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EFFECT OF GIRDLING AND FOLIAR APPLICATION OF SOME NUTRIENTS ON GROWTH, FLOWERING, YIELD AND FRUIT QUALITY OF MANZANILLO OLIVE TREES GROWN IN SANDY SOIL

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ABSTRACT

The effect of girdling and/or a mixture of micronutrients (containing 0.05% chelated Zn, Fe and Mn and 0.05% boric acid) and a mixture of macronutrients (containing 0.5% from each of urea, orthophosphoric acid, potassium sulphate and magnesium sulphate) on growth, flowering, yield and fruit quality of Manzanillo olive trees grown in sandy soil were investigated during 2001 and 2002 seasons. Bearing branches were girdled at one week before full bloom Nutrients were sprayed four times in the first week of April, May, June and July in both seasons.

Girdling and/or spraying nutrients were effective in stimulating shoot length, number of leaves/shoo, leaf area, yield, mean fruit weight, pulp weight % and oil % in the pulp as compared with the check treatment. The studied treatments had an announced reduction on seed weight %. The enhancing effects of the treatments on the number of inflorescences /shoot and number of flowers/inflorescence were proved statistically, only in the second experimental season. The promotion on these characters was associated with carrying out girdling, using micronutrients and macronutrients, in ascending order : A synergistic influence on growth and fruiting was observed when application of nutrients was accompanied with girdling compared to establishing each alone.

The striking treatment responsible for improving yield in quantity and quality of Manzanillo olive trees included girdling the bearing shoots and the use of special nutrient mixture containing 0.5% from urea, orthophosphoric acid, potassium sulphate and magnesium sulphate as well as 0.05% chelated Zn, Fe and Mn and 0.05% boric acid.

INTRODUCTION

Olive is considered one of the important fruit crops in Egypt. The total acreage grown with olive reached about 108322 feddans in 2000 of which 73301 feddans in fruitful production, with total production of about 281745 ton fruits. Around 30% of this area is grown in newly reclaimed lands. The Spanish cv. Manzanillo is the most important commercial variety in the world (Hartmann and Papaioannou, 1971). Manzanillo is early ripening cultivar, good for table olives and for oil production and a heavy bearer (Bailey, 1961). Under sandy soil conditions, olive plants suffer from the lack of macro and micro nutrients. Growth of the trees is weak and this reflects on reducing tree production. Trials aim to stimulate growth of olive trees such as foliar application of nutrients are appreciated. All nutrients play an important role in activating growth and fruiting through encouraging cell division and stimulating the biosynthesis of organic foods (Nijjar. 1985 and Belvins and Lukaszewski, 1998).

Girdling is considered an important practice responsible for improving fruit setting, yield as well as physical and chemical properties of fruits in various olive cvs. through accumulation of organic foods and natural hormones above rings (Proietti and Tombesi, 1990; Lopez-Rivares and Suarez-Garcia, 1990; Eris and Barput, 1992; Barut and Eris, 1994 and Petridou and Voyiatzis, 1994).

Olive trees grown under sandy soil responded very well to the application of macronutrients (Ferreira *et al.*, 1980; Klein and Weinbaum, 1985; Al-Saket, 1987; Cimato *et al.*, 1990 Arquera *et al.*, 2000; Connell *et al.*, 2000; Ragab, 2002 and Ahmed and Ragab, 2002) and micro nutrients (Hartmann *et al.*, 1980; Delgado *et al.*, 1994; Frega *et al.*, 1995; Tan, 1997; Osman and Abo-Taleb-Safia, 1999 and Perica *et al.*, 2001).

This study was conducted to elucidate the effect of girdling and some nutrients on growth, flowering, yield and fruit quality of Manzanillo olive trees.

MATERIALS AND METHODS

The present study was carried out during 2001 and 2002 seasons (ON years) on 6 years old " Manzanillo " olive trees grown in an orchard located at Abou Teshet, Quena Governorate. Surface irrigation system was followed. The trees are planted at 6 × 6m apart and received the same horticultural management except foliar fertilization with N, P, K, Mg, Zn, Fe, Mn and B and girdling. Twenty-one healthy, uniform and regular bearing olive trees were used in this study. The experimental soil has a sandy texture. A composite sample was taken from the soil of the experimental farm and analyzed by the methods of Jackson (1967), one week prior to commencing the experiment. Physio. chemical properties of the soil are shown in Table (1).

Table (1) : Some physio-chemical characteristics of the experimental soil of olive orchard.

Particle size distribution (%) :	
Sand %	: 85.4
Silt %	: 8.6
Clay %	: 6.0
Texture grade	: sandy
O. M %	: 1.11
Total Ca CO_3 %	: 5.12
pH (1 : 2.5 extract)	: 8.0
E.C (1:2.5 extract) (mm hos/ 1cm)	: 1.42
Available nutrients (mg/kg. soil) :	
N	: 95.5
P	: 10.3
K	: 163.0

The experiment involved the following seven treatments :

1- Control treatment (ungirdled and untreated trees).
2- Girdling.
3- Spraying a mixture of micronutrients containing 0.05% chelated Zn, Fe and Mn and 0.05% boric acid (17 % B).
4- Spraying a mixture of macronutrient containing 0.5% urea orthophosphoric acid, potassium sulphate and magnesium sulphate.
5- Spraying a mixture of micronutrients + girdling.
6- Spraying a mixture of macronutrients + girdling.
7- Spraying All nutrients + girdling.

The experiment was arranged in a completely randomized block design with three replicates for each treatment and each replicate was represented by one tree. All nutrients were sprayed four times at the first week of March, April, May and June. All bearing branches of the trees were girdled at the base by removing l0mm width rings of bark at one week before full bloom.

In mid-October of each season, shoot length (cm.) per each tree was measured and number of leaves/shoot was also counted. Twenty leaves from the middle position of the shoot were randomly taken for measuring leaf area (cm^2) according to Ahmed and Morsy (1999) equation. Number of inflorescences per shoot and number of flowers per inflorescence were counted at full bloom (first week of April).

At the optimum harvesting time (last week of October) of each season (according to Sibbett *et al.*, 1986), yield of each tree was recorded as kg/tree. A random sample of 250 fruits was collected from each tree to determine average fruit weight (g) as well pulp and seed weight percentages Fruit oil percentage was determined by extracting the oil from the pulp as described in A.O.A.C. (1980).

The obtained results were subjected to analysis of variance according to Steel and Torrie (1980) using new L.S.D for comparing differences between various treatment means.

RESULTS AND DISCUSSION

1- Effect of girdling and some nutrients on growth characters :

It is evident from the obtained data in Table (2) that single or combined application of girdling and nutrients significantly improved the three growth characters namely shoot length, number of leaves/shoot and leaf area compared to control treatment. The stimulation on such growth aspects was associated with using micro or macro nutrients aside from girdling practice. Carrying out girding, micronutrients and macronutrients, in ascending order was very effective in stimulating such growth characters. The maximum values were recorded on the girdled trees and received four sprays of a mixture containing macro and micro nutrients. The untreated trees produced the minimum values. These results were true in both seasons.

These results are nearly in the same line with those obtained by Proietti and Tombesi (1990) and Lopez - Rivares and Suarez- Garcia (1990)

who worked on girdling, Delgado *et al.* (1994) who worked on micronutrients and Ferreira *et al.* (1980) and Klein and Weinbaum (1985) who worked on macronutrients.

2- Effect of girdling and some nutrients on the number of inflorescences/shoot and number of flowers per inflorescence.

Data in Tables (2&3) clearly show that number of inflorescences/shoot and number of flowers per inflorescence did not alter with girdling and some nutrient treatments in the first season of study. In the second season, such two flowering aspects were positively affected by establishing girdling and spraying of macro and micro nutrients either singly or in combination compared to the check treatment. The superiority of the studied treatments could be arranged as followed in an ascending order, girdling, using microelements and employing macro nutrients. Carrying out girdling accompanied with using all nutrients was superior than establishing each alone in this connection. Girdling aside from spraying macro and micronutrients succeeded in maximizing number of inflorescenes/shoot and number of flowers per inflorescence. The lowest figures were recorded on plants which ungirdled and did not receive these nutrients. Similar results were registered in 2001 and 2002 seasons.

These results are in harmony with those obtained by Eris and Barput (1992) who worked on girdling, Tan (1997) and Osman and Abo. Taleb- Safia (1999) who worked on micronutrients and Connell *et al.* (2000) and Ragab (2002) who worked on macronutrients.

3- Effect of girdling and some nutrients on the yield :

It is clear from the data in Table (3) that single or combined application of girdling and some nutrients significantly increased the yield compared to the check treatment. The preferability of the studied treatments on improving the yield in a descending order was arranged as follows, using macronutrients, micronutrients and girdling. Combined application of girdling and using some nutrients was superior the application of each alone in this respect. The best results with regard to yield were obtained due to carrying out girdling plus foliar application of micro and macro nutrients. Under such promising treatment, yield reached 38.6 and 39.9 kg in both seasons, respectively, while yield reached 23.0 and 24.0 kg in untreated trees in 2001 and 2002 seasons, respectively. Similar results were obtained in both seasons.

These results are in agreement with those obtained by Barut and Eris (1994) and Petridou and Voyiatizs (1994) who worked on girdling, Osman and Abo-Taleb- Safia (1999) and Perica *et al.* (2001) who worked on micronutrients and Ragab (2002) and Ahmed and Ragab (2002) on macrounutrients.

4- Effect of girdling and some nutrients on some physical and chemical properties of the fruits :

Data in Table (3) clearly show that carrying out girdling or spraying micro and macro nutrients either singly or in combination was significantly very effective in improving fruit weight as well as percentages of pulp weight

and oil in the pulp and in reducing percentage of seed weight compared with the check treatment. Carrying out girdling, using micronutrients and spraying macronutrients, in ascending order was necessary for obtaining a great promotion on fruit quality. The maximum values of fruit weight as well as percentages of pulp and oil and the minimum values of seed weight percentage were recorded on the girdled and received four sprays of all nutrients trees. The untreated trees produced unfavourable fruits.

These results are in agreement with those obtained by Eris and Barput (1992), Barut and Eris (1994) and Petridou Voyiatzis (1994) who worked on girdling; Tan (1997), Osman and Abo-Taleb- Saif (1999) and Perica et al. (2001) who worked micronutrients and Connell *et al.* (2000); Ragab (2002) and Ahmed and Ragab (2002) who worked on macronutrients.

The positive action of girdling on growth and fruiting of Manzanillo olive trees could be attributed to its effect in accumulating carbohydrates and other organic foods as well as promoters above rings.

In addition, nutrients are responsible for activating cell division as well as the biosynthesis and translocation of organic foods and these effects explained their important role in growth and fruiting (Nijjar, 1985).

As a conclusion, the best results with regard to growth and yield of Manzanillo olive trees were obtained due to carrying out girdling and foliar fertilizing with a special mixture contaning 0.5% urea, orthophosphoric acid, potassium sulphate and magnesium sulphate, 0.05% chelated Zn, Fe and Mn and 0.05% boric acid.

Table (2): Effect of girdling and some nutrients on some growth characters and number of inflorescences/shoot of Manzanillo olive trees in 2001 and 2002 seasons.

Girdling and nutrient treatment	Shoot length (cm).		No. Of leaves/shoot	
	2001	2002	2001	2002
Control (ungirdled and untreated trees)	14.3	16.2	16.0	18.2
Girdling	17.3	19.3	20.2	22.5
Spraying micronutirents	20.4	22.2	24.0	26.7
Spraying macronutirents	24.5	25.9	29.2	26.2
Spraying micro + girdling	24.7	26.0	27.3	31.0
Spraying macro + girdling	28.0	28.6	33.0	34.2
Spraying micro and macro + girdling	30.5	31.7	37.2	38.2
New L.S.D at 5 %	2.5	2.0	3.2	3.3
Characters	Leaf area $(cm.)^2$		No. Of inflorescences/shoot	
Control (ungirdled and untreated trees)	3.11	3.33	6.8	7.0
Girdling	3.89	3.95	7.1	8.3
Spraying micronutirents	4.61	4.64	7.3	9.5
Spraying macronutirents	5.31	5.33	7.3	10.7
Spraying micro + girdling	5.28	5.34	7.5	10.6
Spraying macro + girdling	6.03	6.02	7.6	11.8
Spraying micro and macro + girdling	6.75	6.61	7.7	13.0
New L.S.D at 5 %	0.80	0.51	NS	1.0

Macronutrients = 0.5 % urea + 0.5 % orthophosphoic acid + 0.5 % magnesium sulphate 0.5 % potassium sulphate

Micronutrients = 0.05% chelated Zn, Fe and Mn+0.05% boric acid +

Table (3) : *Effect of girdling and some nutrients on number of flowers per inflorescence, yield and some fruit characters of Manzanillo olive trees in 2001 and 2002 seasons.*

Girdling and nutrient treatment	No. of flowers/inflorescence		Yield/tree (kg/tree)	
	2001	2002	2001	2002
Control (ungirdled and untreated trees)	11.5	12.4	23.0	24.0
Girdling	11.6	14.0	26.0	27.0
Spraying micronutirents	11.8	15.2	29.2	30.0
Spraying macronutirents	12.0	16.9	33.0	33.0
Spraying micro + girdling	12.0	17.0	33.2	33.8
Spraying macro + girdling	12.2	18.3	36.1	37.0
Spraying micro and macro + girdling	12.3	19.6	38.6	39.9
New L.S.D at 5 %	NS	1.0	2.3	2.5
Characters	**Mean fruit weight (kg.)**		**Pulp weight %**	
Control (ungirdled and untreated trees)	3.91	4.11	68.5	70.2
Girdling	4.56	4.70	71.7	72.2
Spraying micronutirents	5.17	5.30	75.2	75.3
Spraying macronutirents	5.80	5.91	79.0	78.2
Spraying micro + girdling	5.92	5.97	79.5	79.3
Spraying macro + girdling	6.71	6.52	81.9	82.0
Spraying micro and macro + girdling	7.33	7.40	84.8	84.7
New L.S.D at 5 %	0.60	0.55	2.2	2.1
Characters	**Seed weight %**		**Oil % in the pulp**	
Control (ungirdled and untreated trees)	31.5	29.8	15.82	16.11
Girdling	28.3	27.8	16.79	17.01
Spraying micronutirents	24.8	24.7	17.80	17.95
Spraying macronutirents	21.0	21.8	18.91	18.85
Spraying micro + girdling	20.5	20.7	18.90	18.90
Spraying macro + girdling	18.1	18.0	19.92	19.80
Spraying micro and macro + girdling	15.2	15.3	20.91	20.73
New L.S.D at 5 %	1.8	1.9	0.91	0.88

Macronutrients = 0.5 % urea + 0.5 % orthophosphoic acid + 0.5 % magnesium sulphate 0.5 % potassium sulphate

Micronutrients = 0.05% chelated Zn, Fe and Mn+0.05% boric acid +

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تأثير التحليق والرش الورقى لبعض العناصر الغذائية على النمو، الأزهـــار، المحصـــول وجودة الثمار في أشجار الزيتون المنزانيللو النامية فى التربة الرملية

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تم دراسة تأثير التحليق ومخلوط بعض العناصر الصغرى (٠,٠٥% كبريتات الزنك، الحديـــد، المنجنـــيز، ٠,٠٥% حامض البوريك) ومخلوط بعض العناصر الكبرى (٠,٥% من كل من اليوريـــا، حـــامض الأرثوفوســـفوريك، كبريتات البوتاسيوم، كبريتات الماغنيسوم) إما بصورة فردية أو بصورة مشتركة على النمـــو، الأزهـــار والمحصـــول وخصـــائص الجودة لأشجار الزيتون المنزانيللو النامية فى التربة الرملية وذلك خلال موسمى ٢٠٠٠،٢٠٠١ وقد تم تحليق الأفرع المثمرة قبل الأزهار الكامل بأسبوع كما تم رش المخلوطات أربعة مرات فى الأسبوع الأول مـــن أبريـــل، مـــايو، يونيو، يوليو فى كلا الموسمين.

كان التحليق ورش العناصر الغذائية إما بصورة فردية أو بصورة مشتركة فعالا فى تحسين طول النمو، عدد الأوراق على النمو الخضرى ومساحة الورقة، المحصول، متوسط وزن الثمرة، النسبة المئوية للب، النســـبة المئويـــة للزيت فى اللب وذلك بالمقارنة بمعاملة الكونترول وكان للمعاملات تحت الدراسة تأثير واضح فى تقليل النسبة المئويـــة للبذرة وكان التأثير المحسن للمعاملات على عدد النورات الزهرية على النمو الواحد وعدد الأزهار فى النورة معنويا فى الموسم الثانى فقط وكان التحسن فى هذه الصفات مرتبطا بإجراء التحليق، استخدام العناصر الصغرى، استخدام العناصر الكبرى مرتبة ترتيبا تصاعديا وكان التحسن واضحا فى صفات النمو والإثمار عند إجراء التحليق مـــع رش العنـــاصر الغذائية بالمقارنة بالاستخدام الفردى لأى منهما.

وكانت المعاملة المتميزة والتى أدت إلى تحسين المحصول كما ونوعا فى أشجار الزيتون المـــنزانيللو هـــى التى اشتملت على تحليق الأفرع المثمرة مع استخدام مخلوط خاص من العناصر الغذائية يتكون من ٠,٥% من اليوريـــا، حامض الأرثوفوسفوريك، كبريتات البوتاسيوم، كبريتات الماغنسيوم، ٠,٠٥% من كيلات الحديد والزنـــك والمنجنـــيز، ٠,٠٥% من حامض البوريك.