Short communication
Pak. J. Agri. Sci., Vol. 50(3), 517-522; 2013
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
http://www.pakjas.com.pk

EFFECT OF ORGANIC MEDIA ON GROWTH OF VEGETABLE SEEDLINGS

Mesude Unal*

Kocaeli University, Arslanbey Vocational College-41285, Kocaeli, Turkey
***Correspondingauthor's e.mail: mesudeun@kocaeli.edu.tr**

Organic media physical and chemical properties are suitable for growing seedling. It is not is low cost for additional chemical substances. In $NP_2O_5K_2O$ additional media M5 compared to organic media. The purpose of this study was to determine; the use of different growing media for organic production of tomatoes and peppers seedling quality characterictics. The trial was conducted the year 2010 in the greenhouse of Organic Agriculture Program of Arslanbey Vocational School of Kocaeli University. In this research M4 containing peat-stable manure-perlite, M5 containing peat-sand-NPK, M6 containing peat-stable manure and M8 containing peat gave positive results in tomato and pepper seedling cultivation. The quality of tomato and pepper seedling measured values and there were a difference between different growing media statistically at $p<0.05$ level. However, the width of cotyledons of pepper with different growing medium did not differ statistically.
Keywords: Growing media, organic vegetables, seedlings growth, peat, tomato, pepper

INTRODUCTION

Organic agriculture is an agricultural production system in which no chemical inputs are used, and each stage of which, from production to consumption, is controlled and certified. Organic agriculture has started coming to the fore as a result of the green revolution being used especially in the second half of the 20th century, for the purpose of restoring the decaying human health and ecologic balances (Aksoy, 2001; Kurtar and Ayan, 2004; Zengin, 2007; Hammad *et al*., 2011).

Production has already started, although it is in our country is not yet certified organic seed, seedlings were already planted earlier, young plant, nurse, micelle, replication on materials such as steel and tuber is not available as a common. This is why organic farming regulation; production once authorization has been obtained from an authorized materials can be provided is a description of conventional production. Seedlings were already planted earlier, however, is excluded.

Seedling cultivation is a sector having recently started growing in Turkey. Cultivation from seedlings has many advantageous opportunities, such as earlier harvest, utilization of time, economization of land, energy, and seeds, healthy and homogenous production, and warning process for earliness. In order to benefit from these advantages, producers have tended to production not from seeds, but from seedlings, thus increasing their demands for the seedlings of various vegetables (Seniz, 1992; Camlilar, 2002; Kasim *et al*., 2006).

Cultivation from seedlings is much more important in organic production. Use of organic seedlings provides solutions to the worrisome problems of the producers, seeming to be the disadvantages in organic agriculture, such as the higher prices of organically produced seeds, too much loss in the production from seeds, increase in labor due to control the diseases and pests, lower productivity.

Tomato and pepper are among the primary organic products being cultivated in Turkey (Zengin, 2007). According to the data from the Ministry of Agriculture and Rural Affairs for the year 2009, total output of organic tomatoes amounts to 19,154.26 tons, and that of organic peppers amounts to 2,922.25 tons (Anonymous, 2009).

In order to cultivate healthy seedlings, growing media is as important as the ecological conditions. Various plant growing media and dose studies are emphasized in the conducted researches (Rippy *et al*., 2004; Moldes *et al*., 2007; Ostos *et al*., 2008).

Efforts should be escalated for establishing, and expanding growing media, in compliance with the regulations on the production of organic vegetable seedlings, as being an important input in the organic agriculture. Bagci (2007) examined growth of primula plant in different growing media. 50% coco peat + 50% moss peat, 25% coco peat + 75% moss peat, and 100% peat moss has the best result. Birben *et al*. (1999) worked on growth of Begonia (*Begonia semperflorens*) in 7 different growing media. 50% spend mushroom compost +5 0% peat, 25% spend mushroom compost + 50% peat + 25% perlite has the best result.

It is intended with this study to examine the quality features of the seedlings of the tomatoes and peppers, being produced in different growing media so as to be utilized in organic production and to further examine the pH and EC conditions of the organic growing media and to develop suitable growing media well.

MATERIALS AND METHODS

The trial was conducted in the greenhouse of the Organic Agriculture Program of Arslanbey Vocational School of Kocaeli University in the year 2010. Trial incident parcels were established with 4 frequencies according to the randomized plots trial design media, made up of eight different mixtures, were placed in viols of 25. The organic tomato and pepper seeds planted in the viols were kept under controlled conditions until being germinated, then taken into the greenhouse. Seeds were supplied by Yalova Atatürk Central Research Institute. Rio grande type (09) was used for tomato and Y banana organic 341 (07) type was used for pepper.

Growing media were composed of 8 different mixtures. Prepared growing media materials and mixture rates are shown in Table 1**.** Among the growing media materials, peat were utilized upon being supplied under certified from a private organic fertilizer company. Findings from the result of the chemical analysis of the peat are as follows; pH:6.86, EC:1670 (µS/cm), 1.25 in the diluted sample (Richards, 1954), % $CaCO_3$:1.85 Sheibler calcimeter (Richard, 1954), %N:1.4 (Bremner, 1965), P (ppm):19.75 (Olsen *et al.*, 1954), K (ppm):337 ammonium acetate extraction (Carson, 1980), % OM: 28 Walkley-Black wet decomposition method (Jackson, 1962). Leonardit was utilized upon being supplied under certified from a private organic fertilizer company. Total organic substance is 40%, total humic and fulvic acid is 40%, and humidity is 40%. It is unprocessed leonardit in solid form. Zeolite was supplied from a private agricultural products company. Zeolites with particle dimension of 1-4 mm were utilized. Stable Manure; matured sheep manure, permitted by the organic agriculture regulations, and having been obtained from producers operating in extensive stock-breeding, was utilized. Stable manure analysis methods are the same with those of the peat. The following results were obtained from the analysis, pH: 7.46 EC: 1613 (µS/cm), % $CaCO_3$: 2.59, %N: 1.96, P (ppm): 17.05, K (ppm): 552, % O.M. 39.2.

***Pruning wastes*:**These were obtained from pruning the trees, located on the land of KOU Arslanbey Vocational High-School. Pruned leaves, branches, and stems were torn into small pieces and shrunk by being processed in blender. Pruned trees did not undergo chemical processes thereafter. Perlite was supplied from a commercial enterprise. NPK having been utilized in the mixture of M5, was given according to the calculation that provided 15 kg of pure nutrient per hectare from the fertilizer in the rates of 15:15:15.

***Plant calculation stages*:** Germination of tomato seeds started on March 16th while the pepper seeds germinated on March 19th. Abatement was conducted in order to determine healthy seedlings, after germination. The values concerning hypocotyl height, cotyledon length, and cotyledon width of tomato and pepper were measured and recorded, moreover, the lengths of tomato and pepper seedlings were measured throughout the trial. The tomato seedlings were taken out of the viols and their roots were cleaned on April 21th.Then, the seedlings were transferred to greenhouse soil by measuring the root lengths. The same processes were carried out for the pepper seedlings on May 7^{th,} 2010. The growing media left in the viols were air-dried by spreading. After sieving through the sieve of 2 mm, pH and EC in the media were calculated with the help of MI -151 model and MI-180 model multimeter in three replicates of 1:2.5 diluted samples. The results of the study were assessed in accordance with One Way-ANOVA statistical package program. Different groups were determined by Duncan's test.

RESULTS AND DISCUSSION

Initial growth characteristics:

***Hypocotyl height (mm)*:** It is clear in Table 2 that tomato seedlings in media M8 (peat) showed maximum hypocotyl height of 55.00 mm followed by M4 (peat:stable manure:perlite, 2:1:1) with 50.72 mm. The reason that these media gave good results may be that their aeration and hydration capacities, such as peat, perlite, and sand contain good materials. M4, in the meantime, contained stable manure. Stable manure enriches growing media in terms of nutrients. Demir *et al.* (2003a) used trade organic fertilizer and Seker and Ersoy (2005) used cattle and chicken manure stated that organic fertilizer applications affected the soil properties and plant growth positively. Pepper seedlings hypocotyl height at M5 showed maximum hypocotyl height of 22.50 mm followed M8 (20.80 mm), M2 (19.30 mm) and M1 (17.00 mm). A significant correlation at a level of 5% was found between various media mixtures and hypocotyl heights.

***Cotyledon length (mm)*:** A significant correlation at a level of 5% was found statistically between various media

Table 1. Growing media and mixing ratios

Growing media	M1	M2	M3	M4	M5	M6	M7	M8
Mixture Ratios	Peat:SM:P:Zeo 1: 1: 1: 1	Peat:SM:P:Leo 2: 1: 1: 5g/kg	Peat:SM:Ze. 2: 1: 1	Peat:SM:Pe 2: 1: 1	Peat:S:Nit. Phos.Potas. 2:2:15kg /da	Peat:SM 2: 2	peat:Ze 2: 2	Peat 4

M: Growing medium; SM: Stable manure; P: Prunings; Ze: Zeolit; Leo: Leonardite; Pe: Perlite; S: Sand; Nit.Phos.Potas: Nitrogen Phosphorus Potassium

Table 2. Tomato seedling quality values as affected by growing media used

Media	Hypocotyl height (mm)	Cotyledon length (mm)	Cotyledon width (mm)	Seedling height (cm)	Seedling root length (cm)
M1	37.00 ab	11.50 a	3.50 a	6.72 ab	3.42 a
M2	25.02 a	13.72 ab	4.00 ab	5.30 a	3.30 a
M3	37.53 ab	22.03 de	7.00 c	9.50 b	9.37 b
M4	50.72 bc	24.52 e	7.50 c	13.45 c	13.87 b
M5	41.24 abc	20.73 cde	6.12 bc	14.32 c	13.87 b
M6	37.52 ab	14.52 abc	4.50 ab	13.47 c	11.87 b
M7	28.70 a	15.20 abcd	4.50 ab	----	----
M8	55.00 c	19.70 bcde	7.00 c	16.50 c	11.80 b

Means with different letters in the same row, $p<0.05$ level, there is a difference.

mixtures and cotyledon lengths. Tomato seedlingsshowed the highest cotyledon length (24.52 mm) in M4 (Table 2) while M3, M5 and M8 produced 22.03 mm, 20.73 mm and 19.70 mm, respectively, cotyledon length. The lowest length (11.50 mm) was produced in M1. Pepper seedlings hypocotyl height observed was the highest (20.25 mm) in M8 (Table 3). The lowest cotyledon was recorded in M7 with 6.50 mm length.

***Cotyledon width (mm)*:** No statistical correlation was found in various media mixtures for cotyledon width of tomato. It was observed that tomato seedlings showed maximum width in M4 (7.50 mm) (Table 2). M3 (7.00 mm) and M8 (7.00 mm) were statistically similar for cotyledon width. The lowest value produced was at M1 with 3.50 mm. A significant correlation at a level of 5% was examined for various media mixtures and pepper cotyledon width. Pepper seedlings cotyledon width was the highest in M8 with 5.75 mm value. The initial output value of tomato seedlings resulted the best hypocotyl height, cotyledon length and width in media M3, M4, M5 and M8 as M3 contained zeolite together with organic nutrient, M4 had organic nutrients, M5 contained inorganic nutrients and M8 had peat. Ozkaynak and Samanci (2004) stated that peat-perlite rates of 2:1 and 3:1 may be used in potato minituber production in the growing media. Demir *et al.* (2003b) indicated a finding similar to that we have found in the growing media mixture that the differences between the mineral ingredients of lettuce were less than expected in the traditional and organic cultivation. Sahin *et al.* (1998) recommended the peat and peat mixtures as the growing media in their study. Polat *et al.* (2005) cultivated lettuce in various zeolite doses together with chemical fertilizer application at the field conditions and reported that zeolite affected plant development and productivity positively. Schmilewski (2008) while searching alternative growing media reported that the use of peat in growing media would escalate in future.

Seedling characteristics:

***Seedling height (cm)*:** Table 2 shows that tomato seedlings attained the highest height of 16.50 mm in M8 media. M4, M5, M6 and M8 remained statistically in the same group. Table 3 shows that pepper seedlings produced the highest height of 8.78 cm in M6. M3, M5, M6 and M8 were statistical at par.

***Seedling root length (cm)*:** A significant correlation at a level of 5% was found for various media mixtures and seedling root length. Tomato seedlings produced the highest root length (13.87 cm) in M4 and M5 (table 2). In terms of seedlings height and seedling root height values, the best results were recorded in M4 and M5. The significance of the two media is that one takes its nutrient from chemical fertilizer and the other utilizes the nutrients from the stable manure. The media having perlite and sand escalates the respiration. In case of tomato, the best results for seedling root length were observed in M4, M5, M6 and M8. Statistical assessment supports the results. Table 3 shows

Table 3.Pepper seedling quality values as affected by growing media used

Media	Hypocotyl height (mm)	Cotyledon length (mm)	Cotyledon width (mm)	Seedling height (cm)	Seedling root length (cm)
M1	17.00 ab	15.00 ab	3.88	----	----
M2	19.30 ab	18.50 ab	5.38	3.30 b	2.55 ab
M3	14.82 ab	17.13 ab	5.00	7.68 c	8.15 d
M4	14.03 ab	11.00 ab	3.50	3.78 b	4.00 bc
M5	22.50 b	15.00 ab	4.38	7.45 c	7.10 cd
M6	15.00 ab	11.25 ab	4.38	8.78 c	7.95 d
M7	11.50 a	6.50 a	1.88	1.50 ab	1.40 ab
M8	20.80 ab	20.25 b	5.75	7.93 c	6.70 cd

Means with different letters in the same row, $p<0.05$ level, there is a difference.

that pepper seedlings produced the longest roots (8.15 mm) in M3. M3 and M6 statistically made same group.

The best results in terms of seedling height and seedling root height in peppers were found in M3 and M6 and M8 which were statistically at par. Peat is a good growing media if readily available in the vicinity at low cost. Cinkilic (2008) recommended peat and peat + 25% large perlite for cucumber cultivation; however, he mentioned the need for economic growing media as well. Kolsarıci *et al.* (2005) reported that humic acid application has a positive impact both on seedling and root growth of sunflower *(Heliantus annuus L.)*. Baran *et al.* (2001) utilized grape residues with peat (50% residue + 50% peat, 25% residue + 75% peat, and 100% peat mixtures) and reported these as suitable media for use in gardening. Ostos *et al.* (2008) mentioned the utilization of domestic wastes for the growing media in seedling cultivation as an ecological solution in place of the limited peat resources.

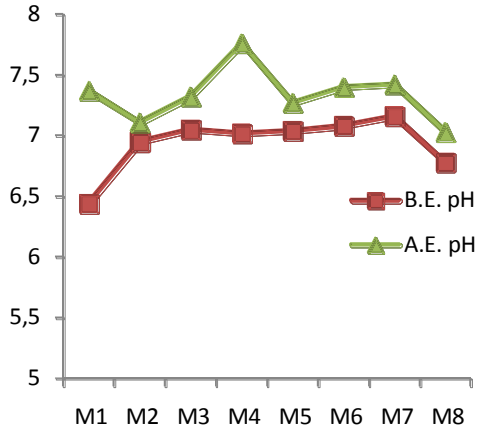

Figure 1. The beginning of the experiment and after the pH value of tomato growing media

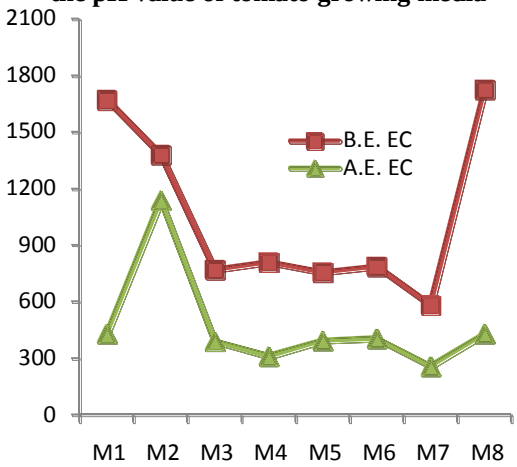

Figure 2. The beginning of the experiment and after the EC (µS/cm) value of the tomato growing media

***pH and EC values*:**pH and EC values of the growing media were calculated in the beginning of the trial. pH ranged 6.44 to 7.16, light acid to neutral. According to Richards (1954) and, Ulgen and Yurtsever (1974) pH value is suitable in terms of obtaining plant nutrients. EC value was in between 583µS/cm and 1725 µS/cm. This is in salt-free class according to Richards (1954) and, Ulgen and Yurtsever (1974). pH of after-trial growing media was in between 7.03 and 7.76 (Fig. 1) in case of tomatoes. Value is neutral and light alkaline. There was an increase in pH in respect to that before the trial. Salinity (EC) decreased after the trial and ranged 258 to1139 µS/cm (Fig. 2). pH of after-trial growing media of pepper was in between 7.06 and 7.99 (Fig. 3). Value tends to change from neutral to alkaline. Salinity (EC) decreased after the trial. The value was 286-1126 µS/cm (Fig. 4). It fell in salt-free group.

pH in the growing media of the both two species increased in respect to that before trial. Passage of hydroxyl ions to the

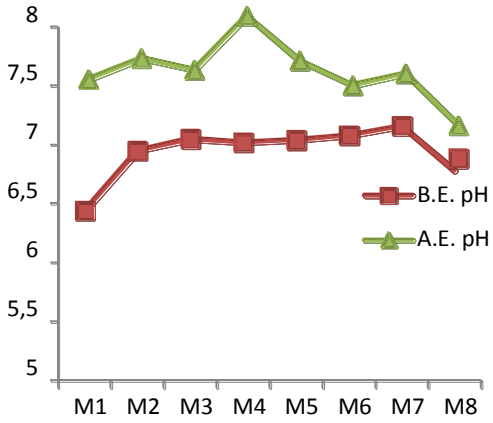

Figure 3. The beginning experiment and after the pH value of pepper growing media

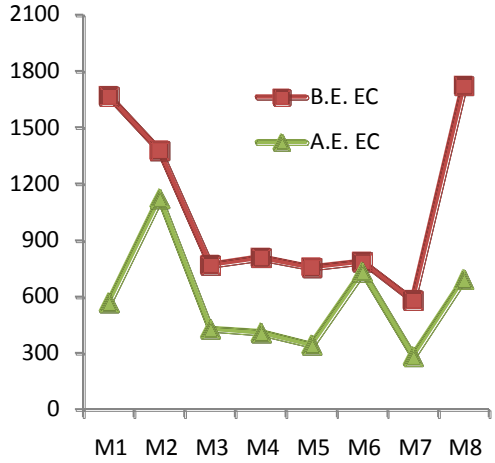

Figure 4. The beginning of the experiment and after EC (µS/cm) value of the pepper growing media

media along with the nitrate intake of the plant from the media may have caused such increases. The results of Cinkilic (2008) regarding pH measurements in the growing media of peat + 25% perlite were similar to those in our study. EC value in the growing media of the both two species decreased in respect to that before trial. Washing of salts with utility water may have caused the variation. Herrera *et al.* (2008) found similar results in their study.

***Conclusion*:** Physical and chemical properties of the seedling growing media should be compatible with the needs of the plants. It may therefore be concluded that, the mixtures containing peat and nutrients may be utilized as growing media. In this study M4 (peat-stable manure-perlite), M5 (peat-sand-NPK), M6 (peat-stable manure) and M8 (peat) gave positive results for tomato and pepper seedlings growth. M3 containing peat-stable manure-zeolite can also be recommended. However, due to the limited resources, research should be sustained for cheaper and ecological new growing media to be utilized in the nursery raising and organic seedling cultivation.

REFERENCES

Aksoy, U. 2001. Ecological agriculture: An Overview, Turkey 2Ecological AgricultureSymposium, 14-16 November 2001, Antalya, Turkey.

Anonymous. 2009. Organic agricultural statistics. Available with updates at www.tarim.gov.tr

Baran, A., G. Cayci, C. Kutuk and R. Hartmann. 2001. Composted grape marc as growing medium for hypostases (*Hypostases phyllostagya*). Bioresrc. Tech. 78:103-106.

Bagci, S. 2007. Growth of primula plant in coir dust and peat based growing media. Master thesis.Ankara Uni.Inst.of Scien.58.

Birben, H., G. Cayci and C.Kutuk. 1999. Spend mushroom compost Begonia (*Begonia semperflorens*) effect on plant development. Turkey III.National HorticulturalCongress, p. 187-199, Kizilcahamam, Ankara, Turkey.

Bremner, J.M. 1965. Methods of soil analysis, Part 2.In: A.C.A. Black (ed.), Chemical and microbiological properties. Amer. Soc. of Agron. Inc., Pub. Agron.Series, No. 9, Madison, Wisconsin, USA.

Carson, P.L. 1980. Recommended potassium test, pp.12-13. In: W.C. Dahnke (ed.), Recommended chemical soil test procedures for the North Central Region. North Central Region Publication 221 (revised). N.D. Agri. Exp. Stn., Fargo, N.D.

Camlilar, M. 2002. Low tunnels with different thickness of plastic sheeting and seed sowingeffects of processing tomato seedling.Master of Science Thesis. 2002. Which department, university and country.

Cinkilic, H. 2008. Production of cucumber seedlings of different organic and inorganic environments.J. Tekirdag Agric. Fac. 5 :151-158.

Demir, H., A. Topuz, M. Golukcu, E. Polat, F. Ozdemir and H. Sahin. 2003a. Mineralmatter content of different organic manure onorganic production of tomato effect.

Akdeniz Uni. J. of the Fac. of Agric. 16: 19-25.

Demir, H., M. Gölükçü, A. Topuz, F. Özdemir, E. Polat and H. Şahin. 2003b. Yedikule iceberg-type lettuce varieties and production of mineral matter content on the ecological effect of different organic manure. Akdeniz Uni. J. of the Fac.of Agric. 16:79-85

Hammad, H.M., A. Khaliq, A. Ahmad, M. Aslam, A.H. Malik and W. Farhad. 2011. Influence of different organic manures on wheat productivity. Int. J. Agric. Biol. 13:137-140.

Herrera, F., J.E. Castillo, A.F. Chica and L.L. Bellido. 2008. Use of municipal solid waste (MSWC) as a growing medium in the nursery production of tomato plants. Bioresrc. Tech. 99 :287-296.

Jackson, M.L. 1962. Soil Chemical Analysis.Prentice Hall. Inc. Cliffs, USA.

Kasim, M.U., R. Kasim and O. Can. 2006.Basic Principles of Vegetable Culture.KocaeliUniversty. Press.Public.No. 220 of 222, Kocaeli, Turkey.

Kolsarıci, O., M.D. Kaya, S. Day , A. İpek and S. Uranbey. 2005. Effects of humic acid doses on emergence and seedling growth of sunflower (*Helianthus annuus* L.) Akdeniz Uni. J. of the Fac. of Agric. 18: 51-155.

Kurtar, E.S. and A.K. Ayan. 2004. Organic farming and condition. J .of the Fac. of Agric. OMÜ Turkey 19:56-64.

Moldes, A., Y. Cendon and M.T. Barral. 2007. Evaluation of municipal solid waste compost as a plant growing media component by applying mixture dosing. Bioresrc. Tech. 98:3069-3075.

Olsen, S.R., V. Cole, F.S. Watanabe and L.A. Dean. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate U.S. Deptt. Of Agric. Cir. 939. Washington, D.C.

Ostos, J.C., R. Lopez-Garrido, J.M. Murillo and R. Lopez. 2008. Substitution of peat for municipal solid waste-and sewage sludge-based composts in nursery growing media: Effects on growth and nutrition of the native shrub *Pistacia lentiscus* L. Bioresrc. Tech. 99:1793-1800.

Ozkaynak, E. and B. Samanci. 2004. Greenhouse andclimate chamberconditionsin differentgrowing mediapotato (*Solanum tuberosum* L.)mini-tuberproduction effects. Akdeniz Uni. J. of Fac. Agric. 17:109-114.

Polat, E., H. Demir and A.N. Onus. 2005. Different levels of zeolitelettuce (*Lactuca sativa* var. Longifolia) the effect of cultivation on yield and quality. Akdeniz Uni. J. Of Fac. Agric. 18:95-99.

Richards, L.A. Ed. 1954. Diagnosis and Improvement of Saline and Alkali Soils.US Deptt.of Agric. Handbook 60:94.

Rippy, J.F.M., M.M. Peet, F.J. Louws, P.V. Nelson, D.B. Orr and K.A. Sorensen. 2004. Plant development and harvest yields of greenhouse tomatoes in six organic growing systems. HortScience 39:1-7.

Schmilewski, G. 2008. The role of peat in assuring the quality of growing media Mires and Peat, Vol. 3, Article 02.pp.1-8.

Sahin, U., A. Ozdeniz, A. Zulkadir and R. Alan. 1998. Irrigated with drip irrigation in greenhouse tomato (*Lycopersicon esculentum* Mill.) in different culture media forplant yield, quality and the effects of plant development. Tr. J. of Agric. AndForest. 22:71-79.

Seker, C. and I. Ersoy. 2005. Leonardit different organic fertilizers and soil properties and corn plant (*Zea mays* L.) effects on development. SUJ.of Fac. Agric. 19: 46-50.

Seniz, V. 1992.Tomato, pepper and Eggplant growing. Supp. of Agric. Res. and Develop. Found. Public. No: S174 26. Yalova.

Ulgen, N. and N. Yurtsever. 1974. Turkey fertilizers and fertilization guide. Soil and Fertilizer Research Institute, Tech. Pub. No:28, Ankara, Turkey.

Yılmaz, E., Z. Alagöz and F. Okturen. 2008. The effect of soil aggregates of organic materialin different applications. Akdeniz Uni. J. of Fac. Agric. 1:213-222.

Zengin, M. 2007. Organic agriculture.136s. Hasad Publish. Istanbul, Turkey.