Effects of Training Methods on Four Melon Cultivars

Yetiştirme Yöntemlerinin Dört Kavun Çeşidine Etkisi

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ABSTRACT

Melon (Cucumis melo L.) is one of the important crops and is widely produced in the world. The aim of the present study was to determine the effects of two training methods (one or two stems) on four melon cultivars (HV1: Zagrit, HV2: Maziane, HV3: Kirkagac, and HV4: Ananas). The field experiment has been accomplished during the 2016-2017 season at the Tripoli Agricultural Technology Center in Libya. Morphological, phenological and fruit traits were observed or measured. The experiment was conducted in a split-plot randomized block design with four replicates. Least significant differences (LSD) were determined at the significance level of 0.05. There were significant differences among most of the studied traits based on the training methods and melon cultivars. The growing method had a significant effect the number of fruit; two-stem plants reached to 4.78 fruit per plant while the one-stem plants produced 3.31 fruit per plant. Moreover, growing method had a significant effect on the weight of the fruit. The plants with two stems scored the highest weight of the fruit reaching 910 g per fruit, while the plants with one stem gave the fruit weight of amounting to 820 g per fruit.

Keywords: Cultivars, Growing Methods, Melon

ÖZET

Kavun (Cucumis melo L.) dünyada yaygın olarak üretilen önemli bir bitkidir. Bu çalışmanın amacı, dört kavun çeşidinde (HV1: Zagrit, HV2: Maziane, HV3: Kırkağaç ve HV4: Ananas) iki yetiştirme yönteminin (bir veya iki gövdeli yetiştiricilik) etkilerini belirlemektir. Deneme, 2016-2017 sezonunda Libya'daki Trablus Tarım Teknolojileri Merkezi'nde gerçekleştirilmiştir. Morfolojik, fenolojik ve meyve özellikleri gözlemlenmiş veya ölçülmüştür. Deneme, bölünmüş parseller tesadüf blokları deneme desenine göre dört tekerrürlü olarak yürütülmüştür. En küçük anlamlı farklar (LSD) 0.05 anlamlılık düzeyinde belirlenmiştir. Yetiştirme yöntemlerine ve kavun çeşitlerine göre incelenen özelliklerin çoğu arasında önemli farklılıklar bulunmuştur. Yetiştirme yönteminin meyve sayısı üzerinde önemli bir etkisi olmuştur; iki gövdeli bitkiler bitki başına 4.78 meyveye ulaşırken, tek gövdeli bitkiler bitki başına 3.31 meyve vermiştir. Ayrıca yetiştirme yönteminin meyve ağırlığı üzerinde önemli bir etkisi olmuştur. İki gövdeli bitkiler meyve başına 910 gr ile en yüksek meyve ağırlığını elde ederken, tek gövdeli bitkiler meyve başına 820 gr ile meyve ağırlığı vermiştir.

Anahtar Kelimeler: Çeşitler, Yetiştirme Yöntemleri, Kavun

INTRODUCTION

It is expected that the population of the world be 7.5 billion, and a demand for food to increase by 50% at 2030. By using the current, values of water, use for agriculture, the calculations indicate that the use of water in irrigation, will increase by 30% as general, and more than 40% of the annual food production comes from irrigated lands.

Crop production from greenhouses, is the most optimum, way to manage the exploitation of water. It is the extensive agricultural system, which requires an increase, in the cost of materials, and labor compared, with the open farming, because the costs of investment, and production are much higher, in greenhouses, than the agriculture, in the open fields, because of the methodologies used to produce crops, in greenhouses are more efficient, than those used in open farming, systems. The success of agricultural system, in greenhouses depends on the production, of more fruits and whit better quality. This property depends on the cultivated variety, and crop management system, and the growth season. Melon is the most versatile speices in the genus Cucumis, and there is wide genetic diversity among the cultivars based on the fruit size shape and taste, based on the characteristics of vegetative growth and climatic adaptation (Sensoy et al. 2007).

The melon is one of the most economically important crops, and is grown widely, in the world. Most likely it originated in Africa, from Iran to India, and later introduced, to other parts of the world. World production of melons was 27 million tonnes, led by China, then Turkey, Iran, and India (FAOSTAT, 2020).

Melon is moderately sensitive to soil salinity, and to the lack of soil water, (Kuşvuran et al., 2007). Training methods, plant density and pruning could have significant effects in melon production Kurtar, 1993; Uygun and Sari, 2000; Temirkaynak et al., 2003; Rodriguez .et al., 2007; Salehi et al., 2010). Melons grown under greenhouse conditions at optimum plant populations and cultural practices can result in higher fruit production than field-grown crops. The melon also occupies a prominent position, among the various, agricultural crops. In relation to the efforts, being made to growing methods, melon in greenhouses to grow, or increase production and improve the quality of fruits in the unit area, and the most prominent methods of growing which contributed in improving the production, and fruit quality is production in greenhouse. Growing on two stems which led to the continuation of production for a longer period, in a regular and balanced, manner, in addition to the increase in the total production rate (Qarouti and Hamden, 2005). Cultivars and growing methods had also significant impacts on melon growth and production (Mitchell et al., 2008; Cantliffe et al., 2009).

The aim of the present study was to identify and determine the following effects:

- To compare of different varieties of melon in terms of plant growth production quantity, and the characteristics of fruits,
- To compare the effect of growing/pruning methods on the different cultivars in terms of growth, production and quality of fruits,
- To determine the possible interaction interaction between melon cultivars and growing methods.

MATERIALS and METHODS

Location: The experiment was conducted at The Tripoli Center for Agricultural technology, which is located geographically, within the area of. The municipal Council of Andalus Quarter Longitude N "58.432 ◌ً49 ◌ٌLatitude E "27.213 ◌ٍ06 ◌ً amd Altitude is 120 feet.

The Experimental Design: The experiment was conducted in a split-plot randomized block design with four replicates. Its advantages are precision and distribution of errors on blocks, and there are no restrictions on the treatments replicates , makes the statistical analysis easier, and could evaluate the messing views two factors were used: two training methods (one or two stems) on four melon cultivars (HV1: Zagrit, HV2: Maziane, HV3: Kirkagac, and HV4: Ananas).

Cultivation Practices before Planting

Soil Analysis: Three samples of greenhouse soil and were taken as following from the beginning, middle, and the end of the one at a depth of 30 cm for the purpose of soil analysis to determine the soil structure and soil salinity was conducted in the laboratory of The Agricultural Research Center. Moreover, the sample of water used in irrigation is taken to determine the salinity, pH, and results were as follows (Table 1)

Soil tillage: Because the production of melon in greenhouses depends greatly on the increase of production of the unit area, so it is necessary to care for the preparing the soil and fertilize well. The soil in the glasshouse was well plowed by the caterpillars at a depth of 35 cm for the purpose of exposure to the sun to eliminate the weeds and mixing the added organic fertilizer (manure).

Table 1. Analysis of Soil Samples

Sample #	Textures	Sand (%)	Clay Sand (%)	Clay (%)
1	Sandy Mud	84.58	12.64	2.78
2	Sandy Mud	83.58	12.14	4.28
3	Sandy Mud	80.58	14.64	4.78
Mean		**82.91**	**13.14**	**2.94**

Soil Sterilization: **S**oil sterilization is considered one of the basic agricultural processes in greenhouses, because the repeated cultivation of the soil with a special crop and a family at close intervals leads to reproduce the pathogens found in the soils (nematodes, fungus, etc). So the method of sterilization by steam was used through perforated pipes extending over the surface of the soil and covered with thermoplastic foil with the edges of the chips firmly fixed by the soil and pumping the steam into the perforated tubes to lift the plastic and then the steam pressure drops to the minimum to obtain the best results. The lid and steam treatment should be continued for 6-8 h. The degree of penetration of soil steam depends on the care given to soil tillage to more depth.

Design of irrigation network: Drip irrigation method with pipes 3/4 inch (16 mm) in diameter were extended along the cultivated lines, and drippers from the type of Spakti with a drain of 7 L h^{-1}.

Organic Fertilizer application: The following requirements were added to soil: Organic Fertilizer per line (75 kg).Chemical fertilizer (NPK 12-24-12) by (12.5 kg ha^{-1}) per line and at 6 g per plant after the completion of sterilization, the pipes were buried and irrigate the greenhouse and lift up to 15 days which was sufficient to sterilize the soil which was an important and fundamental process in greenhouses cultivation to prevent the spread of diseases and nematodes.

Cultivation: The cultivation process was carried out on September 17th 2016, to plant the local varieties HV1 (Zagrit) and HV2 (Maziane) from the Zapatya Center for Agricultural Technology, and two cultivars of HV3 (Kırkağaç) and HV4 (Ananas) were imported from Turkey. The plants were irrigated lightly after cultivation. After that, the cultivation processes were followed which included.

Weed control: The weeds were periodically removed by hoeing.

Preventive Control (October 1st 2016): Through this preventive program, several steps have been taken Eliminate of weeds inside and outside the greenhouse so it well not become a source of infection of plants inside the greenhouse with insects and diseases Spray the calcium hydroxide (lime) at the doors and in and out the sides of the greenhouse.

Trellising by using strings

Of the main stem while continuing to direct the plant to the top. It was noted in this date after the increase in temperature in Tripoli, started the process of flowering significantly. The process of

removing the lateral branches, leaves, and flowers from the main stem till 50 cm in high. After that, the removal process was stopped, and then began directing the plant to the top around the threads of head breeding according to the study plan, as the first line in which all the varieties distributed in the system of replicating growing on one stand, and the second line are in the same way, as all cultivars are cultivated in a replicate system on two stems.

Plant protection: Preventive measures were taken in the past, but after the plants were infected with insects, these pests were kept under the level of economic damage the plant protection is performed according to rise of the infection on the melon crop Insecticidal pesticides are added alternatively to the crop until the infection is eliminated. We exchange the mixtures so as not to generate immunity against the used pesticides. The following is an illustrative table shows the quantities type of pesticide and the date of spray.

Table 2. Pesticide applied during the experiment.

Name of pest	Name of pesticide	Dose	Date of spraying
Mite-spider	Sparkle	200ml/1000L	17/10/2016
Fruit fly	Vantex	25ml/100L	1/11/2016
Australian Powdery bug	Vantex	25ml/100L	15/11/2016
Leafhopper	Confidor	50ml/100L	25/11/2016

Biological Control: The method of biological control was also used on 05-12-2016, when the bacteria (Antario) was applied against the green worm by mixing 50 mg /100 L of water and then spray the crop. This method proved its efficacy by 90% in eliminating the pest.

Fertilization: The melon plants respond to chemical fertilization and it is recommended to add 23-30 ^{3} of it inside the trench of cultivation. The fertilizers were added as batches at different intervals.

Table 3. Applied Chemical Fertilizers

Phases of plant growth	kg N/Fadden	kg P_2O_5/Fadden	kg K_2O/Fadden	Date
-After a week of transplanting	15	24	24	25/9/2016
-At flowering of plant	15		24	20/10/2016
-During fruit setting	15		15	20/11/2016

Fadden = 2500 m²

Irrigation: The method of light irrigation at short intervals was better for the melon than heavy irrigation at long intervals. In general, the need for soil moisture during flowering and fruit setting increases, Care was taken to avoid over irrigation before and during fruit ripening to avoid cracking of fruits the increase in irrigation in the final stages of the plant also affects the characteristics of the fruits such as not forming the external net of melon fruits.

Fruit Harvest: The fruits were harvested usually at the morning in several times, and the fruit that harvested were reached maturity, and maturity degree effect on the fruit in terms of taste and fitness

for shipment and storage The fruits of the melon are sweeter as their maturity increases and the fruits are mature when the fruit is separated naturally.

Studied Traits:

- *Average plant height*: Plant height was measured with a ruler with a precision of 1 mm. on November 20th 2016.

- *Average Stem Thickness*: It was measured with a caliper with a precision of 0.1 mm on December 15th 2016.

- *Shoot dry matter*: Whole fresh shoots were weighted and then they were put in an oven at 70 ° C for 24 hours and then dried shoots were weighed. Then dry matter ratio was calculated.

- *Average fruit number*: Fruits were counted on November 20th and December 20th 2016.

- *Average fruit weight*: Fruits were weighted with a weighing scale with a precision of 0.1 g.

- *Average Fruit Flesh Thickness*: It was measured with a caliper with a precision of 0.1 mm.

RESULTS and DISCUSSION

Plant height

The cultivars and training methods had a significant effect on the height of the plants (Table 4). It is noted the existence of differences in the height of plants, especially between the cv HV1 (Zagrit) which had given height the average height of 255 cm compared to the cv. HV2 (Maziane) which gave the average height of 172 cm. It is clear that training methods had a significant effect on the plant height, where the plants on the two stems scored the highest rate of 235 cm plant^{-1}, while the plants recorded on one stem scored the rate of 222 cm plant^{-1}. The cv. HV1 (Zagrit) grown on two stem were superior and gave the height value of 271 cm plant^{-1}, while the plants grown on one stem gave 239 cm plant^{-1} and the explanation for that the increase in plant density in plants grown on two stems increased the proportion of dry matter, which means that the increase in chlorophyll (photosynthesis), which stimulates the plant to absorb water and nutrients from the soil, which in turn helps increase the length of the plant more. Uygun and Sari (2000) determined that by applying top pruning, a 20% yield increase can be achieved in double lateral arm cultivation compared to single stem cultivation. On the other hand, Salehi et al. (2010) reported that Stem diameter of scions, aerial fresh and dry weights, mean fruit weight and yield, electric conductivity, pH, and sap volume per plant of grafted plants were higher in grafted melons than in the nongrafted ones; However, these traits were unaffected by training methods.

Table 4. Average plant height (cm) on November 20th 2016.

	Training methods		
Cultivars	**One stem (S1)**	**Two stem (S2)**	**Mean**
HV1 (Zagrit**)**	239	271	255 A
HV2 (Maziane**)**	164	181	172 D
HV3 (Kirkagac**)**	233	269	251 B
HV4 (Ananas**)**	252	220	236 C
Mean	222 B	235 A	228

LSD for training methods = LSD 0.09
LSD for cultivars = LSD 0.03
LSD for Interaction = LSD 0.036

Average number of fruit on November 20th 2016

It is clear from the results of Table (5) that the fruit number of cv. HV1 (Zagrit) had significantly the highest mean, which reached 5.91 fruit plant^{-1} while cv. HV4 (Ananas) produced the lowest rate of

2.66 fruit plant^{-1}. The reason is due to the genetic differences between the varieties due to their direct effect in determining the quantity of production. Dalastra et al., (2016) stated that the types of melon and varying the number of fruits per plant had significant effects on the yield and quality related traits. The interaction between the cultivars and training methods had a significant effect on the rate of number of fruits, as the plants of cv. HV1 (Zagrit) grown on two stems were superior and gave the highest rate of 6.16 fruit per plant, and the plants grown on one stem produced the rate of 5.66 fruit per plant. Moreover, there were a significant difference between training methods, where the plants raised on two stems produced 4.01 fruit per plant, while the plants that were grown on two stem gave 4.33 fruit per plant. Rodriguez et al., (2007) reported that the early and total fruit number and yield per area increased linearly with increasing plant density. When studying the melon plant, increasing the vegetative growth characteristics and the number of flowers in the plant, which leads to an increase in the number of fruits and then increase the yield value of each plant. Ban et al. (2006) also reported that plant spacing and cultivar affect melon growth and yield components.

Table 5. Fruit number based on training methods on four melon cultivars.

	Training methods		
Cultivars	**One stem (S1)**	**Two stem (S2)**	**Mean**
HV1 (Zagrit**)**	5.66	6.16	5.91 A
HV2 (Maziane**)**	3.93	3.67	3.93 C
HV3 (Kirkagac**)**	3.82	4.83	4.32 B
HV4 (Ananas**)**	2.66	2.66	2.66 D
Mean	4.01 B	4.33 A	

LSD for Training methods = LSD 0.23
LSD for cultivars = LSD 0.49
LSD for Interaction = LSD 1.0

Fruit weight

There were significant differences among cultivars in terms of fruit weight (Table 6), and cv. HV4 (Kirkagac) had the highest fruit weight (1020 g) among them. Training method had also a significant effect on the weight of the fruit, where the plants grow on two stems scored the highest weight of the fruit reaching 915g per fruit, while the plants bred on one stem gave the fruit weight of amounting to 820 g per fruit. In view of the weight of the fruits, we find that the weight of the fruits of the plants grown on two stems and with reference to the rate of the number of fruits also we find that the number of fruits produced by training on two stems was more. Thus, we have superiority of the plants grown on two stems in the number of their fruits and their weight and it has agreed with the previous study. In terms of fruit qualities, the effect of pruning treatments were found to be statistically significant on cumulative yield, average of fruit weight, fruit scale and height, cavity scale and height, fruit firmness and total soluble solid content TSS (Temirkaynak et al., 2003). While the method of training has a significant effect on the trait of length of fruit, where the plants had one stem recorded the highest rate of fruit length of 14.48 cm. The reason for the superiority of plants grown on one stem is in the rate of the fruit length on its getting on more quantities of nutrients compared with plants training on two stem (Al-Shammary, 2014). On the other hand Rodriguez et al., (2007) reported that fruit width, length, and TSS were unaffected by plant density at either the early or to harvests. The reason is referred to the increase in plant density, which led to increase in the total vegetative and thus increase of the flowers and fruits in terms of the proportion of the number of fruits. The results of the study showed that the production class was affected directly and directly by both the number of fruits on the plant and the rate of weight of the fruit, respectively (Khalil Marie, 2016).

Table 6. Fruit weights (g) based on training methods on four melon cultivars.

	Training methods		
Cultivars	**One stem (S1)**	**Two stem (S2)**	**Mean**
HV1 (Zagrit**)**	800	890	845 B
HV2 (Maziane**)**	780	900	840 B
HV3 (Kirkagac**)**	960	1090	1020 A
HV4 (Ananas**)**	750	780	760 B
Mean	823 B	915 A	

LSD for Training methods = LSD 0.04
LSD for cultivars = LSD 0.08
LSD for Interaction = LSD 0.19

Fruit flesh thickness (cm)

There were significant differences on fruit flesh thickness due to the genetic differences among the melon cultivars (Table 7). The thickest fruit flesh (2.88 cm) was obtained from that (2.60 cm) of cv. HV2 (Maizine) followed by cv. HV3 (Kirkagac). Training methods had no significant effects on fruit flesh thickness.

Table 7. Fruit flesh tickness (cm) based on training methods on four melon cultivars.

	Training methods		
Cultivars	**One stem (S1)**	**Two stem (S2)**	**Mean**
HV1 (Zagrit**)**	2.21	2.44	2.32 C
HV2 (Maziane**)**	2.80	2.95	2.87 A
HV3 (Kirkagac**)**	2.70	2.50	2.60 B
HV4 (Ananas**)**	2.46	2.21	2.33 C
Mean	2.54	2.52	

LSD for Training methods = LSD 0.04
LSD for cultivars = LSD 0.02
LSD for Interaction = LSD 0.06

Shoot dry matter content (%)

The results showed that the plants grown on two stems had the highest percentage of shoot dry matter (14.83%), while the percentage of dry matter of the plants grown on one stem was 13.30% (Table 8) Through this disparity and differences between the ratios of dry matter and the method of training of influence, we conclude that the plant density has effective on the shoot dry matter content, and direct role in increasing the percentage of dry matter where the more vegetative total density increases in terms of increase of leaves and branches, this leads to an increase of photosynthesis i.e. increase chlorophyll which in turn reflects the plant's ability to absorb nutrients and water from the soil. This has been mentioned in a previous study. If a crop is grown at a range of plant densities, and all the plants are harvested at one time, it is generally supposed that the total dry matter yield per unit area will increase with increasing density (El-Sayed et al., 2011).

Table 8. Shoot dry matter content (%) based on training methods on four melon cultivars.

	Training methods		
Cultivars	**One stem (S1)**	**Two stem (S2)**	**Mean**
HV1 (Zagrit**)**	13.14	15.36	14.25
HV2 (Maziane**)**	13.00	13.39	13.20
HV3 (Kirkagac**)**	13.38	14.48	13.93
HV4 (Ananas**)**	13.70	16.09	14.27
Mean	13.30	14.83	

In conclusion, it is seen there were significant differences among most of the studied traits based on the training methods and melon cultivars. Training method with two stems stands out to be choosen.

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