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# Effect of Different Mixtures of Organic Fertilizers on Vegetative Growth, Flowering, Fruiting and Leaf Mineral Content of Picual Olive Trees

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**Abstract:** This study was carried out during 2010 and 2011 seasons to investigate the effect of different mixtures of organic fertilizers on vegetative growth, flowering, fruiting and leaf mineral content of Picual olive trees grown in sandy loamy soil in El-Watania farm located at El-Jouf region, Saudi Arabia. Five treatments were used in this experiment: agricultural waste + mineral fertilizers (compost 1), agricultural waste + 5% sheep manure (compost 2), agricultural waste + 10% sheep manure (compost 3), agricultural waste + 20% sheep manure (compost 4) and agricultural waste + 40% sheep manure (compost 5). The results indicate that compost 3 gave the highest values of all vegetative growth parameters including; Leaf length, width and area, shoot length, pigments content and leaf mineral contents (N, K and Fe). Organic manure fertilization resulted in decreasing heavy metals content (Pb, Ni, Co and Cd). Flowering, fruit set, yield and fruit physical characteristics and oil yield also were the best from trees treated by compost 3. Trees treated by compost 1 and 4 gave the lowest oil acidity values.

**Key words:** Olives · Organic fertilizers · Compost · Fruit quality · Oil Content

## INTRODUCTION

Organic farming is a new system for agriculture production to avoid the use of chemical and synthetic fertilizers. Environmental effects on human health promoted growers to convert to organic production [1]. Olive (*Olea europaea* L.) is an important perennial crop in many agricultural regions of the North Saudi Arabia as it is the most important olive growing region. Generally, geomorphic processes associated with erosion sedimentation have caused substantial changes in soil properties along the slopes of these areas [2]. Leaf-nutrient analysis is the best method for diagnosing tree nutritional status and represents an important tool for determining future fertilization requirements. Presently, the use of leaf analysis as a guide for olive fertilization is still infrequent in North Saudi Arabia countries [3]. Organic matter is not only necessary for plant nutrition as slow release fertilizers but also essential for efficient plant production system [4]. Compost was more efficient in improving soil physical and chemical characteristics and enhancing growth of olive trees. Therefore, these media are recommended for olive cultivation under the arid and semi-arid regions, which are limited in water resources, especially sandy soil [5]. Olive trees when fertilized with organic manure gave the higher leaf content of A and B chlorophylls, N, P, K, Fe, Zn and Mn [6-8]. Organic manures applied to olive trees produced an increase in number of inflorescences per shoot and number of flowers per inflorescence [9, 10]. Organic fertilization maintains adequate mineral content in leaves during growth cycles of the olive trees for having economical yield, also increases fruit set percentage, reduces fruit dropping weaves and improves oil properties [10]. Organic virgin olive oil was superior qualities compared to the conventional virgin olive oil i.e. lower acidity value [11, 12]. The target of this study was to evaluate Picual olive cultivar parameters under using five different compost fertilizers under Saudi Arabia conditions.

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## MATERIALS AND METHODS

The present investigation was carried out during the two successive seasons (2010 and 2011) in El-Watania farm located at El-Jouf region, Saudi Arabia. The study was conducted on ten years old olive trees of Picual cv., (as oil cultivar) grown in sandy soil under drip irrigation system, planted at 5 X 5 m apart and uniform in shape and received the common horticultural practices. Before experiment had been conducted in the 1st season, mechanical and chemical analysis of orchard soil was determined as shown in Table 1.

Forty five trees were selected a completely randomized block design for this study with five treatments each contains nine replicates. Composts that used in this study were as follows:

- (1 Date palm: 1 olives: 1 maize) waste + chemical actives (compost 1)
- (1 Date palm: 1 olives: 1 maize) waste + 5 % sheep manure (compost 2)
- (1 Date palm: 1 olives: 1 maize) waste + 10 % sheep manure (compost 3)
- (1 Date palm: 1 olives: 1 maize) waste + 20 % sheep manure (compost 4)
- (1 Date palm: 1 olives: 1 maize) waste + 40 % sheep manure (compost 5)

Table 1: Some physical and chemical characteristics of soil used for the present study

| Parameters | Value |
|---|---|
| Sand (%) | 77.52 |
| Silt (%) | 10.00 |
| Clay (%) | 12.48 |
| Textural class | Sandy loam |
| Organic matter (%) | 0.208 |
| pH | 8.51 |
| EC (dS/m) | 0.382 |
| $CaCO_3$ (%) | 4.58 |
| Total N % | 0.04 |
| P ppm | 4.12 |
| K ppm | 5.11 |
| Fe ppm | 3.44 |
| Mn ppm | 0.40 |
| Cu ppm | 0.12 |
| Zn ppm | 0.51 |

**Chemical Actives:** 20kg $NH_4SO_4$ +7kg super Phosphate +1.2 kg $K_2O$ / ton compost Organic manure (as compost) fertilizer treatments were added to the soil at the second week of December in both seasons (20 cm depth), at a distance of 70 cm from the tree trunk. Five different organic manures at 50 kg were added per each tree. The chemical composition of the tested organic fertilizers is shown in Table 2 and the component of each dose was estimated on basis of 1000 g N/tree [13].

Table 2: Chemical analysis of different organic used before applying to the trees.

| Parameters | Compost (1) | Compost (2) | Compost (3) | Compost (4) | Compost (5) |
|---|---|---|---|---|---|
| Dry matter (%) | 67.17 | 67.26 | 66.22 | 66.97 | 65.65 |
| pH | 7.52 | 7.32 | 7.31 | 7.15 | 7.11 |
| EC (dS/m) | 3.48 | 3.59 | 3.61 | 3.86 | 4.20 |
| Cubic meter weight (Kg) | 601 | 559 | 546 | 533 | 557 |
| Organic matter (%) | 24.78 | 22.93 | 22.13 | 24.58 | 28.92 |
| Organic C (%) | 14.37 | 13.30 | 12.84 | 14.26 | 16.77 |
| Total N ( % ) | 1.60 | 1.60 | 1.84 | 1.88 | 1.92 |
| $NH_4$ (ppm) | 212 | 136 | 147 | 158 | 162 |
| $NO_3$ (ppm) | 422 | 447 | 465 | 483 | 510 |
| Organic N (%) | 1.54 | 1.70 | 1.78 | 1.82 | 1.85 |
| C / N Ratio | 9 | 8 | 7 | 8 | 9 |
| Available P (ppm) | 34 | 17 | 22 | 27 | 29 |
| Total P ( % ) | 0.518 | 0.532 | 0.525 | 0.602 | 0.639 |
| Available K (ppm) | 925 | 667 | 714 | 808 | 915 |
| Total K ( % ) | 0.622 | 0.318 | 0.337 | 0.398 | 0.417 |
| Total Fe (ppm) | 6425 | 7156 | 7936 | 8130 | 8994 |
| Total Zn (ppm) | 88 | 32 | 32 | 42 | 57 |
| Total Mn (ppm) | 75 | 101 | 109 | 122 | 137 |
| Total Cu (ppm) | 25 | 24 | 28 | 30 | 35 |
| Total Pb (ppm) | 12 | 5 | 5 | 5 | 6 |
| Total Ni (ppm) | 15 | 4 | 4 | 6 | 5 |

Trees were subjected to the following studies:

**Vegetative Growth Measurements**

**Leaf Dimensions:** Twenty mature leaves from the middle of every new spring growth shoot were taken in mid October (after 7 months) from inner and outer portions of the tree, leaf length and width were measured (cm). Leaf area ($cm^2$) according to Ahmed and Morsy [14] was measured using the following equilibration:

$$\text{Leaf area} = 0.53 \text{ (length x width)} + 1.66.$$

**Shoots Length (cm):** Five vegetative branches, aged one year old were randomly chosen and marked per tree at the beginning of growth (early March) to determine shoots length (cm) at the end of each season (first of October ).

**Pigments (Chlorophyll A, B and total Chlorophyll):** Fresh mature leaves samples were selected from the middle of each new shoots and taken at the 1st week of October. Fresh samples (0.03g) from each replicate were extracted with 5ml N dimethyl formamide then chlorophyll a, b and total chlorophyll were determined calorimetrically) at wave length of 663.8 and 646.8 nm respectively, then concentrations of each component was calculated by Porra *et al.* [15] as follows:

Chlorophyll a = 13.43 × A 663.8-3.47× A 646.8 (nm/ml)
Chlorophyll b = 22.9 × A 646.8-5.38 ×A 663.8 (nm/ml)
Total Chlorophyll = 19.43 × A 646.8 + 8.05 × A 663.8 (nm/ml)

**Leaf Mineral Content Was Determined as Follow:** Representative samples of fourth and fifth leaves from the base of spring shoots were collected from each replicate in October during both seasons. The samples were thoroughly washed with tap water, rinsed twice with distilled water and oven dried at 70°C till a constant weight and finally grinds for the following determination: Nitrogen was determined using Micro-Kjeldahl method [16]. Phosphorus was determined by the method of Truog and Meyer [17]. Potassium was determined by the flame photometer according to the method of Brown and Lilleland [18]. Iron, zinc and manganese were determined by using Atomic Absorption technique. Heavy metals content (Pb, Ni, Co and Cd) was determined using atomic absorption (Model, spectronic 21 D). All these macro and micro elements were determined through the two studied seasons.

**Flowering Characteristics:** At full bloom stage (mid of April), average number of inflorescences per twig and average number of flowers per inflorescence were recorded. Fruiting Calculations: Initial and final fruit set percentage were calculated in relation to the total number of flowers on the same twig after 21 and 60 days from full bloom, respectively [19].

**Yield and Fruit Characteristics:** The yield per tree was measured at maturity stage (mid October). Oil yield /tree was determine as follows yield per tree (kg) × contents of oil in fruit (%). For fruit quality, thirty fruits per replicate were randomly picked to determine fruit weight (g), flesh weight (g), seed weight (g), fruit volume ($cm^3$), fruit length (cm), fruit diameter (cm) and fruit shape (L/D ratio). Also, fruit flesh contents of oil, moisture (%) and oil acidity value were determined according to A.O.A.C. [20].

**Statistical Analysis:** Data obtained throughout this study were statistically analyzed using the analysis of variance method as reported by Snedecor and Cochran [21] and the differences between means were differentiated by using Duncan's range test.

## RESULTS AND DISCUSSION

**Growth Characters:** Data presented in Table 3 showed that some growth characters of Picual olive trees were significantly affected by different treatments in both seasons. Trees received Compost 3 and Compost 4 produced higher leaf length compared with the other treatments in the first season, while in the second season, both Compost 3 and Compost 5 gave higher leaf length. The lowest values were recorded by Compost 1 treatment in both seasons. Also leaf width was significantly affected by different mixture organic fertilizer treatments in the first season since Compost 3 and Compost 4 treatments produced higher leaf width compared with the other treatments. In the second season, leaf width was not significantly affected by different treatments. Picual olive trees received Compost 3 and Compost 4 treatments gave higher leaf area values, since they recorded 7.84, 6.92, 7.93 and 7.08 $cm^2$ in first and second seasons, respectively. Concerning the shoot length results in Table 3 indicated that Compost 3 treatment recorded the highest values; while trees received Compost 1 gave the lowest values in the first and second seasons. These results are in disagreement with those of Abdel-Nasser and Harhash [5], who found that sheep manure were more efficient in

Table 3: Effect of different organic fertilizers on vegetative growth characteristics of Picual olive cultivar during 2010 and 2011 seasons

| Treatments | Leaf length (cm) | Leaf width (cm) | Leaf area ($cm^2$) | Shoot length (cm) | Chl. a (nm/ml) | Chl. b (nm/ml) | Total chlorophyll (nm/ml) |
|---|---|---|---|---|---|---|---|
| | | | 2010 season | | | | |
| Compost (1) | 5.59d | 1.05c | 4.77c | 30.08d | 1.95d | 0.28c | 2.23d |
| Compost (2) | 6.37c | 1.37b | 6.27b | 32.42d | 3.61c | 0.69bc | 4.30c |
| Compost (3) | 6.95a | 1.68a | 7.84a | 42.92a | 7.54a | 1.65a | 9.19a |
| Compost (4) | 6.82ab | 1.46ab | 6.92ab | 39.25b | 5.08b | 1.30ab | 6.38b |
| Compost (5) | 6.65b | 1.34b | 6.38b | 36.25c | 3.84c | 0.83bc | 4.67bc |
| LSD 0.05 | 0.19 | 0.28 | 0.98 | 2.63 | 1.23 | 0.74 | 1.64 |
| | | | 2011 season | | | | |
| Compost (1) | 5.50d | 1.43a | 5.65c | 22.83d | 4.44d | 1.82b | 6.26d |
| Compost (2) | 6.15cd | 1.38a | 6.15bc | 26.00c | 5.58cd | 2.22ab | 7.80cd |
| Compost (3) | 7.93a | 1.49a | 7.93a | 35.33a | 13.30a | 3.45a | 16.75a |
| Compost (4) | 6.88bc | 1.48a | 7.08ab | 27.50c | 9.52b | 3.16ab | 12.68b |
| Compost (5) | 7.35ab | 1.39a | 7.05ab | 30.43b | 6.80c | 2.38ab | 9.18c |
| LSD 0.05 | 0.84 | 0.27 | 1.26 | 2.11 | 1.42 | 1.63 | 2.76 |

* Means within each column with the same letter are not significantly different at 5% level.

Table 4: Effect of different organic fertilizers on leaf mineral contents of Picual olive cultivar during 2010 and 2011 seasons

| Treatments | N % | P % | K % | Fe ppm | Zn ppm | Mn ppm | Pb Ppm | Ni ppm | Co ppm | Cd ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2010 season | | | | | |
| Compost (1) | 1.40b | 0.10 | 0.93c | 452.5d | 17.43d | 64.80a | UDL | UDL | UDL | UDL |
| Compost (2) | 1.47b | 0.10 | 1.07c | 630.2c | 18.87c | 50.03b | UDL | UDL | UDL | UDL |
| Compost (3) | 1.70a | 0.10 | 1.83a | 824.6a | 23.70a | 44.67bc | UDL | UDL | UDL | UDL |
| Compost (4) | 1.40b | 0.10 | 1.43b | 768.6b | 20.90b | 50.77b | UDL | UDL | UDL | UDL |
| Compost (5) | 1.47b | 0.10 | 1.47b | 661.2c | 19.30c | 39.30c | UDL | UDL | UDL | UDL |
| LSD 0.05 | 0.21 | NS | 0.25 | 54.82 | 1.24 | 9.14 | -- | -- | -- | -- |
| | | | | | 2011 season | | | | | |
| Compost (1) | 1.03c | 0.10 | 1.07c | 443.9c | 12.37c | 21.43d | UDL | UDL | UDL | UDL |
| Compost (2) | 1.13b | 0.10 | 1.07c | 512.9b | 13.13c | 24.37cd | UDL | UDL | UDL | UDL |
| Compost (3) | 1.27a | 0.10 | 1.43a | 626.1a | 22.33a | 42.80a | UDL | UDL | UDL | UDL |
| Compost (4) | 1.00c | 0.10 | 1.20b | 456.4c | 18.53b | 33.60b | UDL | UDL | UDL | UDL |
| Compost (5) | 1.03c | 0.10 | 1.30b | 547.4b | 17.80b | 27.63c | UDL | UDL | UDL | UDL |
| LSD 0.05 | 0.09 | NS | 0.12 | 39.1 | 1.38 | 4.65 | -- | -- | -- | -- |

* Means within each column with the same letter are not significantly different at 5% level. *UDL: Under the Detection Limit

improving soil physical and chemical characteristics and enhancing growth of olive trees compared to olive chicken manure, therefore this manure is recommended for olive cultivation under arid and semi-arid regions that are limited in water resources, especially sandy soil. Many studies reported that fertilizing power of organic fertilizers is due to their content of stabilized organic matter and due to their component of nutrient elements [22]. These results are in accordance with those obtained by El-Morshedy [23], who found that, chicken manure increased shoot growth rate, leaf area of sour orange seedlings. The observations are in accordance with those obtained by Haggag [24] where, increasing nitrogen fertilization resulted in an increase in leaf area of Picual olive trees in sandy soil.

**Leaf Pigments Content:** Data in Table 3 indicated that pigments (chlorophyll a, b and total) in leaves were increased in trees treated by Compost 3 treatment, while the lowest value was obtained from trees treated by Compost 1 treatment, during this study. The previous results are in agreement with the early findings of Jackson and Volk [25], who reported that potassium is required for development of chlorophyll (b) and activated enzyme reactions involved in chlorophyll (a) synthesis. The increase in chlorophyll (b) may be due to the increase in chlorophyll (a) because chlorophyll (a) is a precursor for the synthesis of chlorophyll (b) content [26]. Moreover, Aly [27] found that all treatments of soil nutrients (N, P, K, Mg and EM) increased the leaf chlorophyll (a) and magnesium gave the highest value concerning to chlorophyll (b) content.

**Leaf Mineral Content:** Data in Table 4 indicated that mixture organic fertilizers significantly affected leaf N, P, K, Fe, Zn and Mn contents in both seasons. The highest nitrogen and potassium percentages in leaves were recorded by trees fertilized with Compost 3 in the first and second seasons. No significant differences were observed between treatments on leaf P % content in the two seasons of study. Likewise, the leaf Fe and Zn contents, the results indicated that, the highest Fe and Zn in leaves were recorded by trees received Compost 3, while trees treated by Compost 1 gave the lowest values during the first and second seasons. Leaf Mn content was higher in trees treated by Compost 1 in the first season, however, in the second season, trees treated by Compost 3 gave the highest value. These results are contrary with those found by Hegazy *et al*. [10], who reported that the applying 100% of organic fertilization (poultry manure) to Picual olive trees gave the highest Fe leaf content in both seasons and Mn in the second season, while leaf Zn content increased in second season with using 100% mineral fertilization. Also these results are in agreement with those obtained by Morsi [28], who found that organic manure increased N, P, K, Mg, Ca, Fe, Zn and Mn in pinnae content of date palm "Seewy cv." grown in new reclaimed land.

**Leaf Heavy Metal Contents:** Data presented in Table 4 showed that all treatments in this study were not contained mineral heavy metals (Pb, Ni, Co and Cd) in leaves. The previous results are agree with the early findings of Fayed [1] who showed that Anna apple trees treated with cattle manure were not contained mineral heavy metals (Pb, Ni and Cd).

**Flowering Characteristics:** Average number of inflorescences per twig and average number of flowers per inflorescence of Picual olive cultivar were significantly affected by the different organic manure application during the two seasons (Table 5). Generally, trees treated by Compost 3 treatment recorded the highest value in this respect compared to the other treatments under study in the first season, however in the second season, average number of inflorescences per twig gave the same trend without significant differences between treatments for average number of flowers per inflorescence. Several studies indicated that the improvement in flowering, resulted by organic fertilization, may be attributed to the stimulation effect of the absorbed nutrients on photosynthesis process which certainly reflected positively on the flowering characteristics [29]. Also, the slow release nutrients resulted from the biodegradation of manure by soil microorganisms could explain the present results [30]. However, the enhancement of flowering characteristics could be attributed to the capability of soil microorganisms to produce growth regulators such as auxins, cytokinines and gibberellins which had a positive effect on flowering process and nutrients uptake [31]. Maksoud [9] reported that all organic manures applied to olive trees produced increases in number of inflorescences/shoot and number of flowers/ inflorescence.

**Fruit Set and Yield:** As shown in Table 5 data indicated that initial and final fruit set and yield were significantly affected by different mixture organic manures in both seasons. Trees treated by Compost 3 recorded the highest fruit set and yield followed by trees treated by

Table 5: Effect of different organic fertilizers on flowering and yield of Picual olive cultivar during 2010 and 2011 seasons

| Treatments | No. of inflorescence/twig | No. of flowers/ inflorescence | Initial fruit set % | Final fruit set % | Fruit yield (kg /tree) |
|---|---|---|---|---|---|
| | | 2010 season | | | |
| Compost (1) | 6.39b | 56.28d | 8.29c | 1.46c | 24.02d |
| Compost (2) | 6.36b | 67.83b | 7.70c | 1.51c | 29.15c |
| Compost (3) | 7.72a | 86.11a | 10.31a | 1.97a | 42.67a |
| Compost (4) | 6.31b | 67.11b | 9.31b | 1.73b | 32.46b |
| Compost (5) | 6.53b | 62.86c | 9.71ab | 1.59bc | 31.58bc |
| LSD 0.05 | 0.64 | 3.54 | 0.84 | 0.15 | 2.69 |
| | | 2011 season | | | |
| Compost (1) | 12.03d | 10.30a | 12.23d | 2.58d | 47.98c |
| Compost (2) | 13.47c | 10.70a | 13.52c | 3.57c | 57.74b |
| Compost (3) | 16.77a | 10.60a | 17.96a | 6.15a | 76.21a |
| Compost (4) | 15.10b | 10.53a | 14.87b | 4.63b | 64.30b |
| Compost (5) | 14.60bc | 10.73a | 12.88cd | 3.74c | 64.60b |
| LSD 0.05 | 1.41 | 1.29 | 0.65 | 0.41 | 7.52 |

* Means within each column with the same letter are not significantly different at 5% level.

Table 6: Effect of different organic fertilizers on fruit physical characteristics of Picual olive cultivar during 2010 and 2011 seasons

| Treatments | Fruit weight (g) | Flesh weight (g) | Seed weight (g) | Fruit volume (cm3) | Fruit length (cm) | Fruit diameter (cm) | Fruit shape index (L/D) ratio |
|---|---|---|---|---|---|---|---|
| | | | | 2010 season | | | |
| Compost (1) | 4.68d | 3.66d | 1.02c | 4.83d | 2.50c | 1.93b | 1.30bc |
| Compost (2) | 5.31c | 4.15c | 1.16b | 5.50c | 2.73b | 2.13a | 1.28bc |
| Compost (3) | 6.39a | 5.08a | 1.31a | 6.33a | 2.87a | 2.03ab | 1.41a |
| Compost (4) | 5.84b | 4.69b | 1.15b | 6.00a | 2.65b | 2.13a | 1.24c |
| Compost (5) | 5.61bc | 4.55b | 1.06c | 5.83bc | 2.73b | 2.02ab | 1.36ab |
| LSD 0.05 | 0.321 | 0.294 | 0.06 | 0.421 | 0.127 | 0.132 | 0.090 |
| | | | | 2011 season | | | |
| Compost (1) | 4.67d | 4.21d | 0.46c | 4.83c | 2.57d | 1.87c | 1.38ab |
| Compost (2) | 4.89cd | 4.33cd | 0.56b | 5.00c | 2.73c | 1.97bc | 1.39ab |
| Compost (3) | 8.05a | 7.38a | 0.67a | 8.17a | 3.03a | 2.33a | 1.30b |
| Compost (4) | 5.45c | 4.80c | 0.65a | 5.67b | 2.90b | 2.20ab | 132ab |
| Compost (5) | 6.10b | 5.43b | 0.67a | 6.17b | 2.77c | 1.93c | 1.43a |
| LSD 0.05 | 0.61 | 0.57 | 0.06 | 0.64 | 0.12 | 0.24 | 0.13 |

* Means within each column with the same letter are not significantly different at 5% level.

Compost 4 and 5, while trees treated by Compost 1 gave the lowest values in this respect. These results are in agreement with those obtained by Abou El-Khashab *et al*. [8] and Hegazi *et al*. [10], they found that organic fertilization maintained adequate mineral contents in leaves during growth cycles of the olive trees for having economical yield; it also increased fruit set percentage and reduced fruit dropping waves. However, these results agree with previous studies on olive cultivars by Hartmann [32], who reported that there was a direct correlation between the percentage of perfect flowers and fruit setting. Who found also that fruit set and yield differed from season to another. On apple trees, Fayed [1] showed that chicken manure gave the best final fruit set percentage on spurs of Anna apple trees compared with cattle manure, town refuse and farming compost.

**Fruit Physical Characteristics:** It is clearly noticed that fruit weight, flesh weight, seed weight, volume, length, diameter and shape index of fruit were significantly affected by different mixture organic manure treatments (Table 6) in both seasons. From the obtained results, trees treated by Compost 3 gave the highest level of all physical parameters except L/D ratio in the second season where it gave the lowest value. These observations are in accordance with those obtained by Hegazi *et al*. [10], they observed that poultry manures proved to be the most efficient manures source in enhancing fruit physical properties of olive trees. Also, considering the differences between the studied cultivars, it may be concluded that olive cultivar of higher fruit weight had a higher flesh weight. These results are also in agreement with that obtained by Maksoud [9], who reported that olive cultivars varied greatly in their flesh weight as affected by organic fertilization.

**Fruit Chemical Characteristics**

**Fruit Oil Percentage:** The percentage of flesh oil content was significantly affected by different mixture organic manure treatments during the two seasons as shown in Table 7. Fruit from trees treated by Compost 5 gave the highest percentage of oil, followed by those treated by Compost 1 and Compost 2 in the first season, while in the second one Compost 3 gave the highest value.

**Oil Yield (kg/tree):** Data presented in Table 7 showed that all treatments affected significantly oil yield as kg /tree in both seasons. Trees treated by Compost 3 gave the highest oil yield in both seasons, followed by Compost 5. Meanwhile, the lowest oil yield was recorded due to fertilization by Compost 1 treatment during the two seasons of the study.

**Moisture (%):** Results in Table 7 indicated that moisture percentage in fruits was significantly affected by different fertilizer treatments. The highest moisture (%) was recorded by trees supplied by Compost 4 and Compost 3 followed by Compost 2, in the first season, while in the second season, trees supplied by Compost 3,2,1 and 4 recorded the highest moisture percentage in the fruits.

Table 7: Effect of different organic fertilizers on fruit chemical characteristics of Picual olive cultivar during 2010 and 2011 seasons

| Treatments | Oil (%) | Oil Yield (kg/tree) | Moisture percentage (%) | Oil acidity (%) |
|---|---|---|---|---|
| | | 2010 season | | |
| Compost (1) | 12.84b | 3.09d | 73.19c | 0.52b |
| Compost (2) | 12.76b | 3.72c | 74.45b | 0.63a |
| Compost (3) | 11.60c | 4.95a | 75.08ab | 0.63a |
| Compost (4) | 11.55c | 3.75c | 75.51a | 0.64a |
| Compost (5) | 14.08a | 4.45b | 73.42c | 0.50b |
| LSD 0.05 | 1.01 | 0.42 | 0.88 | 0.06 |
| | | 2011 season | | |
| Compost (1) | 12.32d | 5.91d | 77.12a | 0.28b |
| Compost (2) | 13.57c | 7.83c | 77.95a | 0.47a |
| Compost (3) | 16.66a | 12.68a | 78.64a | 0.46a |
| Compost (4) | 14.51b | 9.34b | 75.32ab | 0.48a |
| Compost (5) | 14.23b | 9.20b | 72.39b | 0.33b |
| LSD at0.05% | 0.66 | 1.04 | 4.10 | 0.05 |

* Means within each column with the same letter are not significantly different at 5% level.

**Oil Acidity (%):** Oil acidity percentage was significantly affected by different treatments. The lowest total acidity % was recorded when trees fertilized with Compost 1 and 5, while the highest oil acidity (%) was obtained from trees fertilized with Compost 1,2 and 3, in both seasons of the study. These results are in harmony with those obtained by Abou El-Khashab *et al*. [8] who showed that, Koroneiki olive cv. when provided with farmyard manure + compost + biofertilizers (as combination between Phosphorene and Nitrobein) produced the highest fruit oil content. Maksoud *et al.* [33] indicated that flesh oil content was influenced positively by rates of sewage sludge and ammonium sulphate. Flesh oil content raised up to 1.68 and 3.00 % over ones not received sewage sludge since 30 kg/tree and 40 kg/tree, respectively. Also, the obtained results are somewhat in line with the findings by Francisca *et al.* [11] who studied the quality of oil extracted from ecologically methods of the Picual variety comparing with oil extracted from conventional methods and noticed that organic virgin olive oil was a superior quality to the conventional virgin olive oil e.g. lower acidity value. On apple trees, Fayed [1] indicated that chicken manure or compost gave the best fruit and lowest acidity percentage compared to other organic sources (town refuse and cattle manure). The present results are in agreement with those obtained by Hegazi *et al*. [10] who found that organic manure gave lower oil acidity value compared with chemical fertilization in their study on olives.

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