

Influence of Preharvest Application of Ethrel and 2,4-D on Fruit Quality of Balady Orange

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Abstract. The effect of Ethrel and 2,4-D (100 and 200 ppm) applied twice before color break of the fruit on fruit quality of Balady orange trees was studied during the 1985 and 1986 seasons.

Most of the physical characteristics (fruit weight, volume, rind thickness, rind weight and juice percentage) and chemical characteristics (acidity, T.S.S., T.S.S: acid ratio and vitamin C) of the fruit were not affected. Application of Ethrel enhanced chlorophyll (a + b) degradation and at the same time increased carotene synthesis of the fruit rind especially at the 200 ppm concentration.

On the other hand, 2,4-D treatments retarded chlorophyll degradation and decreased carotene content in the fruit rind in both seasons.

Introduction

Orange fruits produced in Riyadh area do not develop normal color. The development of orange color requires cool night [1].

Growth regulating substances have been shown to affect fruit quality of citrus and other fruits [2-8].

The aim of the present investigation was to study the effect of preharvest application of Ethrel (2-chloroethyl phosphonic acid) and 2,4-D (2,4-dichlorophenoxy acetic acid) on fruit quality of Balady orange trees grown in Riyadh area.

Materials and Methods

This investigation was carried out during the 1985 and 1986 growing seasons on Balady orange trees (*Citrus sinensis*, Osbeck) grown at the Experimental Research Station of the College of Agriculture, King Saud University at Dierab, Riyadh region. Twenty similar vigor trees, 11-year-old, budded on sour orange rootstock were used. All trees were subjected to the same cultural practices usually followed in the citrus orchards. Five treatments were applied:

- 1- Control, sprayed with distilled water.
- 2- Ethrel, 100 ppm.
- 3- Erthrel, 200 ppm.
- 4- 2,4-D, 100 ppm.
- 5- 2,4-D, 200 ppm.

The treatments (with Tween-20 used as wetting agent) were applied at random between the selected trees. Each treatment consisted of four replicates, one tree each. The trees were sprayed twice each season. The first spray was done on 27 September, 1985 and on 6 October, 1986 just before color break of the fruits. The second spray was done on 11 November, 1985 and on 22 October, 1986. Fruits of each tree were harvested (December 26, 1985 and December 17, 1986) and a representative sample of 10 fruits was randomly taken from each tree for physical and chemical characteristics determinations. Physical characteristics included fruit weight, volume, rind thickness, rind weight, and juice percentage. Chemical characteristics included titratable acidity, total soluble solids (T.S.S.), vitamin C content and pigments of the fruit rind. Titratable acidity, T.S.S. and vitamin C were determined according to the A.O.A.C. [9]. Chlorophyll and carotene contents were determined according to Wettstein [10].

The data obtained were statistically analyzed using the analysis of variance and the differences between the means were separated according to the L.S.D. method [11].

Results and Discussion

a. Physical characteristics

Data of both seasons showed that the use of Ethrel and 2,4-D (100 or 200 ppm) had no significant effect on the physical characteristics of Balady orange fruits with a few exceptions in the first year (Table 1). Rind weight in the 200 ppm 2,4-D treatment was significantly higher than in all other treatments (Table 1). These results

were, generally, in line with those obtained by Zidan and El-Naggar [12], Fuchs and Cohen [13], and Bacha *et al.* [5].

Table 1. Effect of Ethrel and 2,4-D on physical characteristics of Balady orange fruits in 1985 and 1986 seasons

Treatment	Fruit weight (g)	Fruit volume (cm)	Rind thickness (mm)	Rind weight (g/fruit)	Juice percentage
1985					
Control	126.9	132.4	3.5	31.5	44.2
Ethrel (100 ppm)	126.9	131.6	3.3	33.0	40.6
Ethrel (200 ppm)	122.2	127.3	3.4	32.9	43.2
2,4-D (100 ppm)	115.8	119.5	3.2	31.9	43.7
2,4-D (200 ppm)	132.6	141.9	3.9	40.5	37.2
L.S.D. at 5%	NS	NS	NS	5.8	NS
1986					
Control	116.5	118.9	3.6	32.8	37.7
Ethrel (100 ppm)	118.1	124.0	3.5	34.7	36.0
Ethrel (200 ppm)	113.2	119.7	3.5	33.3	37.3
2,4-D (100 ppm)	108.1	112.3	3.6	32.3	38.4
2,4-D (200 ppm)	112.5	117.5	3.6	33.1	38.6
L.S.D. at 5%	NS	NS	NS	NS	NS

b. Chemical characteristics

The results of this study revealed that the preharvest application of Ethrel or 2,4-D on Balady orange trees did not affect the chemical characteristics of the fruits in both years (Table 2). These results were in agreement with those obtained by other investigators working on different species and cultivars of citrus. Minessy [14] on grapefruits, Chauhan and Rana [15] on Washington navel orange, Bacha *et al.* [5] on Valencia orange and Oh *et al.* [7] on Satsuma mandarin. They found that Ethrel and 2, 4, 5-T did not affect the chemical constituents of treated fruits. On the other hand, El-Hammady *et al.* [4], found that 2, 4, 5-T increased the percentage of T.S.S. in Clementines. Also, Arora *et al.* [3] stated that Ethrel treatments had decreased the percent acidity of "Valencia" orange fruits.

Table 2. Effect of Ethrel and 2,4-D on some chemical characteristics of Balady orange fruits in 1985 and 1986 seasons

Treatment	Acidity %	T.S.S. %	T.S.S./acid ratio	Vitamin C mg/100 ml juice
1985				
Control	0.94	13.5	14.5	58.5
Ethrel (100 ppm)	0.91	13.7	14.9	58.2
Ethrel (200 ppm)	0.93	13.7	14.7	56.7
2,4-D (100 ppm)	0.97	14.0	14.5	56.2
2,4-D (200 ppm)	0.93	13.8	15.0	53.6
L.S.D. at 5%	NS	NS	NS	NS
1986				
Control	1.07	14.3	13.4	53.2
Ethrel (100 ppm)	1.05	14.2	13.6	51.3
Ethrel (200 ppm)	1.03	14.5	14.0	55.0
2,4-D (100 ppm)	1.06	14.2	13.5	57.0
2,4-D (200 ppm)	1.03	13.6	13.3	54.2
L.S.D. at 5%	NS	NS	NS	NS

c. Pigments

Ethrel treatments enhanced chlorophyll (a + b) degradation in the rind of the treated fruits as compared with untreated fruits (control). This was true in both years (Figs. 1 and 2). The higher concentration of Ethrel (200 ppm) had an obvious effect in reduction of chlorophyll (a + b) content than the lower (100 ppm concentration.) These results are in line with those found by Young and John [16], Arora *et al.* [3], Bacha *et al.* [6] and Oh *et al.* [7]. On the contrary, 2,4-D treatments retarded the chlorophyll (a + b) degradation of the rind of Balady orange fruits as compared with the other treatments (Figs. 1 and 2).

Ethrel sprays at 100 and 200 ppm enhanced carotene content especially in the second year as compared with the control. On the other hand, 2,4-D treatments reduced the carotene content of the rind of the fruits in both years (Figs. 1 and 2). Similar results were obtained by Arora *et al.* [3] and Bacha *et al.* [6]. They all found that Ethrel application enhanced external color and also hastened carotenoid accumulation.

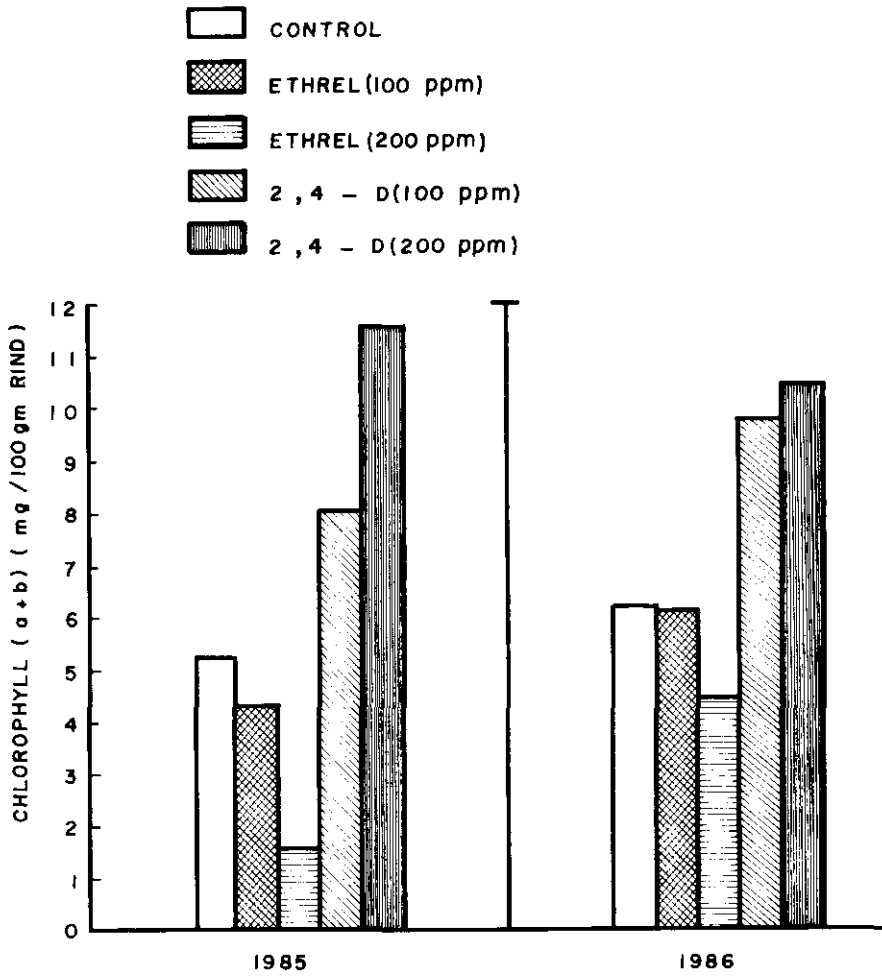


Fig. 1. Effect of Ethrel and 2,4-D on chlorophyll (a + b) of Balady orange fruits in 1985 and 1986

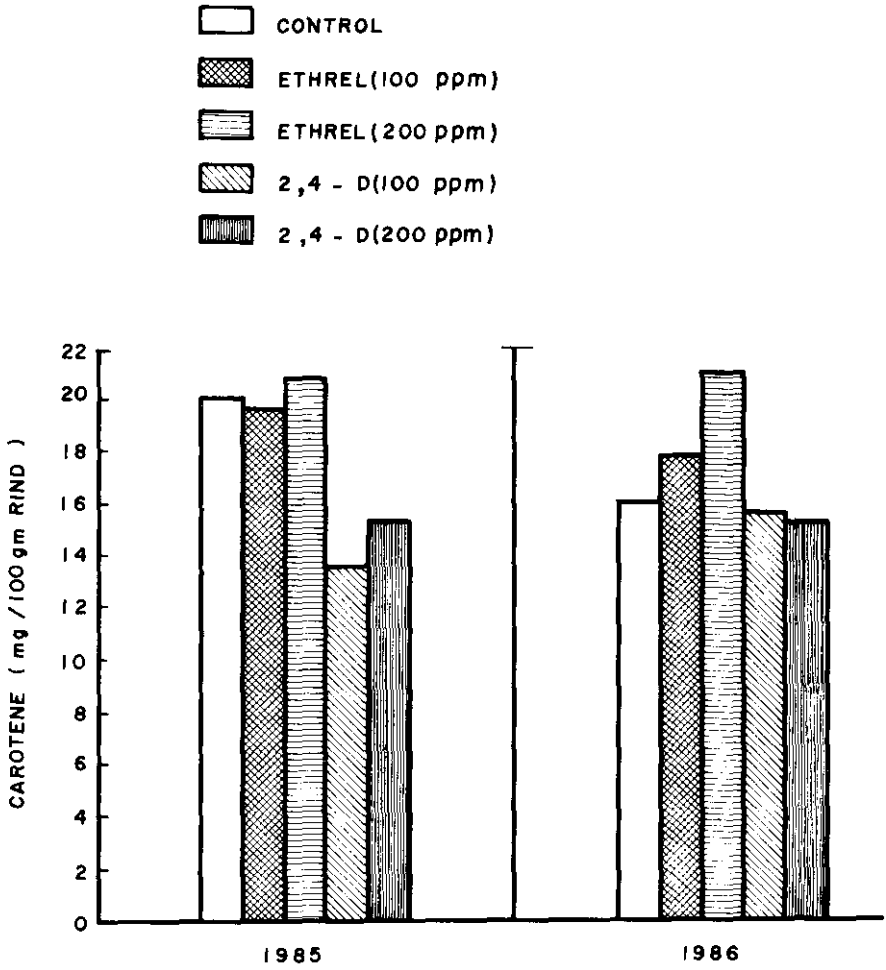


Fig. 2. Effect of Ethrel and 2,4-D on carotene of Balady orange fruits in 1985 and 1986

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تأثير الرش قبل الحصاد بمادتي الإيثريل و ٢ ، ٤ - د على خواص ثمار البرتقال البلدي

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ملخص البحث . درس تأثير الرش بمادتي الإيثريل، ٢ ، ٤ - د (١٠٠، ٢٠٠ جزء في المليون) على خواص ثمار البرتقال البلدي خلال موسمي ١٩٨٥، ١٩٨٦ . وقد أجري الرش مرتين قبل بدء تحول لون الثمار. وقد أوضحت النتائج أن المعاملات المستخدمة لم تؤثر بصورة واضحة على معظم خواص الثمار الطبيعية (وزن، حجم، وزن وسمك القشرة والنسبة المثوية للعصير)، والخواص الكيميائية (الحموضة، المواد الصلبة الذائبة الكلية، النسبة بين المواد الصلبة الذائبة الكلية والحموضة وفيتامين ج) خلال سنتي الدراسة. وأوضحت النتائج أن الرش بمادة الإيثريل قد أدى إلى زيادة واضحة في سرعة تحليل الكلوروفيل من قشرة الثمار وفي الوقت نفسه زيادة محتواها من الكاروتين وخاصة عند استخدام تركيز ٢٠٠ جزء في المليون. في حين حدث العكس عند الرش بمادة ٢ ، ٤ - د حيث أدت إلى تأخير تحليل الكلوروفيل من قشرة الثمار ونقص محتواها من الكاروتين.