Effects of Ethrel and Alsol on the Quality of 'Coratina' Olive Fruits

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ABSTRACT

Mature 'Coratina' olive fruit trees were sprayed with each of 0, 750, 1,000, and 1,250 ppm of Ethrel and Alsol. Two weeks after spraying, the crop was harvested by shaking the branches by hand. The quality of the dropped and the remaining fruits was evaluated. No significant effect of any of the treatments of Ethrel or Alsol was noticed on % moisture; % oil; saponification value; % free fatty acids; % total carbohydrates; % starch; % total sugars, % reducing sugars; and % non-reducing sugars, of the dropped and the remaining fruits. It was concluded that Ethrel and Alsol could be used in aiding olive harvesting without affecting the quality of fruits.

INTRODUCTION

Ethrel (2-chloroethyl phosphonic acid), and Alsol [2-chloroethyl-tris-(2-methoxyethoxy)-silane)], have been extensively used as chemical aids for harvesting olives (5,8,15,16), but studies on the effect of these chemicals on the olive fruit quality are scarce. Reports on other fruit crops, such as apples (1,4), cherries (4), peaches (2), and cranberries (13), showed that Ethrel had induced better colouring, and softer fruits; but other fruit characters such as acidity, total soluble solids, and dry weight were not affected.

In Libya, great attention has recently been given to the use of chemicals in harvesting olives. Results of trials carried out by a team of investigators in the Horticulture Department of the Faculty of Agriculture have shown that Ethrel and Alsol could successfully be used in aiding olives harvesting in Libya (5). The present work was a follow up study, attempted to investigate any possible side-effects of these chemicals on the olive fruit quality. The quality of oil, along with the carbohydrate content of the flesh, was taken into account in the evaluation of fruit quality, since the cultivar used (Coratina), was basically a table olive.

MATERIALS AND METHODS

Mature 'Coratina' olive fruit trees (*Olea europea* L.) grown in Al-Azizia nursery were used in this study. Trees were sprayed to drip off on October 27, 1978 with 0, 750, 1,000, and 1,250 ppm of Ethrel and Alsol. The experimental layout was completely randomized, with 3 replicate trees for a treatment. Trees sprayed with water served as control. Surfactant at 0.1% was added to all treatments except Alsol treatments, where no surfactant was needed. Two weeks after spray the fruits were harvested by hand, shaking the main branches of the trees, until no more fruits had dropped. This was a

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part of a study on the use of chemicals in aiding harvesting of olives (5). About 3 kg sample of fruits from those dropped by shaking, and also from those remaining on the tree after shaking, were taken from each tree to the laboratory for oil and carbohydrate analysis. About 250 gm. of fruits were deseeded and dried to a constant weight in a draft oven at 65°C. The percentage of moisture was determined and the dried fruits were used for oil and carbohydrates analysis by using the following methods:

Oil. Sample of 20–25 gm dried fruits was used for oil extraction using petroleum ether and Soxhlet apparatus. Extraction was carried out for 6 hours. Percentage of oil was determined and expressed on fresh weight bases. The oil quality was evaluated by the saponification value and the per cent free fatty acids, as described by Pearson (12).

Carbohydrates. Two gm of dried fruits were used for sugar extraction using 80% ethanol. Leading and deleading was done by using lead acetate and sodium oxalate, respectively. The non-reducing sugars were determined by hydrolyzing a part of the sugar extract with 1 N HCl for 10 minutes on a water bath at 67°C (3,10). Starch was determined in the dried alcohol insoluble residue by hydrolyzing with 1 N HCl for 4 hours on a water bath at 90°C (6). The reducing power of reducing sugars, non-reducing sugars, and starch, after hydrolysis, was determined by Samogyi micro-copper method, 1952 reagent, as cited by Wistler *et al.* (17). The non-reducing sugars were taken as the difference between the total reducing power of soluble sugars and reducing sugars. All results were expressed in percentage, based on dry weight.

RESULTS AND DISCUSSION

Moisture and oil content. The percentages of moisture and oil were not affected by Ethrel and Alsol treatments (Table 1). The quality of oil as judged by the saponification value, and the per cent free fatty acids, was also unaffected by the Ethrel and Alsol treatments. No significant difference was noticed in the above characteristics in the fruits dropped by shaking and in the fruits remaining on the trees after shaking (Table 1). Hartmann *et al.* (7) after several years of trials on the mechanical harvesting of 'Sevillano' black olives by using Ethrel found that the fruit quality judged by visible damages to fruits was not affected by harvesting aid. Comparing values obtained in this study, with standards recommended for olive oil (14), showed that per cent moisture, per cent oil, and saponification value, were within allowable range, but the per cent free fatty acids was slightly above the recommended range (0.5%–1.9%). This could have been a varietal character, or could be due to rancidification of oil, as a result of drying the fruits before oil extraction.

Carbohydrates. Ethrel and Alsol did not affect the carbohydrate content of 'Coratina' olive fruits. The carbohydrate constituents of fruits expressed as starch, and sugars (reducing and non-reducing), were not changed (Table 2). This was an indication that Ethrel and Alsol had no impact on the carbohydrates and its derivatives. Results on other fruit crops such as peaches (2), apples (1), and cherries (4), showed that preharvest sprays with Ethrel had not affected the total soluble solids and dry weight of these fruits. Comparison of dropped and remaining fruits showed no variation in total carbohydrates, starch and sugars. All values found in this study were within the ranges of carbohydrates as previously reported in olive fruits (9).

The non-significant effects of Ethrel and Alsol on the quality of fruits of olive, as determined in this study, was probably due to the fact that the chemicals were applied only one or two weeks before harvest when the fruits had already attained their desirable maturity. Moreover, previous studies on the fate of Ethrel in Walnuts (11), and citrus (18), using radioisotopes, showed that ethylene was the major breakdown product of Ethrel, with no other by-products being detected. Ethylene naturally develops in fruits during ripening and a considerable change of fruit quality during this stage cannot be expected from the application of ethylene.

Table 1 The effects of Ethrel and Alsol on the moisture and oil contents of 'Coratina' olive fruits.

Analysis	Fruit sample	Control	Ethrel			Alsol			Average	LSD 0.05
			750	1,000	1,250	750	1,000	1,250		
% Moisture	D	70.31	67.39	68.81	69.81	71.98	69.86	69.11	69.61	NS
	R	68.70	67.99	69.52	70.84	71.54	68.36	68.44	69.28	
	Av	69.51	67.69	69.17	70.33	71.80	69.26	68.77		NS
% Oil	D	14.47	15.70	15.27	14.97	13.53	15.32	15.65	14.99	NS
	R	15.49	15.01	15.35	14.83	14.00	16.36	16.27	15.35	
	Av	14.98	15.35	15.31	14.90	13.58	15.84	15.96		NS
Saponification	D	209.9	205.8	209.7	210.3	206.9	198.7	193.6	204.6	NS
Value Mg KOH/1 gm	R	199.4	202.6	209.5	201.0	206.9	202.3	198.7	202.7	
oil	Av	204.6	204.5	209.6	204.7	206.8	200.1	196.2		NS
% Free	D	3.31	2.29	3.25	5.40	2.51	1.65	0.76	2.73	NS
Fatty acids	R	1.80	1.56	4.07	1.81	3.40	2.15	1.39	2.33	
	Av	2.70	1.99	3.66	3.61	2.86	1.85	1.08		NS

D = Dropped fruits; R = Remained fruits; Av = Average.

Table 2 The effects of Ethrel and Alsol on the carbohydrate content of 'Coratina' olive fruits.

Analysis*	Fruit sample	Control	Ethrel			Alsol			Average	LSD 0.05
			750	1,000	1,250	750	1,000	1,250		
Total carbohydrate	D	7.40	8.07	5.60	5.27	6.46	5.78	7.30	6.47	NS
	R	6.30	6.76	5.68	7.04	6.83	5.78	6.41	6.43	
	Av	6.75	7.41	5.64	6.16	6.65	5.78	6.75		NS
Starch %	D	2.64	2.22	2.39	2.14	2.30	2.04	2.71	2.33	NS
	R	1.41	2.22	2.27	2.28	2.05	2.25	1.97	2.06	
	Av	2.03	2.22	2.33	2.21	2.18	2.12	2.27		NS
Total sugars %	D	4.70	5.85	3.26	3.13	4.16	3.74	4.91	4.23	NS
	R	4.90	4.54	3.41	4.76	4.90	3.53	4.44	4.36	
	Av	4.80	5.19	3.34	3.95	4.45	3.66	4.67		NS
Non-reducing sugars %	D	1.32	2.72	1.04	0.57	1.39	1.33	2.17	1.52	NS
	R	1.94	1.32	0.68	1.78	1.99	1.23	1.45	1.44	
	Av	1.69	2.02	0.86	0.98	1.69	1.29	1.81		0.72
Reducing sugars %	D	3.38	3.13	2.22	2.56	2.76	2.41	2.73	2.71	NS
	R	2.96	3.08	2.75	2.58	2.79	2.30	2.99	2.80	
	Av	3.12	3.10	2.48	2.57	2.78	2.37	2.86		NS

D = Dropped fruits; R = Remained fruits; Av = Average
*Based on dry weight

Comparison of the dropped and the remaining fruits showed no significant differences in moisture, oil, and carbohydrate contents. This could only mean that the fruits remaining on the trees might have attained their desirable level of oil and carbohydrates, but still, due to some unknown endogenous factors, did not respond to fruit abscission chemicals used in this study.

A conclusion could be drawn that Ethrel and Alsol might be used safely in aiding the harvesting of olive fruits in Libya, with no fear of any drawbacks or undesirable side-effect on the quality of fruits.

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تأثير مادتى الاثريل و الالصول
على صفات الجودة فى ثمار الزيتـــــون
صنـف " كوراتينـا "

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المستخلـص

عوملت أشجار زيتون بالغة من صنف كوراتينا بالرش بمادتى الاثريـل و الالصول وبتركيزات صفر ، ٧٥٠ ، ١٠٠٠ ، ١٢٥٠ جزء فى المليون . وبعد اسبوعين من الرش تم جمع المحصول عن طريق هز الأفرع بالآيدى ، وتم تقييم صفات الجودة للثمار المتبقية على الأشجار و الثمار التى سقطت نتيجـــة الهـــز .

هذا ولم يلاحظ أى تأثير معنوى لمادتى الاثريل و الالصول بالتركيزات المستعملة فى هذا البحث على أى من صفات الجودة وهى ، رقم التصبـــن ، و النسب المئوية لكل من الرطوبة ، الزيت ، الاحماض الدهنية ، الكربوهيدرات الكلية ، النشا ، السكريات الكلية ، السكريات المختزلة ـ و السكريـــات غيـر المختزلـة .

يستنتج من ذلك انه يمكن استخدام هاتين المادتين لمساعدة جمـــع الزيتون بالطرق الكيماوية دون أن تؤثرا على صفات الجودة فى الثمار .