J. Plant Production, Mansoura Univ., Vol. 6 (5):769 - 781, 2015

USING COMPOST AND OLIVE POMACE FOR TRANSPLANTING OF ROOTED OLIVE (*Olea europea* L. CV. *Aggezi)* CUTTINGS

Abou El-Khashab, A. M. and E. G. Mikhail
Olive and Semiarid Zone Fruits Dep.
Horticulture Research Institute, Agriculture Research Center, Giza

ABSTRACT

An experiment was conducted under saran house at the Nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2013 and 2014 seasons to examine the effect of some growing media, viz. compost + sand at 1:1, 1:2 or 1: 3 ratios, by volume and olive pomace + sand at the same ratio as suitable alternatives for traditional media (either loam + sand or peatmoss + sand at 1:2, v/v for each) usually used for transplanting rooted olive cuttings, transplanting times (on spring or autumn) and their interactions on growth and quality of rooted olive cuttings cv. Aggezi transplanted after 1, 2 or 3 months from rooting start for each time in 10-cm-diameter black plastic bags filled with about 1 kg of one of the aforementioned media.

Results indicated that survival (%) of transplants was significantly increased by planting the rooted cuttings in compost + sand (1: 2, v/v) and olive pomace + sand (1: 1 or 1: 2, v/v) media, as these two media gave the highest percentages in most cases of both seasons. The first period (of spring) recorded the highest survival (%) for rooted cuttings transplanted after one month compared to those of the second period (of autumn), while the two periods alternatively scored the highest percent of survival for rooted cuttings transplanted after either 2 or 3 months from rooting commencement. However, the best survival (%) at all was attained by transplanting in either compost + sand or olive pomace + sand media (1: 2, vol. for each) on either first or second period. The results also showed that most vegetative and root growth parameters of the produced transplants were greatly improved by planting in either compost + sand (1 : 2, v/v) or olive pomace + sand (1 : 1or 1:2, v/v) media regardless of time of planting (either in spring or in autumn), but the mastery in both seasons was for planting in compost + sand (1 : 2, v/v) medium that recorded the highest means in most characters. The content of total chlorophyll in the leaves was significantly decreased in response to various treatments applied in such study, except of planting in sand amended with compost at 2: 1 or 3: 1, v/v which gave values greatly near to those registered by control media in the only 1st season.

Hence, it can be recommended to transplant the rooted cuttings of olive cv. Aggezi in compost + sand (1 : 2, v/v) medium at any period of the year as a more suitable and cheaper medium than peatmoss + sand one.

ITRODUCTION

In Egypt, olive tree (*Olea europaea* L.) is considered to be an important fruit. It can be as a good candidate for planting in the new reclaimed areas, where other crops grow badly, due to drought and salinity tolerance (Abou El-Khashab, 2002). Besides, nutritional and health issues of olive fruits and olive oil. Hence, planting olive trees increased rapidly in Egypt. The majority of olive orchards production in Egypt is affected negatively by either the shortage of integrated managerial programs (Zyton project, 2013) or the opposite environmental effect as an arid and semiarid region conditions.

Nowadays, growing media amended with compost may play a vital role in improving growth and quality of rooted cuttings. In this regard, Mirales de Imperial *et al*. (2003) reported that growth of rooted *Olea europaea* cv. Cornicabra cuttings and their content of N, P and K was improved when transplanted in sand amended with composted sewage sludge (CSS), pruning residues + CSS and thermo-dehydrated sewage sludge at the rates of 10, 20, 40, 80 and 120 t/ha. The content of organic matter in the mixture increased as the application rate increased. This finding was emphasized by Basirat *et al*. (2008), who revealed that media of peat moss + vermiculite (1:1, vol.); sand + peat moss (3:1, vol.); sand + peat moss + loam (3:1:0.5, vol.); sand + sawdust (2:1, vol.); sand + sawdust + loam (3: 1: 0.5, vol.); sand + rice husk (3:1, vol.); sand + rice husk + loam (3:1:0.5, vol.); sand + vermicompost (2: 1, vol.); sand + vermicompost + loam (2:1:0.5, vol.) + sand-straw compost (2:1, vol.); sand + straw compost + loam (2:1:0.5, vol.); sand + wood bark + loam (2:1:0.5, vol.); sand + perlite + loam (2:1:0.5, vol.) and sand + loam (9:1, vol.) were suitable and had acceptable durability percentages after transplantation of rooted olive cuttings. Peat moss + vermiculite substrate gave the best shoot growth and dry weight, followed by sand + vermicompost, sand + vermicompost + loam and sand + loam ones.

Similar observations were also obtained with olive by Rodriguez *et al*. (2007), El-Motty *et al*. (2009), Camposeo and Vivaldi (2011), Yaseen *et al*., (2012), Al-Kahtani and Ahmed (2012), Toscano *et al*. (2013), Fernandez-Hernandez *et al*. (2014) and Rautenstrauch *et al*. (2014) they found that biohumus obtained by compositing olive pomace at 9 kg/olive plant generated a substantial improvement of the physical, chemical and microbiological soil properties and greater orchard development and productivity, replacing the chemical fertilization at a much lower cost. Likewise, Montemurro (2014) mentioned that olive pomace compost and olive mill waste water application could be a suitable substitute of the traditional methods (green manure of broad bean) to improve overall soil fertility and sustain yield in organic olive grove. Moreover, Aranda *et al*. (2014) stated that application of olive oil extraction by-products to soils of olive groves (carbonated or silicic) could lead to important mid-to-long term agro-environmental benefits, and be a valuable alternative use for one of the most widespread polluting wastes in the Mediterranean region.

Besides, Kotsiris *et al*. (2013) reported that *Olea europaea* and *Pittosporum tobira* plants exhibited better growth and higher chlorophyll content in the composted-amended substrate (pumice + compost + zeolite, 65: 30: 5). On olive, tomato, lettuce, strawberry and white button mushroom, Nair *et al*. (2014) claimed that humified compost prepared from olive mill solid waste significantly increased total organic carbon and humic substances by 40 and 58 %, respectively in the soil and enhanced crop productivity. Incorporation organic wastes into the soil after an appropriate composting process can improve plant resistance to nematode and fungi attack by stimulating root development and plant growth because of their large content of nutritive elements (Sasanelli *et al*. 2011; D`Addabbo *et al*. 2012; Abdel-Dayem *et al*. 2012 and Abdel-Dayem *et al*. 2014). Also can act as a method for weed control (Boz *et al*., 2009), for improving soil fertility, water-holding capacity and physical and chemical properties (Cucci *et al*., 2013; Bueno *et al*., 2014 and Killi *et al*., 2014), and finally its impact on ground water was the minimum compared to mineral fertilizers (Caputo *et al*., 2013).

The current work aims to explore the suitable organic substitutes less costing than peat moss for preparing a better growth medium for transplanting rooted olive cuttings

MATERIALS AND METHODS

An investigation was performed under saran house conditions (65 % % shade) at the Nursery of Hort. Res. Inst., ARC, Giza, Egypt throughout the two consecutive seasons of 2013 and 2014 in order to evaluate the effects of different growing media on growth and quality of olive rooted cuttings after transplanting from mist condition.

Therefore, rooted cuttings of olive (*Olea europea* L. cv. Aggezi) were transplanted after one, two and three months from rooting commencement (on first of May, June and July for the first period, and on first of October, November and December for the second one in each season) in 10-cm-diameter black plastic bags (one cutting/bag) filled with about 1 kg of one of the following media:

1- Loam + washed sand (1 : 2, by volume).
2- Peatmoss + washed sand (1 : 2, by volume).

These two media referred to as control, as they are usually used in traditional production methods.

3- El-Obour compost + washed sand (1 : 1, by volume).
4- El-Obour compost + washed sand (1 : 2, by volume).
5- El-Obour compost + washed sand (1 : 3, by volume).
6- Olive pomace compost + washed sand (1 : 1, by volume).
7- Olive pomace compost + washed sand (1 : 2, by volume).
8- Olive pomace compost + washed sand (1 : 3, by volume).

Both El-Obour and olive pomace composts were soaked before use in current water for 48 hours, while all media were sterilized after preparing in 70 °C for 30 min. Some physical and chemical properties of the used sand and loam, as well as of peatmoss, El-Obour and olive pomace composts are shown in Tables 1 and 2, respectively.

Table (1): The physical and chemical properties of the used sand and loam during 2013 and 2014 seasons.

Soil texture	Seasons	Particle size distribution (%)				SP	EC (dS/m)	pH	Cations (meq/l)				Anions (Meq/l)		
		Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
Sand	2013	89.03	2.05	0.40	8.52	23.00	3.16	7.92	7.50	1.63	33.60	0.50	3.20	22.00	18.03
	2014	90.10	1.95	0.50	7.45	22.86	3.74	7.89	19.42	8.33	7.20	0.75	1.60	7.00	27.10
Loam	2013	10.18	46.17	19.53	24.12	35.00	3.38	8.09	17.50	9.42	20.00	0.79	3.80	10.00	33.91
	2014	10.30	46.54	18.88	24.28	33.00	3.51	8.16	18.00	8.95	20.50	0.85	3.65	10.20	34.45

Table (2): Physical and chemical analysis of El-Obour compost; olive pomace and peatmoss, respectively used in both seasons.

El-Obour compost		Olive pomace		Peatmoss	
Character	**Content**	**Character**	**Content**	**Character**	**Content**
Weight of/m^3 (kg)	500-550	Moisture (%)	7.00	Structure (Fine)	0.70
Humidity (%)	25-30	pH	4.70	EC (1:3,6 v/v; mS/cm)	150.00
pH (1-2.5)	7.5-8.0	EC dSm-1	3.45	pH (1-2.5) ($CaCl_2$)	2.5-3.5
EC (1:5) (dS/m^{-1})	3.-4	Organic matter (%)	55.00	pH (1-2.5) (H_2O)	3.0-4.0
Water hold capacity	250-300 %	Total nitrogen (%)	0.96	Vol. weight (g/l)dry	55-90
Total nitrogen	1-1.4 %	Protein (%)	8.20	Porosity (vol. %)	95-98
Organic matter	34-38 %	Organic carbon (%)	32.47	Water vol(%)	40-80
Organic carbon	19.8-22 %	C/N ratio	34.00	Air vol. (%)	16-55
C/N ratio	1-14.2	Fat (%)	6.80	Nitrogen (N)	50 mg/l
NaCl	1.1-1.25 %	Ash (%)	3.52	Total nitrogen	0.9-1.1
Total phosphorus	0.5-0.75 %	Total P (%)	0.16	Phosphorus (P_2O_5)	50 mg/l
Total potassium	1.25-1.75 %	Total potassium	1.14	Total phosphorus	0.02-0.1
Fe (ppm)	1500-1800	Total Phenols (%)	1.20	Potassium (K_2O)	50 mg/l
Mn (ppm)	25-50			Total potassium	0.03-0.05
Cu (ppm)	50-75			Organic carbon	55-60 w. %
Zn (ppm)	150-225			Organic matter	94-99 w. %

The layout of the experiment in both seasons was a complete randomized block design, with three replicates as each one contained 30 rooted cuttings (Mead *et al*., 1993). All the usual agricultural practices necessary for such plantation were carried out whenever needed.

At the end of each period in the two seasons, (on 1st September for the first period and 1st February for the 2nd one), data were recorded as follows: survival (%), the whole transplant length (cm), stem length (cm), root length (cm), number of branches/transplant, number of leaves/transplant, leaf area (cm^2), the total leaf area (cm^2) that calculated from multiplication of leaf area by number of leaves, fresh weight (g) of stem, root system and roots less than 3 mm diameter. In fresh leaf samples, total chlorophylls (mg/g FW) were determined according to the method of Moran (1982).

Data were then tabulated and subjected to analysis of variance using SAS Institute Program (1994), followed Duncan's Multiple Range Test (Duncan, 1955) to compare the significancy among means of the different treatments.

RESULTS AND DISCUSSION

Effect of compost, transplanting date and their interaction on:

1- Vegetative and root growth of the resulted transplants.

Data in Table 3 reveal that survival (%) of rooted cuttings transplanted after one month from planting was significantly improved in the first season by planting in peatmoss + sand (1 : 2, vol.) and compost + sand (1 : 2, vol.)

media, while in the second one by planting only in the latter medium. Transplanting in 1^{st} of May gave better survival (%) than transplanting in October, 1^{st} in both seasons. Interaction treatments, however indicated that the highest survival (%) was recorded in the two seasons when the rooted cuttings were transplanted on May, 1^{st} and raised in one of the previously mentioned media.

On the other side, transplanting after either 2 or 3 months from planting recorded 100 % survival by planting in olive pomace + sand (1:1, vol.) medium in the first season, but in the second one, that was achieved by planting in either compost + sand or olive pomace + sand media at (1:2, v/v) for each. Transplanting at both 1^{st} November and 1^{st} December in the first season significantly gave higher survival % than transplanting at either 1^{st} June or 1^{st} July, while the opposite was the right in the second season. In general, combining between transplanting in these two media (compost + sand and olive pomace + sand at 1: 2 v/v for both) and these two times (June and November or July and December) scored the utmost high survival % in the two seasons. A similar trend was also gained when combining between transplanting in peatmoss + sand (1: 2, vol.) medium at either 1^{st} November or 1^{st} December in the 1^{st} season, as well as when connecting between transplanting in both loam + sand and peatmoss + sand (1 : 2, v/v for each) media at 1^{st} June in the 2^{nd} season.

As for transplant length (cm), it was the longest by transplanting in either peatmoss + sand or compost + sand media (at 1: 2, v/v for both) in both seasons. Olive pomace + sand (1: 2, v/v) medium also registered a longest length in the 2^{nd} season. Transplanting in the second period increased such parameter in the 1^{st} season to 38.56 cm with significant difference compared to 37.40 cm recorded by transplanting in the first period. In the 2^{nd} season, the opposite was the right. Interactions exhibited that transplanting at the second period in either peatmoss + sand or compost + sand (1: 2, v/v for each) gave the longest transplants in the first season, whilst in the second one, that was attained by transplanting at the first period in both compost + sand and olive pomace + sand media at 1: 2, v/v for both.

Similarly, results of stem length (cm), No. branches/ transplant, root length (cm), fresh weight of stem, root system and roots less than 3-mm-diameter, No. leaves/transplant, leaf area (cm^2) and total area (cm^2) were illustrated in Tables 4, 5 and 6, as these parameters were improved by most media used in this trial, especially when compared to the medium of loam + sand (1:2, v/v), with the superiority of media supplemented with either compost or olive pomace at 1: 2 ratio which often gave the highest means in most traits mentioned above in most cases of both seasons. Moreover, transplanting at the first period induced better improvement in most above named characters than transplanting in the second period, as it scored higher means in most instances of the two seasons. Regarding the effect of interactions, it was fluctuated, but the prevalence was mostly for the combining between transplanting in composted sand (1:2 or 1: 3 ratios) and transplanting at the first period. The sand fortified with olive pomace, especially at 1: 2, v/v ratio exhibited also better effect regarding some parameters than compost.

3

4

5

6

Improving growth of the produced transplants cultivated in sand amended with organic composts may indicate the high manurial value of these composts in improving plant growth (Drechsel and Reck, 1998), in enhancing the electrical conductivity (EC), pH and organic matter content in the soil mixture (Ranjana *et al*., 1998). Besides, increasing cation exchange capacity and fertility plus raising the water holding capacity of the growing medium (Gonzalez and Cooperband, 2003). In this concern, Beltran *et al*. (2015) confirmed that olive pomace has considerable amounts of Fe, Na, Mg, Mn, Ca, Ba and Li. Arvanitoyannis and Kassaveti (2007) reported that composted olive waste can be used as an amendment in agriculture because of its high N and P content, and as a biofertilizer for toxic metal removal. Application of compost from olive mill solid waste stimulated microbial activity and the biogeochemical cycles because of the initially increased dehydrogenase, β-glucosidase, phosphatase and urease activities (Romero *et al*. 2005). Furthermore, Ehaliotis *et al*. (2005) concluded that residues and by-products of olive mills may provide effective root-zone heating at greenhouse production scale and may satisfy nutrients demands during plant growth.

These findings, however are in harmony with those obtained by Mirales de Imperial *et al*. (2003) and Basirat *et al*. (2008) on rooted olive cuttings, El-Motty *et al*. (2009), Camposeo and Vivaldi (2011), Toscano *et al*. (2013) and Montemurro *et al*. (2014) on olive, Kotsiris *et al*. (2013) on olive and Pittosporum and Nair *et al*. (2014) on olive, tomato, lettuce, strawberry and white button mushroom.

2- Total chlorophyll content in the leaves.

It is obvious from data shown in Table 6 that compost + sand media at 1 : 2 and 1 : 3 ratios are the only treatments that gave total content of chlorophyll (mg/g FW) closely near to that of control media in the first season with non significant differences among them, whereas other media suppressed significantly it. In the second season, however all the tested media greatly reduced the means of such constituent comparing with those of control ones (loam + sand or peatmoss + sand at 1 : 2, v/v for each). In the first season, transplanting at the first period significantly improved content of total chlorophyll over that recorded by transplanting in the second period, but in the second season, the opposite was the right. Regarding the interaction effect, data showed that the highest content of total chlorophyll was achieved by transplanting at the second period in the medium of compost + sand (1 : 2, v/v), followed by transplanting at the first period in the same medium at 1: 3, v/v ratio in the 1st season. In the 2nd season, that was true for transplanting at the 1st period in control media, which raised content of this constituent to the utmost high records and followed by transplanting in the same period in either compost + sand (1: 3, v/v) or olive pomace + sand (1 : 2, v/v) medium.

These results could be interpreted and discussed as earlier before in case of vegetative and root growth of the resulted transplants. On the contrary, those results of Mirales de Imperial *et al*., (2003) on rooted olive cuttings and Kotsiris *et al*., (2013) on *Olea europaea* and *Pittosporum tobira*.

According to the aforementioned gains, it can be advised to use compost + sand (1: 2, v/v) medium for transplanting the rooted cuttings of olive cv. Aggezi as a suitable and cheap medium for peatmoss + sand one at any period of the year.

REFERENCES

Abdel-Dayem, E. A.; Erriquens, F.; Verrastro, V.; Sasanelli, N.; Mondelli, D. and Cocozza, C. (2012). Nematicidal and fertilizing effects of chicken manure, fresh and composted olive mill wastes on organic melon. Helminthologia, 49(4):259-269.

Abdel-Daym, E. A.; Erriquens, F.; Sasanelli, N.; Ceglie, F. G.; Zaccone, C.; Miano, T. and Cocozza, C (2014). Effects of several amendments on organic melon growth and production, *Meloidogyne incognita* population and soil properties. Scientia Horticulturae, 180:156-160.

Abou El-Khashab, A. M. (2002). Growth and chemical constituents of some olive cultivars as affected by biofertilizers and different water regimes. Egypt. Agric. Res., NRC-1(2):243-265.

Al-Kahtani, S. H. and Ahmed, M. A. (2012). Effect of different mixtures of organic fertilizers on vegetative growth, flowering, fruiting and leaf mineral content of Picual olive trees. American-Eurasian Journal of Agri. & Environ. Sci., 12(8):1105-1112.

Aranda, V.; Macci, C.; Peruzzi, E. and Masciandaro, G. (2014). Biochemical activity and chemical-structural properties of soil organic matter after 17 years of amendments with olive-mill pomace co-compost. Journal of Environmental Management, 147:278-285.

Arvanitoyannis, I. S. and Kassaveti, A. (2007). Current and potential uses of composted olive oil waste. International Journal of Food Science & Technology, 42(3):281-295.

Basirat, M.; Ghalebi, S.; Meschi, M. and Hosseini-Mazinani, M. (2008). A study of the effect of different media on durability and growth indices of rooted olive cuttings after transplanting. Acta Horticulturae, 91 (1): 197-202.

Beltran, M.; Sanchez-Astudillo, M.; Aparicio, R. and Garcia-Gonzalez, D. L. (2015). Geographical traceability of virgin olive oils from south-western Spain by their multi-elemental composition. Food Chemistry, 169:350-357.

Boz, O.; Ogut, D.; Kamil, K. and Dogan, N. M. (2009). Olive processing waste as a method of weed control for okra, Faba Bean, and Onion. Weed Technology, 23(4):569-573.

Bueno, L. A.; Bosch-Rubia, G.; Sanchez-Montilla, R. and Monetta, P. (2014). Use of compost from olive oil by-products as soil amendment: effect on physical and chemical properties of loamy-sand soils. Acta Horticulturae, 1057:417-422.

Camposeo, S. and Vivaldi, G. A (2011). Short-term effects of de-oiled olive pomace mulching application on a young super high-density olive orchard. Scientia Horticulturae, 129(4):613-621.

Caputo, M. C.; Girolamo, A. M. de and Volpe, A. (2013). Soil amendment with olive mill wastes: impact on groundwater. Journal of Environmental Management, 131:216-221.

Cucci, G.; Lacolla, G. and Caranfa, G. (2013). Use of composted olive waste as soil conditioner and its effects on the soil. International Journal of Agricultural Research, 8(4):149-157.

D'Addabbo, T.; Renco, M.; Papajova, I.; Radicci, V. and Sasanelli, N. (2012). Effect of compost amendments on soil nematophauna. Giornate Fitopatologiche, Milano Marittima (RA), 13-16 Marzo; 489-493.

Drechsel, P and B. Reck (1998). Composted shrub-prunings and other organic manures for small holder farming systems in southern Rwanda. Agroforestry Systems, 39 (1): 1-12.

Duncan, D. B. (1955). Multiple range and multiple F. Tests. Biometrics,11: 1- 42.

Ehaliotis, C.; Zervakis, G. I. and Karavitis, P. (2005). Residues and by-products of olive-oil mills for root-zone heating and plant nutrition in organic vegetable production. Scientia Horticulturae, 106(3):293-308.

El-Motty, E. Z. A.; Shahin, M. F. M.; El-Migeed, M. M. M. A. and Sahab, A. F. (2009). Comparative studies of using compost combined with plant guard and flespar on the morphological, physiological and rhizospheric microflora of olive seedlings. American-Eurasian Journal of Agricultural and Environmental Science, 6(4):372-379.

Fernandez-Hernandez, A.; Roig, A.; Serramia, N.; Civantos, G. C. and Sanchez-Monedero, M. A. (2014). Application of compost of two-phase olive mill waste on olive grove: effects on soil, olive fruit and olive oil quality. Waste Management, 34(7):1139-1147.

Gonzalez, R. F. and L. R. Cooperbend (2003). Compost effects on soil chemical properties and field nursery production. J. Environ. Hort., 21 (1): 38-44.

Killi, D.; Anlauf, R.; Kavdir, Y. and Haworth, M. (2014). Assessing the impact of agro-industrial olive wastes in soil water retention: implications for remediation of degraded soils and water availability for plant growth. Inter. Biodeterioration & Biodegradation, 94:48-56.

Kotsiris, G.; Nektarios, P. A.; Ntoulas, N. and Kargas, G. (2013). An adaptive approach to intensive green roofs in the Mediterranean climatic region. Urban Forestry & Urban Greening, 12(3):380-392.

Mead, R.; Curnow, R. N. and Harted, A. M. (1993). Statistical Methods in Agriculture and Experimental Biology. 2nd Ed., Chapman & Hall Ltd., London, 335 pp.

Mirales de Imperial, R.; Beltran, E. M.; Porcel, M. A.; Beringola, M. L.; Valero Martin, J.; Calvo, R. and Delgado, M. del M. (2003). Nutrients availability by three types of sewage sludge addition. Revista Internacional de Contaminacion Ambiental, 19(3):127-136.

Montemurro, F.; Ferri, D.; Fiore, A. and Diacono, M. (2014). Suitability of untreated and composted olive mill by-products as amendments in organic olive orchards. Compost Science & Utilization, 22(4):216-229.

Moran, R. (1982). Formula for determination of chlorophyllous pigment extracted with N, N-dimethyl formamide. Plant Physiol, 69: 1376-81

Nair, N.; Altieri, R.; Esposito, A. and Saville, K. (2014). Recent studies on preparation of humified compost using olive mill waste for horticultural purposes. Acta Horticulturae, 1018:465-469.

Ranjana, A.; Gupta, G. N.; Kacchawaha, G. R. and Bohra, N. K. (1998). Growth and amebiorative effect of *Atriplex lentiformis* in response to management practices on an arid salt-affected land. Current Agric., 22 (1/2): 69-75.

Rautenstrauch, J. C.; Aguerre, R. N. and Mendez, H. F. (2014). Agronomic and economic benefits of the application of olive pomace and harvest residues composted with bioaugmentation on olive orchards. Acta Horticulturae, (1057):301-307.

Rodriguez, I.; Garcia, C. and Hernandez, Teresa, M. (2007). Composting of sludge from residual water. Agricultura, Revista Agropecuaria, 76 (899): 600-605.

Romero, E.; Benitez, E. and Nogales, R. (2005). Suitability of wastes from olive-oil industry for initial reclamation of a Pb/Zn mine tailing. Water, Air & Soil Pollution, 165(1/4):153-165.

Sasanelli, N.; D'Addabbo, T. and Mancini, L. (2011). Suppressive effect of composted olive mill wastes soil amendments on the root-knot nematode *Meloidogyne incognita*. Acta Horticulturae, (914):229-231.

SAS, Institute. (1994). SAS/STAT User`s Guides Statistics.Ver. 6.04, 4th Ed., SAS. Institute Inc. Cary, N.C., USA.

Toscano, P.; Casacchia, T.; Diacono, M. and Montemurro, F. (2013). Composted olive mill by-products: compost characterization and application on olive orchards. Journal of Agricultural Science and Technology, 15(3):627-638.

Yaseen, T.; Dawalibi, V.; D'Onghia, A. M.; Ippolito, A. and Nigro, F. (2012). Effect of organic media, alone or in combination with bio-products, on olive plantlets growth and *Verticillium dahlia* infection. Acta Horticulturae, (949):289-296.

Zyton Project, (2013). Best practices for olive production in Egypt. United States Agency International development (USAID).

استخدام الكمبوست وتفلة الزيتون لتفريد عقل الزيتون المجدرة (صنف عجيزى)

عبد العزيز أبو الخشب وعماد جرجس ميخائيل
قسم بحوث الزيتون وفاكهة المناطق شبه الجافة، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر.

أجريت تجربة بأحدى الصوبات السيران بمشتل معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمى ٢٠١٣، ٢٠١٤ لدراسة تأثير بعض بيئات النمو: كمبوست عضوى + الرمل بنسبة ١ : ١، ١: ٢ أو ١ : ٣ بالحجم، تفلة الزيتون + الرمل (بنفس النسبة الحجمية السابقة) كبدائل ملائمة للبيئات التقليدية (الطمى + الرمل أو البيتموس + الرمل بنسبة ١ : ٢ لكل منهما على حدة) والمستخدمة عادة لشتل عقل الزيتون المجدرة، وكذلك موعد الشتل (فى الربيع أو الخريف) والتفاعلات بينهما على نمو وجودة شتلات الزيتون المجدرة (صنف عجيزى) التى تم شتلها بعد ١، ٢ أو ٣ أشهر من بدء التجذير (لكل عروة من العروتين السابق ذكرهما: عروة الربيع وعروة الخريف) فى أكياس بلاستيك سوداء قطرها (١٠ سم) ملأت بحوالى ١ كجم من إحدى البيئات سالفة الذكر.

أوضحت النتائج المتحصل عليها أن النسبة المئوية لحياة الشتلات الناتجة قد زادت معنوياً عند الشتل فى بيئتى الكمبوست + الرمل (١ : ٢ حجما) وتفلة الزيتون + الرمل (١:١، ١: ٢ حجماً)، حيث أعطت هذه البيئات أعلى نسبة مئوية للبقاء فى معظم الحالات بكلا الموسمين. كذلك أعطت العروة الأولى (الربيع) أعلى نسبة لبقاء الشتلات الناتجة من عقل مجدرة شتلت بعد شهر واحد من بداية التجذير مقارنة بالعروة الثانية (الخريف)، بينما تبادلت هاتين العروتين إحراز أعلى نسبة لحياة الشتلات الناتجة من عقل مجدرة شتلت بعد شهرين أو ثلاثة من بدء التجذير. إلا أن أفضل نسبة للحياة على الإطلاق حققتها توليفة الشتل فى بيئة الكمبوست + الرمل أو تفلة الزيتون + الرمل (بنسبة ١: ٢ لأى منهما) + الزراعة فى اى من العروتين المذكورتين. أوضحت النتائج أيضاً أن معظم قياسات النمو الخضرى والجذرى للشتلات الناتجة قد تحسنت بشكل معنوى عند الشتل فى بيئتى الكمبوست + الرمل (١ : ٢ حجما) أو تفلة الزيتون + الرمل (١:١، ١: ٢ حجما) بصرف النظر عن موعد عروة الزراعة (ربيعية أو خريفية)، لكن السيادة فى كلا الموسمين كانت للزراعة فى بيئة الكمبوست + الرمل (١: ٢ حجما) والتى سجلت أعلى القيم فى معظم الصفات. أما محتوى الوراق من الكلوروفيل الكلى فقد إنخفض معنوياً نتيجة لمختلف المعاملات المطبقة بهذه الدراسة، باستثناء الزراعة فى بيئة الرمل المدعومة بالكمبوست (بنسبة ١: ٢ أو ١: ٣ حجما) والتى أعطت قيماً قريبة من القيم التى سجلتها بيئتى المقارنة دون وجود فروق معنوية فيما بينهما.

وعليه؛ يمكن التوصية بشتل عقل الزيتون المجدرة (صنف عجيزى) فى بيئة الكمبوست + الرمل (بنسبة ١: ٢ حجما) فى الربيع أو الخريف كبديل ملائم ورخيص لبيئة البيتموس + الرمل (١: ٢ حجماً).

Table (3): Effect of media, transplanting time and their interaction on survival % and length of olive (*Olea europea* L. cv. Aggezi) transplants during 2013 and 2014 seasons.

Transplanting Time / Media	Survival (%) after 1 month from planting			Survival (%) after 2 month from planting			Survival (%) after 3 month from planting			Transplant length (cm)		
	First May	First Oct.	Mean	First June	First Nov.	Mean	First July	First Dec.	Mean	First Sept.	First Feb.	Mean
First season: 2013												
Loam+ Sand (1:2, V/V)	76.67e	76.67e	76.67D	95.83c	95.83c	95.83CD	95.83c	95.83c	95.83CD	36.38de	38.83ab	37.61B
Peatmoss + Sand (1:2, V/V)	93.33a	86.67bc	90.00A	96.30c	100.00a	98.15BC	96.30c	100.00a	98.15B	38.52a-c	39.72a	39.12A
Compost + sand (1: 1, V/V)	83.33cd	76.67e	80.00C	92.13de	91.07e	91.60E	87.96e	86.90e	87.43G	37.17b-e	38.16a-d	37.67B
Compost + sand (1: 2, V/V)	90.00ab	86.67bc	88.33A	96.67bc	100.00a	98.33B	96.67c	96.30c	96.48BC	38.25a-d	39.80a	39.03A
Compost + sand (1: 3, V/V)	86.67bc	83.33cd	85.00B	96.30c	95.83c	96.07B-D	92.13d	95.83c	93.98DE	36.96b-e	38.78ab	37.87AB
Olive pomace + sand (1:1, V/V)	80.00de	70.00f	75.00DE	100.0a	100.00a	100.00A	100.00a	100.00a	100.00A	37.92a-d	38.17b-d	38.04AB
Olive pomace + sand (1:2, V/V)	80.00de	66.67f	73.33E	91.67e	95.24cd	93.45E	91.67d	95.24c	93.45E	38.55a-c	38.58b-d	38.07AB
Olive pomace + sand (1:3, V/V)	56.67g	46.67h	51.67F	94.44c-e	93.33c-e	93.89DE	87.78e	93.33cd	90.56F	35.42e	36.67c-e	36.04C
Mean	80.83A	74.17B		95.50B	96.41A		93.63B	95.43A		37.40B	38.56A	
Second season: 2014												
Loam + Sand (1:2, V/V)	86.67bc	76.67ef	81.67B	100.00a	95.83b	97.92AB	96.30AB	95.83A-C	96.07BC	36.08cd	35.89cd	35.98BC
Peatmoss + Sand (1:2, V/V)	90.00ab	76.67ef	83.33B	100.00a	95.83b	97.92AB	100.00A	95.83A-C	97.92AB	38.94ab	36.94bc	39.94A
Compost + sand (1: 1, V/V)	83.33cd	53.33i	68.33E	95.83b	100.00a	97.92AB	95.83A-C	94.44B-D	95.14BC	37.22bc	31.73e	34.47CD
Compost + sand (1: 2, V/V)	93.33a	80.00de	86.67A	100.00a	100.00a	100.00A	100.00A	100.00A	100.00A	40.53a	36.49cd	38.51A
Compost + sand (1: 3, V/V)	90.00ab	73.33fg	81.67B	96.67ab	95.24b	95.95BC	96.67AB	91.07DE	93.87C	38.03bc	36.19cd	37.11AB
Olive pomace + sand (1:1, V/V)	76.67ef	66.67h	71.67D	95.83b	95.24b	95.54BC	91.67C-E	89.68E	90.67D	37.17bc	34.33d	35.75BC
Olive pomace + sand (1:2, V/V)	83.33cd	70.00gh	76.67C	100.00a	100.00a	100.00A	100.00A	100.00A	100.0A	40.67a	36.55b-d	38.61A
Olive pomace + sand (1:3, V/V)	66.67h	50.00i	58.33F	95.24b	94.44b	94.84C	90.48DE	88.89E	89.68D	35.71cd	31.97e	33.84D
Mean	83.75A	68.33B		97.95A	97.07B		96.37A	94.47B		38.04A	35.01B	

Means within the same column followed by the same letter (s) are not significantly different using Duncan Multiple Range Test 5 % level.

Table (4): Effect of media, transplanting time and their interaction on some growth parameters of olive (*Olea europea* L. cv. Aggezi) transplants during 2013 and 2014 seasons.

Transplanting time / Media	Stem length (cm)			No. branches/transplant			Root length (cm)		
	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean
First season: 2013									
Loam+ Sand (1:2, V/V)	19.92g	24.60a	22.26B	3.03a	2.83ab	2.93A	16.47c-f	14.33hi	15.40D
Peatmoss + Sand (1:2, V/V)	21.93d-f	21.19f	21.56C	3.17a	2.97a	3.07A	16.58c-f	18.53ab	17.56A
Compost + sand (1: 1, V/V)	22.58b-d	23.22b	22.90A	2.93ab	2.75ab	2.84A	16.25d-g	19.61a	17.93A
Compost + sand (1: 2, V/V)	21.67d-f	22.03d-f	21.85BC	3.17a	3.06a	3.11A	16.58c-f	17.78bc	17.18AB
Compost + sand (1: 3, V/V)	21.64d-f	21.67d-f	21.66BC	3.13a	2.11b	2.62A	15.32f-h	17.11cd	16.21CD
Olive pomace + sand (1:1, V/V)	22.25c-e	21.17d-f	21.71BC	3.07a	2.50ab	2.78A	15.67e-h	17.00c-e	16.33BC
Olive pomace + sand (1:2, V/V)	23.00bc	21.42ef	22.21BC	2.90ab	2.75ab	2.83A	15.55f-h	16.08d-g	15.82CD
Olive pomace + sand (1:3, V/V)	21.58ef	21.67d-f	21.63BC	2.73ab	2.47ab	2.60A	13.83i	15.00g-i	14.42E
Mean	21.82A	22.12A		3.02A	2.68B		15.78B	16.93A	
Second season: 2014									
Loam+ Sand (1:2, V/V)	21.14b-d	20.39c-e	20.90AB	2.65a-c	2.45a-c	2.55AB	14.68fg	15.50d-f	15.09CD
Peatmoss + Sand (1:2, V/V)	22.14ab	20.67b-e	21.40A	2.72ab	2.58a-c	2.65AB	17.81ab	16.28c-e	17.04A
Compost + sand (1: 1, V/V)	16.68f	17.61f	17.15C	2.41a-c	2.43a-c	2.42AB	17.72ab	14.12g	15.92BC
Compost + sand (1: 2, V/V)	23.17a	20.28de	21.72A	2.81a	2.97a	2.89A	17.36a-c	15.64d-f	16.50AB
Compost + sand (1: 3, V/V)	21.33b-d	21.81a-c	21.57A	2.78ab	2.67a-c	2.72AB	16.69b-d	14.54fg	15.62CD
Olive pomace + sand (1:1, V/V)	21.58b-d	20.20se	20.89AB	2.67a-c	1.90bc	2.28AB	15.58d-f	14.13g	14.86D
Olive pomace + sand (1:2, V/V)	22.08ab	21.11b-e	21.59A	2.70ab	2.39a-c	2.54AB	18.39a	15.44d-f	16.92A
Olive pomace + sand (1:3, V/V)	20.50c-e	19.76e	20.13B	2.50a-c	1.78c	2.14B	15.21e-g	12.22h	13.72E
Mean	21.11A	20.23B		2.65A	2.40A		16.68A	14.73B	

Means within the same column followed by the same letter (s) are not significantly different using Duncan Multiple Range Test 5 % level.

Table (5): Effect of media, transplanting time and their interaction on fresh weight of stem, roots and roots less than 3-mm-diameter of olive (*Olea europea* L. cv. Aggezi) transplants during 2013 and 2014 seasons.

Transplanting time / Media	Stem fresh weight (g)			Roots fresh weight (g)			Root weight > 3 mm diameter		
	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean
First season: 2013									
Loam+ Sand (1:2, V/V)	5.93a-c	5.43c-e	5.68A	2.01a	1.54e	1.77AB	0.940a	0.723b	0.832A
Peatmoss + Sand (1:2, V/V)	5.94a-c	5.43c-e	5.69A	1.99ab	1.82a-e	1.91A	0.943a	0.763b	0.853A
Compost + sand (1: 1, V/V)	5.74a-d	5.45c-e	5.60A	1.80a-e	1.67b-e	1.74AB	0.917a	0.563c	0.740B
Compost + sand (1: 2, V/V)	6.01ab	5.48c-e	5.75A	1.97a-c	1.72a-e	1.85A	0.950a	0.733b	0.842A
Compost + sand (1: 3, V/V)	6.15a	5.54b-e	5.85A	1.95a-d	1.75a-e	1.85A	0.945a	0.713b	0.830A
Olive pomace + sand (1:1, V/V)	5.92a-c	5.39de	5.66A	1.97a-c	1.55e	1.76AB	0.980a	0.543c	0.762B
Olive pomace + sand (1:2, V/V)	6.15a	5.14e	5.65A	1.99ab	1.63de	1.81A	0.920a	0.620c	0.770B
Olive pomace + sand (1:3, V/V)	5.29de	5.11e	5.20B	1.66c-e	1.50e	1.58B	0.730b	0.573c	0.652C
Mean	5.89A	5.37B		1.92A	1.65B		0.916A	0.654B	
Second season: 2014									
Loam+ Sand (1:2, V/V)	5.38a-d	5.13d	5.26AB	1.71ab	1.79a	1.75AB	0.780bc	0.703cd	0.742B
Peatmoss + Sand (1:2, V/V)	5.73a	5.11d	5.42A	1.66ab	1.60ab	1.63AB	0.753bc	0.703cd	0.728B
Compost + sand (1: 1, V/V)	5.32a-d	4.97d	5.14AB	1.63ab	1.63ab	1.63AB	0.610ef	0.667de	0.638D
Compost + sand (1: 2, V/V)	5.70ab	5.21b-d	5.46A	1.80a	1.70ab	1.75AB	0.793b	0.703cd	0.748B
Compost + sand (1: 3, V/V)	5.64a-c	5.17cd	5.40A	1.82a	1.74ab	1.78A	0.790b	0.883a	0.837A
Olive pomace + sand (1:1, V/V)	5.24b-d	5.06d	5.15AB	1.71ab	1.64ab	1.68AB	0.737b-d	0.663de	0.700BC
Olive pomace + sand (1:2, V/V)	5.41a-d	5.03d	5.22AB	1.57ab	1.63ab	1.60AB	0.770bc	0.563f	0.667CD
Olive pomace + sand (1:3, V/V)	5.21b-d	4.91d	5.06B	1.63ab	1.44b	1.54B	0.697cd	0.563f	0.630D
Mean	5.46A	5.07B		1.69A	1.65A		0.741A	0.681B	

Means within the same column followed by the same letter (s) are not significantly different using Duncan Multiple Range Test 5 % level.

Table (6): Effect of media, transplanting time and their interaction on number of leaves/transplant, leaf area, assimilation area and total chlorophyll content of olive (*Olea europea* L. cv. Aggezi) transplants during 2013 and 2014 seasons.

Transplanting time / Media	Number of leaves/transplants			Leaf area (cm^2)			Total area (cm^2)			Total chlorophyll (mg/g. FW)		
	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean	First Sept.	First Febr.	Mean
First season: 2013												
Loam+ Sand (1:2, V/V)	45.58a	41.92b	43.75A	3.17ab	2.72bc	2.95A-C	144.4ab	114.4e-g	129.4B	70.97a-c	69.05b-d	70.01A
Peatmoss + Sand (1:2, V/V)	44.43a	39.78cd	42.10B	3.11a-c	3.14a-c	3.12AB	138.3b	125.1d	131.7B	70.84a-c	70.94a-c	70.89A
Compost + sand (1: 1, V/V)	45.45a	39.06d	42.25B	3.12a-c	3.01a-c	3.07AB	142.0ab	117.5ef	129.7B	69.86a-c	63.60f	66.73B
Compost + sand (1: 2, V/V)	45.50a	39.91cd	42.70AB	3.18ab	3.29a	3.23A	145.0a	131.2c	138.1A	69.28a-d	71.97a	70.62A
Compost + sand (1: 3, V/V)	44.88a	34.73e	39.81C	3.10a-c	3.19ab	3.15AB	138.9ab	110.6g	124.7C	71.74a-c	69.44a-d	70.56A
Olive pomace + sand (1:1, V/V)	42.75b	35.42e	38.93CD	2.82a-c	2.62c	2.72C	119.7de	91.60i	105.7E	68.86b-d	64.42ef	66.64B
Olive pomace + sand (1:2, V/V)	41.39bc	34.50e	37.94D	3.00a-c	2.90a-c	2.95A-C	124.2d	98.42h	111.3D	70.74a-c	65.41ef	68.07B
Olive pomace + sand (1:3, V/V)	39.42d	32.42f	35.92E	2.83a-c	2.89a-c	2.86BC	111.7fg	93.44hi	102.6E	68.43cd	66.81de	67.62B
Mean	43.64A	37.22B		3.04A	2.97A		133.0A	110.3B		70.08A	67.70B	
Second season: 2014												
Loam+ Sand (1:2, V/V)	34.40f	30.89h	32.64D	2.96b-d	3.25a-c	3.11AB	102.2e	101.2e	101.7D	69.15a-d	71.73a	70.44A
Peatmoss + Sand (1:2, V/V)	33.22fg	34.61f	33.92D	3.00b-d	3.32ab	3.16AB	99.34e	114.8cd	107.0C	68.23b-e	71.55a	69.89AB
Compost + sand (1: 1, V/V)	34.88ef	27.31i	31.09E	2.75de	2.64de	2.70CD	96.41e	72.35g	84.38E	67.15c-e	69.91a-c	68.53AB
Compost + sand (1: 2, V/V)	39.36bc	37.18cd	38.27B	3.11a-d	3.49a	3.30A	120.6bc	129.8a	125.2A	69.55a-c	69.59a-c	69.57AB
Compost + sand (1: 3, V/V)	37.56cd	35.42d-f	36.49C	3.48a	3.10a-c	3.29A	131.7a	110.1d	120.9B	68.83a-e	70.81ab	69.82AB
Olive pomace + sand (1:1, V/V)	40.42b	30.80h	35.61C	2.81c-e	2.66de	2.74CD	116.3c	85.09f	100.7D	66.26e	69.64a-c	67.98B
Olive pomace + sand (1:2, V/V)	46.14a	36.97de	41.56A	2.62de	3.23a-c	2.93BC	123.6b	118.3bc	120.9B	67.22c-e	70.40ab	68.81AB
Olive pomace + sand (1:3, V/V)	31.33gh	25.63i	28.48F	2.69de	2.43e	2.56D	83.02f	62.60h	72.81F	66.63de	69.75a-c	68.19B
Mean	37.16A	32.35B		2.93A	3.02A		109.1A	99.27B		67.88B	70.42A	

Means within the same column followed by the same letter (s) are not significantly different using Duncan Multiple Range Test 5 % level.