabbit | | 3.79 c | 0.337 bc | 3.70 c | 3.79 c | 0.357 bc | 3.82 c |
| Compost | | 4.83 a | 0.423 abc | 4.53 a | 4.83 a | 0.433 a | 4.57 a |
| | | Effect of the interaction | | | | | |
| Bunjii | Quail | 3.64 d | 0.320 c | 4.21 bc | 3.64 d | 0.337 cd | 4.19 b |
| | Turkey | 4.48 b | 0.377 abc | 4.40 ab | 4.48 b | 0.387 abc | 4.41 ab |
| | Chicken | 4.51 b | 0.397 ab | 4.44 ab | 4.51 b | 0.423 a | 4.45 ab |
| | Rabbit | 3.82 c | 0.347 bc | 3.72 d | 3.82 c | 0.363 bcd | 3.82 c |
| | Compost | 4.88 a | 0.427 a | 4.56 a | 4.88 a | 0.437 a | 4.60 a |
| Shunghi | Quail | 3.60 d | 0.310 c | 4.07 c | 3.60 d | 0.320 d | 4.17 b |
| | Turkey | 4.41 b | 0.343 bc | 4.37 ab | 4.41 b | 0.350 bcd | 4.42 ab |
| | Chicken | 4.46 b | 0.380 abc | 4.42 ab | 4.46 b | 0.403 ab | 4.49 ab |
| | Rabbit | 3.75 cd | 0.323 c | 3.67 d | 3.75 cd | 0.347 bcd | 3.82 c |
| | Compost | 4.78 a | 0.420 a | 4.50 a | 4.78 a | 0.427 a | 4.53 a |

Means in same column by similar letters are not statistically different at 0.05 level according to Tukey test.

TABLE V
EFFECT OF DIFFERENT ORGANIC FERTILIZERS ON YIELD COMPONENT OF BELL PEPPER PLANTS DURING TWO SEASONS

| Characters | | 2013/2014 season | | | | 2014/2015 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | E. yield $Kg/m^2$ | T. yield $Kg/m^2$ | Fruit NO /plant | F. weight g | E. yield $Kg/m^2$ | T. yield $Kg/m^2$ | Fruit NO /plant | F. weight g |
| Treatments | | Effect of hybrids | | | | | | | |
| Bunjii | | 2.44 a | 7.88 a | 18.87 a | 145 a | 2.69 a | 8.22 a | 22.13 a | 146 a |
| Shunghi | | 1.89 b | 6.97 b | 17.78 b | 140 b | 2.14 b | 7.31 b | 20.58 b | 146 a |
| | | Effect of organic fertilizers | | | | | | | |
| Quail | | 1.24 e | 5.40 e | 15.07 c | 127 d | 1.46 e | 5.75 e | 18.07 d | 127 c |
| Turkey | | 2.18 c | 7.88 c | 19.80 a | 143 b | 2.44 c | 8.21 c | 22.80 b | 142 b |
| Chicken | | 2.49 b | 8.17 b | 19.83 a | 151 a | 2.76 b | 8.52 b | 22.83 b | 155 a |
| Rabbit | | 1.81 d | 6.92 d | 16.83 b | 134 c | 2.03 d | 7.27 d | 18.97 c | 147 b |
| Compost | | 3.11 a | 8.73 a | 20.13 a | 157 a | 3.38 a | 9.08 a | 24.13 a | 158 a |
| | | Effect of the interaction | | | | | | | |
| Bunjii | Quail | 1.42 e | 5.82 f | 15.50 d | 128 e | 1.64 e | 6.17 f | 18.50 e | 128 de |
| | Turkey | 2.42 c | 8.57 b | 20.66 a | 145 bc | 2.68 c | 8.90 b | 23.66 ab | 145 bc |
| | Chicken | 2.79 b | 8.74 ab | 20.43 ab | 155 ab | 3.05 b | 9.09 ab | 23.43 b | 158 a |
| | Rabbit | 2.07 d | 7.13 d | 17.04 d | 137 cde | 2.29 d | 7.48 d | 20.33 d | 138 cd |
| | Compost | 3.51 a | 9.12 ab | 20.74 a | 159 a | 3.78 a | 9.46 a | 24.74 a | 160 a |
| Shunghi | Quail | 1.06 f | 4.98 g | 14.58 e | 125 e | 1.28 f | 5.33 g | 17.58 e | 125 e |
| | Turkey | 1.93 d | 7.19 d | 18.95 c | 141 cd | 2.20 d | 7.52 d | 21.95 c | 139 c |
| | Chicken | 2.20 cd | 7.60 c | 19.27 c | 147 bc | 2.46 cd | 7.95 c | 22.27 c | 150 ab |
| | Rabbit | 1.54 e | 6.72 e | 16.62 d | 132 de | 1.76 e | 7.07 e | 17.62 e | 156 a |
| | Compost | 2.71 b | 8.34 b | 19.50 bc | 154 ab | 2.97 b | 8.69 b | 23.50 b | 157 a |

Means in same column by similar letters are not statistically different at 0.05 level according to Tukey test.

TABLE VI
EFFECT OF DIFFERENT ORGANIC FERTILIZERS ON FRUIT QUALITY OF BELL PEPPER DURING TWO SEASONS

| Characters | | 2013/2014 season | | | 2014/2015 season | | |
|---|---|---|---|---|---|---|---|
| | | Fruit diameter cm | Fruit length cm | Fruit firmness $Kg/cm^2$ | Fruit diameter cm | Fruit length cm | Fruit firmness $Kg/cm^2$ |
| Treatments | | Effect of hybrids | | | | | |
| Bunjii | | 8.41 a | 9.07 a | 3.05 a | 8.68 a | 9.54 a | 3.13 a |
| Shunghi | | 8.27 b | 8.89 b | 2.88 a | 8.54 b | 9.37 b | 2.97 a |
| | | Effect of organic fertilizers | | | | | |
| Quail | | 7.87 b | 8.47 c | 2.98 a | 8.07 b | 8.95 c | 3.05 a |
| Turkey | | 8.53 a | 9.10 b | 2.90 a | 8.83 a | 9.56 b | 3.00 a |
| Chicken | | 8.63 a | 9.22 b | 2.98 a | 8.93 a | 9.68 ab | 3.10 a |
| Rabbit | | 8.03 b | 8.63 c | 2.88 a | 8.23 b | 9.14 c | 2.95 a |
| Compost | | 8.70 a | 9.48 a | 3.07 a | 9.00 a | 9.94 a | 3.13 a |
| | | Effect of the interaction | | | | | |
| Bunjii | Quail | 7.90 c | 8.53 d | 3.10 a | 8.10 b | 9.04 de | 3.17 a |
| | Turkey | 8.63 a | 9.17 b | 2.93 a | 8.95 a | 9.63 b | 3.07 a |
| | Chicken | 8.70 a | 9.30 ab | 3.07 a | 9.02 a | 9.76 ab | 3.20 a |
| | Rabbit | 8.07 bc | 8.70 cd | 2.93 a | 8.27 b | 9.16 cde | 3.00 a |
| | Compost | 8.77 a | 9.67 a | 3.20 a | 9.09 a | 10.13 a | 3.20 a |
| Shunghi | Quail | 7.83 c | 8.40 d | 2.87 a | 8.03 b | 8.86 e | 2.93 a |
| | Turkey | 8.43 ab | 9.03 bc | 2.87 a | 8.75 a | 9.49 bcd | 2.93 a |
| | Chicken | 8.53 a | 9.13 bc | 2.90 a | 8.85 a | 9.59 bc | 3.00 a |
| | Rabbit | 7.97 c | 8.57 d | 2.83 a | 8.17 b | 9.12 de | 2.90 a |
| | Compost | 8.60 a | 9.30 ab | 2.93 a | 8.92 a | 9.76 ab | 3.07 a |

Means in same column by similar letters are not statistically different at 0.05 level according to Tukey test.

TABLE VII
EFFECT OF DIFFERENT ORGANIC FERTILIZERS ON TSS AND VITAMIN C OF BELL PEPPER FRUIT DURING TWO SEASONS

| Characters | | 2013/2014 season | | 2014/2015 season | |
|---|---|---|---|---|---|
| | | TSS % | vitamin C g/100g | TSS % | vitamin C g/100g |
| Treatments | | Effect of hybrids | | | |
| Bunjii | | 7.63 a | 0.180 b | 7.66 a | 0.184 b |
| Shunghi | | 7.55 a | 0.190 a | 7.63 a | 0.190 a |
| | | Effect of organic fertilizers | | | |
| Quail | | 7.43 b | 0.180 b | 7.47 b | 0.183 b |
| Turkey | | 7.50 b | 0.183 b | 7.50 b | 0.186 b |
| Chicken | | 7.83 a | 0.193 a | 7.87 a | 0.192 a |
| Rabbit | | 7.40 b | 0.183 b | 7.53 b | 0.184 b |
| Compost | | 7.83 a | 0.193 a | 7.93 a | 0.193 a |
| | | Effect of the interaction | | | |
| Bunjii | Quail | 7.47 bc | 0.177 c | 7.47 c | 0.179 e |
| | Turkey | 7.50 bc | 0.180 bc | 7.53 bc | 0.181 de |
| | Chicken | 7.83 a | 0.188 abc | 7.83 abc | 0.188 abc |
| | Rabbit | 7.43 c | 0.181 bc | 7.53 bc | 0.183 cde |
| | Compost | 7.90 a | 0.190 ab | 7.93 a | 0.190 ab |
| Shunghi | Quail | 7.37 a | 0.183 bc | 7.47 c | 0.186 bcd |
| | Turkey | 7.50 bc | 0.187 abc | 7.47 c | 0.190 ab |
| | Chicken | 7.77 ab | 0.198 a | 7.83 abc | 0.195 a |
| | Rabbit | 7.33 c | 0.183 bc | 7.47 c | 0.183 cde |
| | Compost | 7.77 ab | 0.198 a | 7.90 ab | 0.196 a |

Means in same column by similar letters are not statistically different at 0.05 level according to Tukey test.