

## The Effect of Alsol and Ethephon Alone or Combined with Antitranspirants for Harvesting Olive Fruits

MOHAMED S. SHALADAN AND MOHAMED I. EL-TAMZINI<sup>1</sup>

### ABSTRACT

'Chemlali' olive fruits sprayed with ethephon (1000 ppm) or alsol (3000 ppm) significantly reduced fruit removal force (FRF) and increased fruit drop one week following treatment. Ethephon treated branches with polyethylene bags have more per cent of fruit drop and excessive leaf drop. Spraying Vapor Gard (VG) 1 hour, or 1 day following ethephon had no additional effects over ethephon alone. Mixing alsol with Folicote (FC) resulted in a significant FRF reduction than alsol alone 2 days from spray but was equally effective 1 week from spray.

### INTRODUCTION

Alsol (2-chloroethyl-tris (2 methoxyethoxy)silane), and ethephon (2-chloroethyl phosphonic acid) were very promising as chemical aids for harvesting olives (2,7,10,11,12,14). Prevailing wind and/or rainfall shortly after treatments may reduce their effectiveness (1). Wind reduces abscission agent effectiveness, presumably by enhancing ethylene escape from the tissue via transpiration process; and rainfall by washing off the material from leaf and fruit surfaces. Film-forming antitranspirants (AT) were reported to increase water-vapour diffusion resistance (3,4,6,8,9), increase plant water potential (3,4,5,6), a condition enhancing abscission (9). It was our belief that the thin film formed by AT spray, in addition to increasing plant water potential, may act as physical barrier to the escape of ethylene released from abscission agents, and may thus maintain or increase its effectiveness under unfavourable conditions. This paper presents data on the effects of alsol and ethephon alone, and, with Vapor Gard and Folicote, on facilitating harvesting of 'Chemlali' olive fruits.

### MATERIALS AND METHODS

Series of experiments were conducted on 'Chemlali' olive trees (*Olea europaea* L.) to study the effect of abscission chemicals: ethephon and alsol sprayed alone and with antitranspirants: Vapor Gard (VG) or Folicote (FC) on harvesting olive fruits.

#### Experiment 1

The experiments were conducted to study the effect of ethephon and VG, alone or together, on FRF and fruit drop. Fruiting branches were selected from 'Chemlali' olive trees grown in the Secretariate of Agricultural Research Farm at Sidi-El-Mesri. All

<sup>1</sup>Department of Horticulture, Faculty of Agriculture, Al-Fateh University, Tripoli, S.P.L.A.J.

selected branches were shaken (before initial FRF measurement) until no more fruits dropped, to eliminate inferior fruits and those of low FRF. Branches were sprayed on 21 November 1979 to the height of 2–2.5 m with water (control), VG 1%, and ethephon (1000 ppm) alone, or followed by VG spray 1 hour later. Three tree replicates per treatment were used. Four to six fruiting branches from each tree were labelled and the number of fruits per branch counted. Half the branches assigned to each treatment were inserted in polyethylene bags for protection from wind and possible rainfall. The other half remained unbagged. FRF was measured before treatment and 1 week later on 50 fruits per tree (using Hunter spring gauge LKGI). The fruits were selected at random from the treated area, away from labelled branches.

### Experiment 2

This was conducted on 8 December 1979 using the same basic treatment control, VG 1%, ethephon (1000 ppm) and ethephon followed by VG. Vapor Gard was sprayed 1 day later to allow for ethephon absorption. Six fruiting branches were assigned per treatment. FRF was measured before and 7 days after treatment.

### Experiment 3

A similar experiment to that described earlier was conducted on 10 December 1979 with an addition of alsol treatment (3000 ppm); the abscission agent was mixed with VG 1%. Treatments were made on 6 fruiting branches per treatment. FRF were determined at intervals.

### Experiment 4

An experiment was conducted at the Faculty of Agriculture Research Farm, Al-Fateh University, Tripoli, to study the effectiveness of alsol alone, or mixed with Vapor Gard or Folicote, on FRF under simulated rainfall. Six fruiting branches were assigned to one of the following treatments: Alsol 3000 ppm, alone or mixed with VG 5%, or FC 5%. Treatments were made on 27 December 1979. Three branches from each treatment were washed with water (10L/branch) 24 hours after treatment, simulating rainfall. Branches were shaken before initial FRF measurement to remove inferior fruits. FRF was evaluated at intervals.

## RESULTS AND DISCUSSION

### Experiment 1

Ethephon at 1000 ppm and VG at 1%, alone or combined, resulted in a significantly higher percentage of fruit drop than the control in both bagged and unbagged branches (Table 1). Fruit drop and leaf abscission were significantly higher in bagged than unbagged branches, possibly due to ethylene build-up in polyethylene bags. It was surprising that VG was as effective as ethephon on fruit drop in both bagged and unbagged branches, though ethephon was more effective on FRF than VG (Table 1). A possible explanation is that the thin film formed by VG spray over leaf and fruit surfaces may have trapped the ethylene produced naturally by leaves and fruits and thus increased the effective ethylene concentration. The higher fruit drop in treated bagged than treated unbagged branches emphasizes the importance of protection, particularly under unfavourable weather conditions.

Table 1 The Effect of Ethephon and Vapor Gard alone or together on Fruit and Leaf Drop of 'Chemlali' Olives.

Treatment	FRF (% of original)	% Fruit dropped	% Leaf dropped
<b>Bagged</b>			
Control	—	12.7	0.9
Ethephon 1000 ppm	—	92.6	83.7
VG 1%	—	91.4	18.1
Ethephon 1000 ppm + VG 1% <sup>z</sup>	—	96.3	77.8
<b>Unbagged</b>			
Control	152.81	28.5	—
Ethephon 1000 ppm	25.08	61.6	—
VG 1%	86.56	51.0	—
Ethephon 1000 ppm + VG 1% <sup>z</sup>	39.41	48.6	—
LSD 0.05	28.98	18.36	17.25

<sup>z</sup>VG sprayed 1 hr after ethephon spray.

## Experiment 2

Ethephon at 1000 ppm and VG at 1% alone, and ethephon followed by VG spray one day after ethephon application, resulted in a significant reduction in FRF after 7 days from spray (Table 2). The results were fairly similar to those of unbagged treated branches reported in experiment 1 (Table 1).

Spraying VG one day after ethephon application has no additional effect on FRF over ethephon alone. It is worthy to note that the FRF of the control increased by 52% (Table 1), and by 41% (Table 2) after 7 days from spray, possibly due to dropping of fruits of low FRF, leaving only fruits with high attachment force which biased the data.

## Experiment 3

Ethephon at 1000 ppm and alsol at 3000 ppm reduced significantly FRF 4 days from spray and resulted in more than 70% reduction in FRF 1 week from spray. Short, intense rainfall (4 mm) occurred 30 hours after spray which may have negated any possible effect of washing on FRF.

Table 2 The Effect of Ethephon and Vapor Gard alone or together on Fruit Removal Force (FRF) of 'Chemlali Olive Fruits.

Treatments	FRF (gram)		
	Before spray	7 days after spray	FRF (% of original)
Control	491 a <sup>z</sup>	696 a	141.7
Ethephon 1000 ppm	534 a	147 c	27.5
VG 1%	525 a	451 b	85.9
Ethephon 1000 ppm + VG 1% <sup>y</sup>	551 a	220 c	39.9

<sup>z</sup>Means within a column followed by same letter are not significantly different at 5% level of Duncan's multiple range test.

<sup>y</sup>VG sprayed one day after ethephon spray.

Table 3 The Effect of Alsol, Ethephon and Vapor Gard singly or in combination on Fruit Removal Force (FRF) of Chemlali Olive Fruits.

Treatment	FRF (g)			
	Before treatment	After treatment (days)		
		4	7	11
Control	438 a <sup>z</sup>	487 a	590 a	501 a
Vapor Gard 1%	535 a	459 a	524 a	544 a
Ethephon 1000 ppm	410 a	285 b	108 b	67 b
Ethephon 1000 ppm + Vapor Gard 1% <sup>y</sup>	540 a	460 a	244 c	222 c
Alsol 3000 ppm	449 a	309 b	70 b	57 b
Alsol 3000 ppm + Vapor Gard 1% <sup>y</sup>	442 a	198 c	111 b	64 b

<sup>z</sup>Means followed by same letter are not significantly different at 5% level of Duncan's multiple range test.  
<sup>y</sup> = VG mixed with ethephon.

Table 4 The Effect of Alsol alone or mixed into Vapor Gard (VG) or Folicote (FC) on Fruit Removal Force (FRF) of Olive Fruits

Treatment	% decrease in FRF (days from spray)		
	2	6	12
Alsol 3000 ppm (control)	56.4 a <sup>z</sup>	86.0 a	83.8 a
Alsol 3000 ppm (washed with water)	58.9 a	86.7 a	80.3 a
Alsol 3000 ppm + FY <sup>y</sup> 5% (control)	68.7 b	92.4 a	85.0 a
Alsol 3000 ppm + FY <sup>y</sup> (washed with water)	67.5 ab	92.8 a	88.3 a
Alsol 3000 ppm + VG 5% <sup>y</sup> (control)	50.3 a	91.5 a	83.8 a
Alsol 3000 ppm + VG 5% (washed with water)	59.9 a	88.9 a	85.4 a

<sup>z</sup>Means within a column followed by same letter are not significantly different at 5% level of Duncan's multiple range test.

<sup>y</sup> = FC and VG were mixed with Alsol.

Under experimental conditions, ethephon and alsol were very effective in reducing FRF of 'Chemlali' olive fruits. Both compounds were equally effective in reducing FRF 1 week from spray. Ethephon alone, or mixed with VG or FC, reduced fruit removal force by more than 70% within 1 week of spray in all experiments reported herein. Thus harvesting can be done after 7 days from spray. Delay in harvesting may result in shrivelling of fruits as a result of formation of abscission zone.

Spraying VG after 1 hour (Table 1), or one day after ethephon application (Table 2), or mixed with ethephon and/or alsol (Tables 3 and 4) had no additional effect on FRF over ethephon or alsol alone. Mixing FC with alsol resulted in the highest reduction in FRF 2 days from spray (Table 4).

The data reflect that antitranspirant may prove to be effective in overcoming the adverse effects of unfavourable weather conditions prevailing shortly after application.

The antitranspirants tested were not subjected to unfavourable conditions. Evaluation of different antitranspirants under diverse conditions are needed before any conclusion can be drawn.

#### LITERATURE CITED

1. Anonymous. 1975. Alsol abscission-inducing agent for use as a harvest aid on olives product profile, CBA-GIGY.

2. Ben-Tal, Y. and S. Lavee. 1976. Increasing the effectiveness of ethephon for olive harvesting. *HortScience* 11: 489-499.
3. Davenport, D. C., R. M. Hagan and P. E. Martin. 1972. Antitranspirants for conservation of leaf water potential of transplanted citrus trees. *HortScience* 7: 511-12.
4. Davenport, D. C., M. A. Fisher and R. M. Hagan. 1972. Some counteractive effects of antitranspirants. *Pl. Phy.* 49: 722-24.
5. Davenport, D. C., P. E. Martin and R. M. Hagan. 1973. Effect of an antitranspirant on water-use by highway oleander (*Nerium oleander* L.) planting. *J. Amer. Soc. Hort. Sci.* 98: 421-25.
6. Davenport, D. C., K. Kriu and R. M. Hagan. 1975. Antitranspirant effects on the water status of 'Manzanillo' olive trees. *J. Amer. Soc. Hort. Sci.* 100: 618-22.
7. El-Tamzini, M. I., M. Y. Shurfa, H. S. Ahmed and M. S. Shaladan. 1980. Use of ethrel and alsol as chemical aids for harvesting olives. *L. J. Agr.* (Vol. 9).
8. Gale, J. and R. M. Hagan. 1966. Plant antitranspirants. *Ann. Rev. of Plant Physiology.* 17: 269-282.
9. Hartmann, H. T., M. El-Hamady and J. Whisler. 1972. Abscission induction in the olive by cycloheximide. *J. Amer. Soc. Hort. Sci.* 97: 781-85.
10. Hartmann, H. T., W. Reed, J. E. Whisler and K. W. Opitz. 1975. Mechanical harvesting of olives. *Cal. Agr.* 29(6): 4-6.
11. Hartmann, H. J., W. Reed and K. Opitz. 1976. Promotion of olive fruit abscission with 2-chloroethyl-tris-(2-methoxy ethoxy)-silane. *J. Amer. Soc. Hort. Sci.* 101: 278-281.
12. Lavee, S. and A. Haskal. 1976. Further field studies of the mode of application and efficiency of various ethylene-releasing chemicals to facilitate olive fruit harvest. *Riv. ortoflorofruit.* 60: 166-175.
13. Martin, J. D. and L. B. Link. 1973. Reducing water loss of potted chrysanthemums with pre-sale application of antitranspirant. *J. Amer. Soc. Hort. Sci.* 98: 303-306.
14. Vitagliane, C. 1975. Ethylene-releasing compounds to loosen olive fruits for mechanical harvesting. *HortScience* 10: 591.

## مستخلص

تأثير مادة الالصول والايثفون  
( اثيريل ) بدون خلط وخلطها  
بالمواد المضادة للنتج على  
كفاءة جميع شمار الزيتون  
صنف شماللى

\* ————— \*

محمد سليمان شلدان  
محمد ابراهيم الطمزينى

أدت معاملة الأفرع المثمرة بمادتي الالصول ( ٣٠٠٠ جزء فى فى  
المليون ) ، الايثفون ( ١٠٠٠ جزء فى المليون ) الى خفض قوة التصاق  
الشمار بالأفرع الى ١٥ - ٤٠ ٪ من قوة الشد الأصلية الأمر الذى أدى الى  
سهولة جمع شمار الزيتون . وعند حماية الأفرع المعامله من الرياح  
والأمطار بتغطيتها بأكياس البولى اثيلين ارتفعت نسبة تساقط الشمار  
والأوراق عنها فى الأفرع المعاملة الغير مغطاه واخلط مادة الايثفون  
بمادة فيبور جارد والالصول بمادتي فيبور جارد أو فولى كوت بتركيز ٥ ٪  
( مواد مضادة للنتج ) بهدف تقليل هروب غاز الاثيلين المنطلق من مادتي  
الالصول والايثفون لم تؤدى الخلط الى تغيير فى كفاءة المركبات بعهد  
(٧) أيام من الرش برغم أن خلط مادة الالصول بمادة فولى كوت أدت الى  
خفض قوة شد الشمار بدرجة ملحوظة بعد يومين من الرش مما يشير الى  
امكانية استعمال هذه المعاملات للمحافظة على كفاءة مادتي الالصول  
والايثفون خاصة وأن المواد المضادة للنتج لم يتمكن من دراسة تأثيرها  
تحت ظروف جوية سيئة لاعتدال المناخ أثناء اجراء هذه التجارب .