THE EFFECT OF SOIL MULCHING AND FOLIAR SPRAY OF POTASSIUM CHLORIDE ON FLOWERING, FRUITING, FRUIT CHARACTERISTICS AND YIELD OF OLIVE TREES CV. MANZANILLO AT NORTH SINAI PENINSULA.

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ABSTRACT

Flowering, initial fruit set, fruit retention, fruit characteristics and yield of olive trees cv. Manzanillo under the conditions of El-Maghara region, North Sinai Peninsula as affected by soil mulching around the trunk (using Polyvinyl acetate 1:1 v/v) and foliar spay of potassium chloride (0, 1 and 2 %) were studied in the two seasons of 2003 and 2004. The results obtained revealed that, soil mulching treatment significantly increased the mean flower number per inflorescence, inflorescence number per meter length, initial fruit set, fruit retention but did not affect the perfect flower percentage. Meanwhile, fruit weight, volume and flesh weight increased significantly by soil mulching, especially during the second season, while fruit shape index, flesh/fruit % and flesh thickness did not differ significantly compared to control. Foliar spray of 2 % KCl increased the mean flower number and inflorescence number per meter. However, foliar spray of 2 % KCl followed by 1 % KCl increased significantly initial fruit set, fruit retention compared with control trees. 2 % KCl spray enhanced significantly fruit and flesh weight compared with both of 1% KCl and control during the second season. Moreover, 1 % and 2 % KCl increased significantly flesh thickness compared with control. Concerning the interaction between soil mulching and foliar spray treatments, mean flower no., Initial fruit set and fruit retention were increased significantly by soil mulching and 2 % KCl. However, fruit volume and weight, flesh weight and flesh thickness increased significantly by soil mulching and 2 % KCl during the second season.

Soil mulching and KCl foliar spray enhanced tree yield significantly. However, Generally the yield in the second season was greatly increased than that obtained during the first season.

Keywords: Olive (*Olea europaea L*.). cv. Manzanillo, Soil mulching, potassium chloride, Foliar spray, Flowering, Fruiting, yield.

INTRODUCTION

The olive tree is native to the Mediterranean region, tropical and central Asia and various parts of Africa. The olive has a history almost as long as that of western civilization. At a site in Spain, Carbon- dating has shown olive seed found there to be eight thousand years old. Olea europaea may have been cultivated independently in two places, Crete and Syria.

Olive tree yields two main products, olive oil and various types of pickled olives. Manzanillo is a double purpose cultivar and it characterized by large, rounded- oval fruit, skin brilliant purple, changing to deep blue-back when mature, excellent for oil and pickles.

Few studies were conducted on the effect of foliar spray of KCl and soil mulching on flowering fruiting and fruit characteristics of olives. Laz

(1993) reported that the olive tree in the “on” year had significantly higher perfect flower percentage than that of the tree in “off” year, also the number of panicle per meter was significantly higher in “on” year than those obtained in “off” year. Hegazy (2001) reported that in Manzanillo olive trees, the perfect flower percentage varied from year to year. Sari El-Deen and Fadl (1977) in a study on some olive cultivars, they concluded that the increase in yield was a result of some increase in number of inflorescence and in number of perfect flowers, which consequently lead to an increase in fruit set and yield. Abbas and El-Khoreiby (1988) reported that fruit retention after about 20 days from the end of blooming was sharply reduced, then approximately steady up to harvest. They added that the critical period that affecting the yield of olive trees located within 20 days after petal fall.

Shaheen (1995) revealed that the initial fruit set as well as the final fruit set were improved by treatments of foliar spray, especially by Boron and Zinc treatments. He added that the density of flowers increased significantly, especially with application of B and Zn treatments, and the heaviest fruit yield of picual olive trees was obtained by spraying trees with B, Zn or Mg with the superiority of Zn treatments

QinXuanNan *et al.*, (1993) stated that foliar application of 2 % KCl on Eureka lemon resulted in improving the quality and yield of local lemon production. While, Brahmachari, *et al.*, (1997) reported that foliar feeding of calcium (calcium chloride, 1 and 1.5 %) and potassium (potassium nitrate, 1 and 1.5 % and potassium chloride a and 1.5 %) resulted in improving yield of guava (*Psidium guajava L*.).

Concerning soil mulching practices, Sharma and Acharya (2000) found that mulching during standing crop of maize was most effective in conserving rainwater, mulching at maize harvest is either good as good or inferior to mulching in the standing crop of maize, depending on the rainfall events. Mulching significantly increased maize yield during third cropping cycle onwards. Kirchhof *et al.*,(2000) indicated that mulch as a soil amendment tended to increase yields in drier areas due to its water conservation effect. In wet areas mulching was not necessary and could lead to yield reduction if conditions were too wet.

Generally, Alleviating the adverse environmental conditions is of a vital important for vigorous and long-term production of the agricultural crops.

From this point of view, the current study was conducting during the two seasons of 2003 and 2004 at El-Maghara region, which located at very dry conditions, hence, plants suffer from drastically processes of sand encroachment, limited water resources and other adverse climatological conditions.

The main objective of this study was to investigate the role of soil mulching and foliar spray of KCl on flowering, fruiting, fruit characteristics and yield of olive trees under the stress conditions of El-Maghara region.

MATERIALS AND METHODS

This investigation was carried out in El-Maghara Research Station, which located at 80-km southwest El-Arish City, during the two seasons of 2003 and 2004. The objective of this investigation is to study the effect of soil mulching using polyvinyl acetate (1:1 v/v) and foliar spray of KCl (0, 1 and 2 %) on flowering, fruiting, fruit characteristics and yield of 12-years old olive trees. Foliar spray of Potassium chloride (0, 1 and 2 %) was applied simultaneously with treatment of soil mulching during three periods of olive tree development. The first application was before full bloom (March), the second application after fruit set (June) and the last application was conducted 2-months before harvesting (September) during the two seasons of the study. The experiment designed in a randomized complete blocks. Three replicates were selected for each treatment, three trees for replicate.

Fifteen shoots one year old (*Olea europaea L*. cv Manzanillo) each tree were chosen at random and labeled. Thirty inflorescences were randomly chosen on each tree for estimating the perfect flower percentage. Twenty shoots of one year old on each tree were labeled for counting mean flower number at full bloom. Initial fruit set determined after 7 days of petal fall and fruit retention was recorded after 20 days of the end of blooming (Abbas and El-Khoreiby, 1988).

Fruit characteristics; weight, volume, shape index, flesh weight, flesh/fruit percentage and flesh thickness was recorded after harvesting on mid of October during the two seasons of study. Data were statistically analyzed according to Sendecor and Chochran (1972). Mean differences were conducted using Multiple Range Duncan's $LSD_{0.05}$ by MSTATC Program.

RESULTS AND DISCUSSION

1. Effect of soil mulching

1.1. Average no. of flowers/ Inflorescence

The obtained data (table 1) showed that, the average no. of flowers/ Inflorescence was increased significantly by soil mulching treatment as compared with control, in both seasons. The recorded values were 12.22 and 11.24; 11.45 and 10.85 respectively.

1.2. Average no. of inflorescence/ meter

Soil mulching treatment increased the inflorescence number/ meter as compared with the control. The records achieved during first and second seasons were 42.07 and 41.75; 51.79 and 51.01 respectively, table (1).

1.3. Perfect flower percentage

Table (1) show that, the perfect flower percentage was not affect by soil mulching.

In general, it can be observed that, during the second season the inflorescence number/ meter and the perfect flower percentage increased than in the first season. This may be attributed to the increase of carbohydrates reserved from the previous "off "year.

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This result is in agreement with findings obtained by Laz (1993), Shaheen (1995) and Hegazi (2001), where they found that such parameters are changeable from season to season.

1.4. Fruit set

The results obtained, show that the initial fruit set increased significantly by soil mulching it recorded 11.18 and 10.26; 16.14 and 14.83% in trees treated by soil mulching and the control during the first and second season, respectively. (Table 1).

Fruit retention, also increased significantly by soil mulching treatment recording 1.391 and 1.282; 2.00 and 1.86 % in trees treated by soil mulching and in the control during the first and second season, respectively.

However, results of the second season indicated that the initial fruit set after 7 days from petal fall increased than in the first season, the same trend obtained in fruit retention. Moreover, during the two seasons of the study, the percentage of fruit retention after 20 days after the end of blooming was greatly decreased than result obtained after 7 days from petal fall. The results obtained are in agreement with that obtained by Abbas and El_khoreiby (1988).

1.5. Fruit characteristics

From data presented in table (2), it can be observed that, fruit weight, volume and flesh weight during the first season was not affected by soil mulching treatment compared with control. However, in the second season the same parameters increased significantly as affected by soil mulching compared with the control, Moreover, fruit shape index, flesh/fruit % and flesh thickness were not affected by soil mulching treatment compared with the control in the two seasons of study. This may be due environmental factor especially rainfall, Sharma and Acharya (2000).

1.6. Yield

Figures (1 and 2), show that the yield of olive trees was enhanced significantly by soil mulching treatment compared with control. The values obtained were 4.93 and 4.25; 11.99 and 11.57 kg/tree in trees which applied by soil mulching and the control in the first and second seasons, respectively. The results obtained is in agreement with that obtained by Kirchhof *et al* (2000)

2. Effect of Foliar spray of potassium chloride:

2.1. Average no. of flowers/ Inflorescence

From table (3), it can be concluded that, mean flower number increased by foliar spray of KCl 1% and 2 % as compared with control. In the second season, mean flower number increased significantly by application of KCl 2 % compared with using 1 % and control it recorded 11.78, 11.32 and 10.35, respectively.

2.2. Average no. of inflorescence/ meter

From the results obtained in table (3), during the first season, the average no. of inflorescence/ meter was not affected by foliar spray of KCl. However, in the second season the application of 1 % and 2 % KCl significantly affect the inflorescence no. per meter compared to control. The recorded values were 52.05, 51.75 and 50.42 respectively.

2.3. Perfect flower percentage

Data of table (3) show that the effect of foliar spray of KCl was not significant on the perfect flower percentage during the two seasons of study. However, it increased in the second season than in the first season.

2.4. Fruit set

Fruit set increased significantly by using 2 % KCl followed by 1 % KCl compared with the control. The recorded values were 11.90, 10.84 and 9.42; 17.48, 15.61 and 13.38 % respectively during the first and second season. Moreover, fruit retention reduced greatly to 1.51, 1.33 and 1.16; 2.16, 1.95 and 1.67 % in trees sprayed by 2%, 1 % KCl and the control during the first and second season respectively, table (3). These results are agreement with Abbas and El-khoreiby (1988), Hegazy (2001), Laz (1993) and Shaheen (1995).

2.5. Fruit characteristics:

From table (4), fruit shape index and flesh/fruit percent were not affected by foliar spray of KCl during the two seasons of study. However, fruit weight, volume, flesh weight and flesh thickness were not affected by foliar spray of KCl during the first season, while in the second season, fruit weight increased significantly by using 2% KCl followed by 1 % KCl compared with control it recorded, 7.74, 7.25 and 7.14 gm, respectively. Fruit volume and flesh weight increased significantly by using 2 % KCl compared to both of 1 % KCl and the control. Moreover, flesh thickness increased significantly by foliar spray of 1 % and 2 % KCl compared with control. The results obtained are in agreement with those obtained by QinXuannan *et al* (1993)

2.6.Yield

As shown in figures (1 and 2) the application of 2 % KCl was of superior affect on the yield/ tree followed by that applied with 1 % KCl compared with control trees. The recorded values were 5.09, 4.57 and 4.08; 12.05, 11.57 and 11.51 kg/tree respectively during the first and the second season. However, tree yield in the second season increased greatly than in the first season this may be due to the effect of previous low crop of the off year. The results obtained are in agreement with those obtained by Sari El-Deen and Fadl (1977), Shaheen (1995), Laz (1993) and Brahmachari *et al.*, (1997).

3. Effect of Soil mulching and Foliar spray of KCl

3.1. Average no. of flowers/ Inflorescence

From table (5) it can observed that, average flower no. per inflorescence increased significantly in trees treated by both of soil mulching treatment and foliar spray of 2 % KCl as it recorded 12.60 and 12.13 in the first and second season respectively.

3.2. Average no. of inflorescence/ meter

Average no. of inflorescence/ meter, during the first season was not differ significantly by foliar spraying of KCl levels and by soil mulching.

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However, in the second season, treatments of soil mulching with 1 % KCl, soil mulching with 2 % KCl and without soil mulching with 1 % KCl recorded the highest values, recording 52.34, 52.24 and 51.76 inflorescence, respectively, table (5).

3.3. Perfect flower percentage

It did not affected by soil mulching with foliar spray of KCl levels, table (5).

3.4. Fruit set

The data achieved show that the soil mulching treatment with application of 2 % KCl significantly enhanced fruit set and fruit retention compared the other treatments, table (5). The recorded values were12.52 and 18.41% for fruit set percentage, and 1.60 and 2.27 % for fruit retention in the first and second season respectively.

3.5. Fruit characteristics

Fruit shape index did not affect by soil mulching and KCl levels during the two seasons. Although, during the first season fruit weight, volume, flesh weight, flesh/fruit % and flesh thickness did not differ significantly between treatments, however, during the second season, fruit weight, volume and flesh weight increased significantly by using foliar spray of 2 % KCl with soil mulching compared with the other treatments, they recorded 8.03 gm, 8.01 cm 3 and 6.93 gm, respectively.

While flesh thickness increased significantly, by using 1 % and 2 % KCl with soil mulching treatment compared with other treatments, table (6). The different response of the studied parameters to treatments during the two seasons may be attributed to the different climatic conditions. Where during the first season climatic conditions were low adverse than that obtained during the second season, hence the applied treatments can be more efficiency under the very adverse conditions. These results are in agreement with those obtained by Brahmachari *et al.* (1997), QinXuanNan *et al* (1993) and Sharma and Acharya (2000).

3.6. Yield

Figures (1 and 2) showed that 2 % KCl application with soil mulching increased tree yield significantly in first season compared with the other treatments.

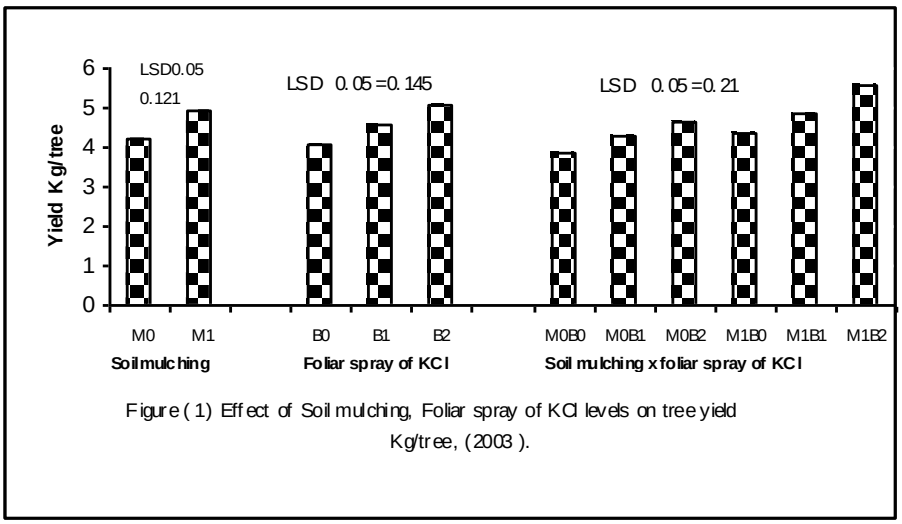

Figure (1) Effect of Soil mulching, Foliar spray of KCl levels on tree yield Kg/tree, (2003).

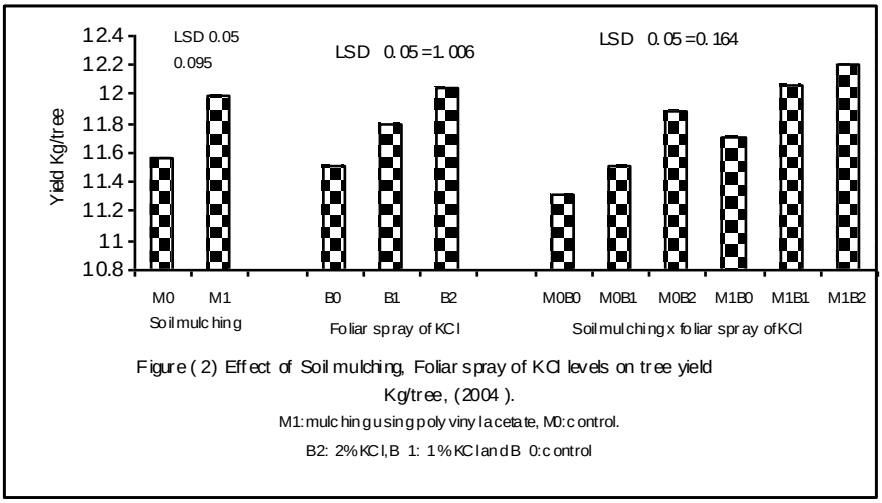

Figure (2) Effect of Soil mulching, Foliar spray of KCl levels on tree yield Kg/tree, (2004).

M1: mulching using polyvinyl acetate, M0: control.

B2: 2% KCl, B 1: 1% KCl and B 0: control

In second season, treatments of 1 % KCl with soil mulching and 2 % KCl with soil mulching enhanced significantly tree yield compared with the other treatments.

Moreover, tree yield increased greatly in the second season than in the first season. This may be due to the increase in inflorescence number and increase of perfect flower percentage, which consequently lead

Conclusion

From the results obtained it could be concluded that the soil mulching treatment increased average no. of flowers, while it did not affect perfect flower percentage. Moreover, fruit characteristics except, fruit shape index, flesh/fruit % and flesh thickness were improved during the second season by soil mulching compared with the control. In addition, yield was significantly increased by soil mulching treatments. The different trend of fruit characteristics as affected by treatments during the two seasons may be due to the different climatic conditions during the two seasons, especially rainfall which was greater in the first season than that obtained in the second one. In addition to the beneficial effect of soil mulching on fruit set and fruit retention and to the water conservation effect of soil mulching especially under the dry condition of the region of study**.** Also foliar spray of KCl 2 % have had a beneficial effects on flowering except perfect flower percentage. KCl 2%

followed by KCl 1 % enhanced initial fruit set and fruit retention compared with control. Application of KCl treatments increased significantly fruit weight, volume and flesh thickness. Tree yield increased significantly by foliar spray of KCl. Applying Soil mulching treatment with 2 % KCl increased significantly floral characteristics, initial fruit set, fruit retention fruit weight, volume, flesh weight and flesh thickness especially in the second season. Tree yield was enhanced significantly by soil mulching and 2 % KCl. In general view, floral density, perfect flowers, fruit set, fruit retention and yield were greatly increased during the second season than in the first season. This may be due to the previous crop load. From the concluded results it could be recommended that soil mulching and foliar spray of 2 % KCl were important especially under the adverse conditions in the dry areas.

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دراسات على تأثير تغطية التربة والرش الورقى بكلوريد البوتاسيوم علىتزهير واثمار وخواص الثمار وانتاج أشجار الزيتون صنف مانزانيللو تحت ظروف منطقة المغارة شمال سيناء.

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مركز بحوث الصحراء – شعبة البيئة وزراعات المناطق الجافة- القاهرة-مصر

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أجريت هذه الدراسة على أشجار الزيتون صنف مانزانيللو بمحطة بحوث المغارة لدراسة تأثير تغطية التربة بمادة البولي فينيل استيت المخففة بالماء ١:١ حجما وكذلك أثر الرش بكلوريد البوتاسيوم ١ و ٢ % على الإزهار و الإثمار ومواصفات الثمار والإنتاج في عامي ٢٠٠٣ و ٢٠٠٤ . ويمكن تلخيص أهم النتائج فيما يلي:

١- زاد كلا من عد الأزهار/نورة وعدد النورات /متر طولي زيادة معنوية عند استخدام معاملة تغطية التربة مقارنة بالأشجار غير المعامله.

٢- لم تتأثر نسبة الأزهار الكاملة بمعاملة تغطية التربة أو بالرش بكلوريد البوتاسيوم.

٣- أدت معاملة تغطية التربة إلى زيادة العقد الابتدائي وكذلك نسبة الثمار المتبقية بالمقارنة بالأشجار غير المعامله.كما أدى الرش بكلوريد البوتاسيوم بتركيز ٢ % إلى الحصول على أعلى القيم للعقد المبدئي والثمار المتبقية على مدار الموسمين.

٤- بالنسبة لمواصفات الثمار فان وزن الثمار وحجمها ووزن اللحم تأثرت في الموسم الثاني حيث زادت معنويا بتغطية التربة كما أدى الرش بكلوريد البوتاسيوم في هذا الموسم بتركيزي ١، ٢ % إلى زيادة معنوية في وزن الثار وحجمها وزيادة سمك اللحم مقارنة بالأشجار الغير معاملة .

٥- أدت معاملات تغطية التربة والرش بكلوريد البوتاسيوم إلى زيادة معنوية في إنتاج الأشجار بالمقارنة بإنتاج الأشجار الغير معامله.

٦- أدى الرش بكلوريد البوتاسيوم بمعدل ٢ % مع معاملة تغطية التربة إلى زيادة معنوية في إنتاج الأشجار بالمقارنة بباقي المعاملات.

٧- بصفة عامة لوحظ زيادة كبيرة في متوسط عدد النورات و نسبة الأزهار الكاملة ونسبة العقد الابتدائي ونسبة الثمار المتبقية وكذلك الإنتاج في الموسم الثاني من الدراسة عنه في الموسم الأول.

٨- من النتائج المتحصل عليها يتضح ضرورة تطبيق تغطية التربة والرش بكلوريد البوتاسيوم خاصة تحت ظروف المناطق الجافة.

Table (1): Effect of Soil mulching on flowering and fruit set of olive trees during the seasons of 2003 and 2004.

Treatments	2003					2004				
	Flowering			Fruit set %		Flowering			Fruit set %	
	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %
M1	12.22 a	42.07 a	45.66	11.18 a	1.391 a	11.45 a	51.79 a	55.71	16.14 a	2.00 a
M0	11.24 b	41.75 b	45.40	10.26 b	1.282 b	10.85 b	51.01 b	55.41	14.83 b	1.86 b
LSD $_{0.05}$	0.31	0.76	N.S	0.26	0.034	0.25	0.58	N.S	0.267	0.049

M0: without mulching. And M1: soil mulching using polyvinyl acetate (1:1 v/v).
*** After 7 days from petal fall and** After 20 days after the end of blooming.**
N.S: Not significant differences

Table (2): Effect of Soil mulching on fruit characteristics of olive trees during the seasons of 2003 and 2004.

Treatments	Fruit characteristics (2003)						Fruit characteristics (2004)					
	Fruit weight (gm)	Fruit volume (cm^3)	Fruit Shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)	Fruit weight (gm)	Fruit volume (cm^3)	Fruit shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)
M1	8.38	8.38	1.261	7.19	85.92	0.63	7.52 a	7.51 a	1.244	6.48 a	86.02	0.63
M0	8.18	8.11	1.248	7.03	86.02	0.63	7.23 b	7.19 b	1.242	6.24 b	86.13	0.63
LSD $_{0.05}$	N.S	N.S	N.S	N.S	N.S	N.S	0.10	0.098	N.S	0.09	N.S	N.S

Table (3): Effect of foliar spray of KCl on flowering and fruit set of olive trees during two seasons of 2003 and 2004.

Treatments	2003					2004				
	Flowering			Fruit set %		Flowering			Fruit set %	
	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %
KCl 1 %	11.75 ab	41.90	45.53 a	10.84 b	1.33 b	11.32 b	52.05 a	55.55	15.61 b	1.95 b
KCl 2%	12.16 a	42.22	45.51 a	11.90 a	1.51 a	11.78 a	51.75 a	55.59	17.48 a	2.16 a
Control	11.28 b	41.60	45.56 a	9.42 c	1.16 c	10.35 c	50.42 b	55.53	13.38 c	1.67 c
LSD 0.05	0.61	N.S	1.106	0.536	0.034	0.31	0.74	N.S	0.348	0.104

Table (4): Effect of foliar spray of KCl on fruit characteristics of olive trees during the seasons of 2003 and 2004.

Treatments	Fruit characteristics (2003)						Fruit characteristics (2004)					
	Fruit weight (gm)	Fruit volume (cm^3)	Fruit Shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)	Fruit weight (gm)	Fruit Volume (cm^3)	Fruit shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)
KCl 1 %	8.12	8.09	1.25	6.59	85.74	0.63	7.25 b	7.23 b	1.25	6.24 b	85.94	0.64 a
KCl 2%	8.33	8.30	1.25	7.15	86.11	0.63	7.74 a	7.69 a	1.24	6.68 a	86.26	0.64 a
Control	8.39	8.34	1.25	7.25	86.05	0.63	7.14 c	7.12 b	1.24	6.16 b	86.01	0.62 b
LSD 0.05	N.S	N.S	N.S	N.S	N.S	N.S	0.1	0.113	N.S	0.097	N.S	0.02

Table (5): Effect of Soil mulching and foliar spray of KCl on flowering and fruit set of olive trees.

Treatments	2003					2004				
	Flowering			Fruit set %		Flowering			Fruit set %	
	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %	Mean flower no./ inflorescence	Inflorescence no./ meter	Perfect flower %	Initial * fruit set %	Fruit** retention %
M0 × B0	10.74 d	41.76	45.06	9.05 e	1.14 d	10.11 d	50.03 d	55.00	13.05 e	1.64 d
M0 × B1	11.25 cd	41.68	45.55	10.45 c	1.29 c	11.00 c	51.76 a-c	55.59	14.92 c	1.88 c
M0 × B2	11.73 b	41.79	45.60	11.28 b	1.42 b	11.44 b	51.25 bc	55.62	16.54 b	2.06 b
M1× B0	11.81 b	41.44	45.95	9.79 d	1.18 d	10.59 c	50.82 cd	56.06	13.71 d	1.71 d
M1 × B0	12.25 ab	42.12	45.50	11.23 b	1.39 b	11.64 b	52.34 a	55.50	16.30 b	2.03 b
M1 × B0	12.60 a	42.65	45.53	12.52 a	1.60 a	12.13 a	52.24 ab	55.56	18.41 a	2.27 a
LSD $_{0.05}$	0.53	N.S	N.S	0.45	0.059	0.43	1.00	N.S	0.46	0.084

M0: without mulching. And M1: soil mulching using polyvinyl acetate (1:1 v/v).
B0: Without foliar spray of KCl, B1: foliar spray of 1 % KCl and B2: 2 % KCl.
Values of the same letters are not different significantly.
N.S: Not significant

Table (6): Effect of Soil mulching and foliar spray of KCl on fruit characteristics of olive trees.

Treatments	Fruit characteristics (2003)						Fruit characteristics (2004)					
	Fruit weight (gm)	Fruit volume (cm^3)	Fruit Shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)	Fruit weight (gm)	Fruit volume (cm^3)	Fruit shape index	Flesh weight (gm)	Flesh/ fruit %	Flesh thickness (cm)
M0 × B0	8.39	8.35	1.26	7.29	86.64	0.64	7.25 c	7.19 c	1.23	6.29 c	86.54 a	0.63 bc
M0 × B1	7.69	7.63	1.24	6.56	85.61	0.61	6.99 d	6.99 d	1.25	5.99 d	85.74 b	0.63 bc
M0 × B2	8.44	8.36	1.24	7.25	85.81	0.63	7.46 b	7.38 b	1.24	6.44 bc	86.32 a	0.63 bc
M1× B0	8.38	8.33	1.26	7.20	85.46	0.63	7.03 d	7.06 cd	1.24	6.02 d	85.49 b	0.61 d
M1 × B0	8.55	8.55	1.26	7.34	85.88	0.64	7.52 b	7.48 b	1.25	6.49 b	86.36 a	0.64 a
M1 × B0	8.21	8.25	1.27	7.05	86.41	0.62	8.03 a	8.01 a	1.24	6.93 a	86.20 a	0.64 a
LSD $_{0.05}$	N.S	N.S	N.S	N.S	N.S	N.S	0.16	0.17	N.S	0.16	0.49	0.02

M0: without mulching. And M1: soil mulching using polyvinyl acetate (1:1 v/v).
B0: Without foliar spray of KCl, B1: foliar spray of 1 % KCl and B2: 2 % KCl.
Values of the same letters are not different significantly.
N.S: Not significant