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Use of Ethrel and Alsol as Chemical Aids for Harvesting Olives

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ABSTRACT

Spraying olive trees (*Olea europaea* L.) Cv., Coratina with Ethrel (2-Chloroethyl Phosphonic Acid) significantly faciltated hand-harvesting of olives. Total fruit harvested during the 1977 season by two labourers hand-shaking the trees for 2 to 3 minutes ranged from 69–83% depending on concentration, compared to 20% for the control. Percentage of fruit harvested during the 1978 season was less than in 1977. Treatment with Ethrel at 750, 1000 and 1250 ppm resulted in 68, 57 and 73% reduction in Fruit Removal Force (FRF) 2 weeks from spray. Alsol (2-Chloroethyl-tris (2-Methoxy ethoxy)-Silane) was ineffective in the October spray of 1978, but was very effective in the November spray in reducing FRF and, consequently, facilitating hand-harvesting of olives. Alsol at 1000 and 1250 ppm resulted in harvesting 50 and 47% of the crop in 2 to 3 minutes by shaking alone. Both Alsol and Ethrel treatments increased leaf abscission over the control. However, the amount of dropped leaf was considered negligible as compared to that which falls during present methods of harvesting. Alsol and Ethrel (750–1000 ppm) appeared to be very promising aids to harvesting olives without excessive leaf drop.

INTRODUCTION

A major proportion of the olive fruit crop is lost each year due to difficulties in recruiting enough labour for harvesting. Research was directed toward the use of mechanical and/or chemical aids for minimizing manpower requirements for harvesting olives (2,4,6,7,8). The use of chemical aids for harvesting is an attractive prospect under Libyan farming conditions, particularly in the coastal area, for the following reasons:

(a) Interplanting of vegetables and temporary fruit trees between olive trees would make mechanical harvesting of olives difficult in the future.
(b) Chemical aids are much cheaper and easier to use.
(c) Less leaf drop and no damage to tree.

Reports indicate that Alsol and Ethrel markedly reduced the FRF of olive fruits, thus facilitating both hand and mechanical harvesting of olive fruits (1,2,5,8). Alsol was reported to be more effective than Ethrel in reducing FRF without causing excessive leaf drop (3). Varieties differ widely in their sensitivity to ethylene (1) and consequently in fruit and leaf drop. Both Ethrel and Alsol are ethylene releasing chemicals (6,9). Our preliminary work on Ethrel during the 1976 season showed that spraying local olive trees with Ethrel doubled the amount of harvested fruits per unit time and reduced

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leaf drop by 30% of that of the control, by harvesting with conventional harvesting method.

The objective of this work was to evaluate Alsol and Ethrel, as chemical aids for harvesting olives.

MATERIALS AND METHODS

Mature Coratina olive trees (*Olea europaea* L.) grown in Al-Azizia nursery were selected for this experiment during the 1977 and 1978 seasons. Trees were sprayed to drip-off on 3 November 1977 with Ethrel at 750, 1000, 1250 and 1500 ppm using 3 trees/treatment. The experiment was repeated on 27 October 1978, using both Ethrel and Alsol at 750, 1000 and 1250 ppm and on 22 November 1978 at 1000 and 1250 ppm Alsol and Ethrel using 2 and 3 trees replicate/treatment, respectively. Trees sprayed with water served as control. Surfactant at 0.1% was added to all treatments except Alsol treatments (no surfactant needed). FRF was measured every 2–3 days with Hunter spring force gauge model LKG1. Measurements were made during a 2 week period after spray on 50 random fruits per tree, selected from the periphery of the tree. The fruits dropped before harvesting were collected. Harvesting was done by hand, labourers shaking trees until no more fruits dropped. Fruits that remained after shaking were collected and the percentage of fruit drop was calculated. Total leaves dropped were weighed, and the percentage of healthy leaves dropped were assessed as a double handful of dropped leaves from each tree. The data were subjected to statistical analysis.

RESULTS AND DISCUSSION

% Fruit Drop

Ethrel treatments at all concentrations were very effective in facilitating harvesting of olive fruits Table (1). Ethrel resulted in harvesting 69–83% of the tree crop compared to 20% for the control. More than 50% of the tree crop was harvested in 3 to 5 minutes shaking. Treated trees dropped 21 to 27% of their crop before harvesting. Ethrel treatments were equally effective in facilitating harvesting and were significantly different from the control (Table 1). Percentage fruit harvested by Ethrel treatments in October and November of the 1978 season were less than those of the 1977 season but were higher than Alsol, possibly due to the prevailing wind shortly after spray. The ineffectiveness of Alsol in the 22 October 1978 experiment may have been due to the prevailing wind shortly after treatment, during maximum ethylene production from

Table 1. Effect of Ethrel on fruit and leaf drop of Coratina olive after 2 weeks from spray during 1977 season.

Treatment	% Fruit drop			Dropped leaves (kg)	Healthy leaves (%)
	Preharvest	By shaking	Total		
Control	4.86	15.77	20.63	0.40	40.93
Ethrel					
750 ppm	21.05	48.42	69.47	1.83	69.11
1000 ppm	21.38	58.28	79.66	1.33	71.28
1250 ppm	27.00	52.57	79.58	2.77	77.18
1500 ppm	27.59	55.81	83.40	2.33	76.22
LSD 0.05	16.64	10.00	18.31	1.56	15.22

Table 2. Effects of Ethrel and Alsol on fruit and leaf drop of Corotina olive after 2 weeks from spray.

Treatment	Oct. 27, 1978			Leaf dropped (kg)	Nov. 22, 1978
	Preharvest	% Fruit drop by shaking	Total		% Fruit dropped[z] by shaking
Control	1.94	5.80	7.73	0.20	8.80
Ethrel					
750 ppm	11.8	51.34	63.14	2.09	—
1000 ppm	8.77	36.03	44.79	0.78	39.43
1250 ppm	20.53	44.74	65.27	1.91	30.56
Alsol					
750 ppm	13.94	26.11	40.05	0.36	—
1000 ppm	3.06	8.77	11.83	0.28	50.00
1250 ppm	1.66	10.76	12.42	0.62	47.22
LSD 0.05	8.42	13.56	17.71		11.25

[z]Based on crop remained on tree at harvest time (Fruits dropped preharvest were excluded).

Alsol. Ethylene production from Alsol starts a few hours after spray and reaches a maximum within 3 days of spraying (6), while Ethrel is a slow releaser and thus escaped the adverse effects of wind. Alsol was very effective in facilitating harvesting of olives in the November 1978 experiment. Spraying olive trees with 1000 and 1250 ppm. Alsol in late season (November), resulted in harvesting 50 and 47.2% of the tree crop, respectively, by shaking for 3–5 minutes, compared to 8.8% for the control. Fruit-drop before shaking was noticeable but was not assessed in the November experiment of 1978. Thus it was not possible to calculate the percentage total of fruit dropped.

Fruit Removal Force (FRF)

Olive fruit attachment force (FAF) was significantly reduced by Ethrel and Alsol. FAF for Coratina olive fruits averaged 810 g before treatment, it decreased to 241, 345 and 226 gram, 2 weeks after spray with Ethrel at 750, 1000 and 1250 ppm, respectively, compared to 752 gram for control. Ethrel was about 3 times as effective as Alsol in reducing FRF in the 22 October experiment (Fig. 1). However, one month later (27 November 1978), Alsol spray resulted in a significantly higher reduction in FRF than Ethrel (Fig. 2), but not as high as in earlier spray. Ethrel at 750, 1000, and 1250 resulted in 68, 57, and 73% reduction in FRF which resulted in harvesting a total of 63, 44 and 65% of the drop, respectively, compared to 7% reduction in FRF and 7.7% harvested fruits for the control. Alsol at 1000 and 1250 ppm reduced FRF by 34 and 33% (Table 2) which resulted in 50 and 47% fruit drop, respectively, by shaking by 2 unskilled labourers for 3–5 minutes (Table 2). Highest reduction in FRF was during the first 6 days for both Alsol and Ethrel treatments. However, minimum pull force was reached within 3 to 6 days for Alsol depending on concentration, and up to 11 days from spray for Ethrel (Figs 1 and 2).

It has been reported that Alsol is far superior to Ethrel in reducing FRF (2,5,6). Our data are in agreement with those findings only during late spray, suggesting that chemical aids are influenced by weather and time of spray. Wind has been reported to offset the effectiveness of ethylene releasing chemicals (1).

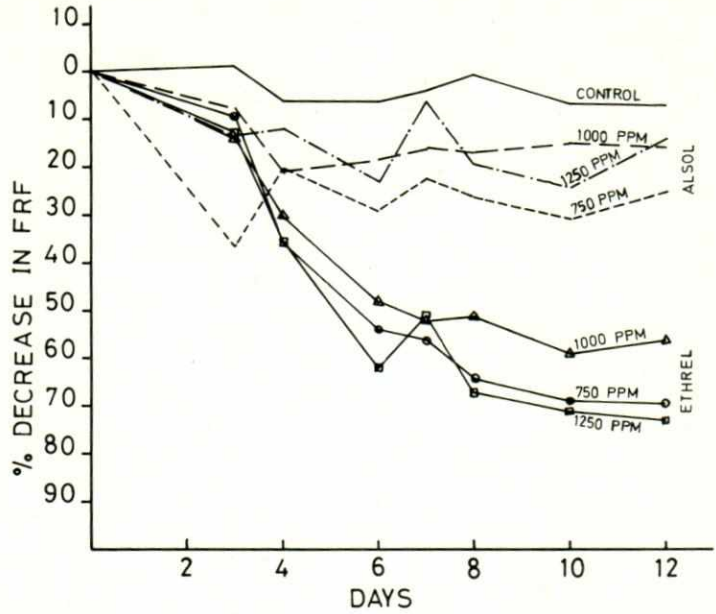

Fig. (1) Effect of Alsol and Ethrel on Fruit Removal Force of Coratina Olive Fruits During October, 1978 Spray.

Leaf drop %

Ethrel treatments resulted in an average of 2.1 kg leaf abscission during 1977 of which more than 26% of the leaves abscised were classified as senescent (Table 1). There is no significant difference between Ethrel treatment in respect of leaf abscission. Alsol resulted in a much less leaf drop than Ethrel and was comparable to that of control, particularly at lower concentration (750 and 1000 ppm) Alsol which is in agreement with other reports (5,6).

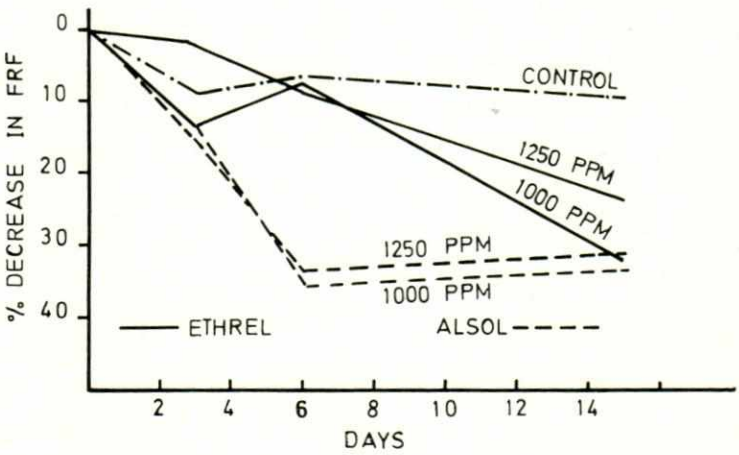

Fig. (2) Effect of Alsol and Ethrel on FRF of Coratina Olive Fruits during November, 1979 Spray.

The amount of leaf abscised was considered negligible compared to the amount of leaf fall during conventional harvesting methods (unpublished data). Hartmann *et al.* (5) reported that leaf abscission up to 25% did not influence the flower production of the following season.

It is therefore safe and economical to use Ethrel and Alsol at the concentrations tested as chemical aids for harvesting olives. A major proportion of olives annually lost could be harvested. Thousands of work hours could be saved. Harvesting of untreated trees took an average of two and a half hours while it was possible to harvest up to 83% of a treated tree crop in less than 5 minutes with same amount of labour and method of harvesting.

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استعمال مادتى الاثريل والالصول لتسهيل جمع ثمار الزيتون

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المستخلص

تم رش أشجار الزيتون صنف كموراتينا بمادتى الاثريل والالصول بتركيزات مختلفه تتراوح من ٧٥٠ وحتى ١٥٠٠ جزء فى المليون . أدت المعاملة بمادة الاثريل الى تقليل قوة شد الثمار بحوالى ٥٧ – ٧٣ ٪ التى أدت الى جمع ٦٩ – ٨٣ ٪ من محصول الاشجار حسب التركيز فى مدة ٣ – ٥ دقائق بالهز اليدوى وباستعمال عاملين للشجرة الواحده . لا توجد فروق معنوية بين تركيزات مادة الاثريل المستعملة فى موسم ١٩٧٧ ووجد أن مادة الاثريل أكثر فعالية من مادة الالصول فى بداية موسم ١٩٧٨ بينما فى نهاية موسم الجمع تفوقت مادة الالصول على الاثريل خاصة باستعمال التركيز ١٠٠٠ جزء فى المليون .

أدت معاملة الاثريل الى زيادة كمية الاوراق المتساقطه الا أنها لم تزد عن ٢ كم للشجرة الواحده منها ٢٦ ٪ أوراق مصابه أو وصلت الى مرحلة الشيخوخه وتعد كمية الاوراق المتساقطه باستعمال مادة الاثريل غير ذات قيمة مقارنة بالاوراق المتساقطه بطرق الجمع التقليدية ولن تؤثر على الازهار فى الموسم التالى . وتمتاز مادة الالصول بقلة الاوراق المتساقطة .

باستعمال هذه المركبات الكيميائيه يمكن تقليل الفاقد سنويا من محصول الزيتون لسرعة وكفاءة الجمع وبالتالى زيادة انتاج الزيت سنويا وحسابيا يمكن جمع أكثر من ١٥ شجره معامله قبل جمع شجرة واحده غير معامله وبكفاءة تتعدى ٧٥ ٪ .