EFFECT OF BIOZYME AND GIBBERELLIC ACID ON FRUIT SET, YIELD AND FRUIT CHARACTERS OF "COSTATA" PERFIMMON

A.S. M. WALLY, H.MOKHTAR AND E.M. EL-FAKHARANAY

Horticulture Research Institute, Agricultural Research Centre, Giza, Egypt.

(Manuscript received 2 June 1998)

Abstract

Biozyme at 1500 and 3000 ppm alone or combined with gibberellic acid (GA3) at 25 ppm were sprayed at full bloom of persimmon Cv. Costata trees. All treatments increased fruit set (%) and yield/tree as compared with the control. The highest fruit set, yield and retained fruits percentage were recorded by the treatment of 3000 ppm Biozyme + 25 ppm GA3 as compared with the control. On the other hand all treatments reduced fruit weight, volum and dimensions as compared with the control. The treatment of GA3 at 25 ppm alone or combined with Biozyme at 1500 ppm increased significantly fruit frimness as compared with the control. Fruit chemical characters were not affected by all treatments.

INTRODUCTION

Persimmon (Diospyros kaki, L.) variety Costata (partheno-carpic) drops its fruits profusely. Bargandzhiya (1977) stated that the causes of kaki fruit drop are: variety, inadequate pollination and midsummer drought. Fruit drop had been reduced by GA3 application in different fruit species such as perimmon (Bargioni, *et al.*, 1979 and Blumenfeid, 1986); pears (Golubin'skil, *et al.*, 1977); apples (Goldwin (1978) and Boffelli and Eccher (1978). As regard to GA3 action, at least three important actions are appearent. The first that GA intensifies an organ ability to function as a nutrient sink. A second action is GA ability to increase the synthesis of IAA in plant tissues. The third action involves acceleration the synthesis of hydrolytic enzymes as amylase and other hydrolytic enzymes in aleurone cells (Addicott and Addicott, 1982).

Mode of action for micro elements was explained by Larue and Johnson (1989). Iron (Fe) complexes with proteins to form important enzymes in the plant and is associated with chloroplasts, where it has some role in synthesizing chlorophyll. Zinc (Zn) has been identified as a component of almost 60 enzymes; therefore, it has a role in many plant functions and it has a role as an enzyme in

producing the growth hormone IAA. It also accumulates and plays an important role in seed development, which may explain the sensitivity of fruit growth to zinc deficiency. Manganese (Mn) participates in several important processes including photosynthesis and nitrogen and carbohydrate metabolism. Magnesium (Mg) functions as an activator of many important enzyme reactions and as a major component of the chlorophyll. Boron is involved in several processes in the plant, including protein synthesis, transport of sugars, and the metabolism of plant hormones. Sulfer (S) is incorporated into certain amino acids (cysteine, methionine) and subsequently becomes part of certain enzymes, vitamins, and oil.

Treatments with GA3 at 25, 50 or 100 mg/litre about 10 days after full bloom significantly reduced fruit drop in "Saijo" persimmon (Yamamura *et al.*, 1989). In addition, Hasegawa, *et al.* (1991) stated that GA3 at 200 ppm applied on persimmon cvs "Saijo" and "Hiratanenashi" at full bloom or 10 days after, improved percentage of fruit set over the control. Injection of GA_3 and GA_{4+7} delayed abscission of "Redkist" and "Redakin" peach fruits punctured seeds by 6 to 10 days and increased fruit retention through stage III in "Loring" peach (Stutte and gage, 1990). Also, Ogilvie *et al.* (1991) on rose, reported that although there were fewer seed per fruit, fruit set was higher in more crosses when GA_3 was applied to the stigma at a concentration of 250 ppm ten days after pollination. In addition, GA_4 or GA7 application at 200 ppm markedly increased fruit set in Pyrus pyrifolia cultivars (Inomata *et al.*, 1992).

Many investigators reported that biozyme compound enhanced growth and flowering and improved yield and its components of some crops (Siviero, 1989 on pepper; Sharma *et al.*, 1991, on soybean; Kumar *et al.*, 1991, on tea plants; Hewedy *et al.*, 1994, on common bean; and Makarem and Makarem and Mokhtar, 1996 on apple).

The aim of this investigation is to study the effect of Biozyme or GA_3 as foliar spray alone or combined together on fruit set, retained fruits, fruit characteristics and yield of "Costata" persimmon fruits.

MATERIALS AND METHODS

The present investigation was performed for two successive seasons (1996 and 1997) on trees of persimmon cv. Costata, of 7-years old grown in loamy soil in the Horticultural Research Station at El-Kanater, Kalubia Govermorate. Trees were

subjected to similar cultural practices.

Biozyme is a commercial product, it contains:

- 78.7% biological active extracts of plant origin and growth regulators (32.2 ppm GA3; 32.2 ppm IAA and 82.2 ppm zeatine).
- 1.88% micro-nutrient (Fe. 0.49%; Zn 0.37%; Mn 0.12%, Mg 0.14%, B. 0.30% and 50.44%).
- 19.27% solvents and conditioners.

The following treatments were foliar sprayed at full bloom in the two seasons:

1. 1500 ppm Biozyme (0.038 ppm GA3, 0.038 ppm IAA, 0.069 ppm zeatine, 0.137 ppm Fe, 0.104 ppm Zn, 0.033 ppm Mn, 0.039 ppm Ma, 0.084 ppm B and 0.123 ppm S).
2. 3000 ppm Biozyme (0.075 ppm GA3, 0.075 ppm IAA, 0.138 ppm zeatine, 0.273 ppm Fe, 0.207 ppm Zn, 0.066 ppm Mn, 0.078 ppm Ma, 0168 ppm B and 0.246 ppm S).
3. 25 ppm gibberellic acid (GA3).
4. 1500 ppm Biozyme + 25 ppm GA3.
5. 3000 ppm Biozyme + 25 ppm GA3.
6. Control (tap water).

Three trees were used for each treatment (one tree for each replicate). Fruit set (%) and yield (Kg/tree) were determined after treatments. Fruits were picked at full colour and fruit weight, volume, diameter and height were determined. Fruit firmness (lb/Inch2) was determined by hand pressure tester (Balluf pressure tester - MEG, Co.). Total soluble solids (%) was recorded by a hand refractometer. Total acidity (%) was determined as malic acid in fruit juice according to A.O.A.C. (1965). Tannins contents (%) was determined as malic acid in fruit juice according to A.O.A.C. (1965). Tannins contents (%) were evaluated according to the method of Winton and Winton (1958).

The statistical analysis was carried out according to Snedecor and Cochran (1990) and L.S.D. test was used for performance of individual comparisons.

RESULTS AND DISCUSSION

Fruit Set:

The effect of Biozyme at 1500 ppm and 3000 ppm alone or combined with GA_3 at 25 ppm or GA_3 alone at 25 ppm during the two successive seasons of 1996 and 1997 are show in Table 1. It is clear that all treatments of Biozyme and/or GA3 increased fruit set as compared with the control. The highest fruit set percentages was recorded with the application of 3000 ppm Biozyme + 25 ppm GA_3 (64.58 and 69.95%) followed by 1500 ppm Biozyme + 25 ppm GA (61.61 and 66.18%) as compared with the control (36.06 and 41.79%) in the two seasons, respectively, there was a high significant correlation (r) between fruit set and yield/tree.

Table 1. Effect of Biozyme and GA3 on fruit set and yield of "Costat" persimmon during 1996 and 1997 seasons.

Treatment	Fruit set (%)		Yield/tree (Kg.)	
	1996	1997	1996	1997
1500 ppm Biozyme	48.88	48.88	48.88	48.88
3000 ppm Biozyme	39.28	39.28	39.28	39.28
25 ppm GA3	59.25	59.25	59.25	59.25
1500 ppm Biozyme + 25 ppm GA3	61.61	61.61	61.61	61.61
3000 ppm Biozyme + 25 ppm GA3	64.58	64.58	64.58	64.58
Control	36.06	36.06	36.06	36.06
L.S.D. at 5%	0.41	0.41	0.41	0.41

Correlation between fruit set and yield: r at 1% = 0.976799 and 0.97669 for 1st and 2nd seasons, respectively.

These results agree with those of Stutte and Gage (1990) using GA_3 and on GA_{4+7} "loring" peach; and Hasegawa, *et al.* (1991) using GA_3 on persimmon cvs "Saijo" and "Hirataneshi" at full bloom or 10 days after. Also the results agree with several other investigatoves using Biozyme (Siviero, 1989 on pepper; Sharma, *et al.*, 1991, on soybean; Kumar, *et al.*, 1991 on tea plants; Hewedy, *et al.* 1994, on common bean; and Makarem and Mokhtar, 1996, on apple).

Yield/Tree:

Table 1 illustrates the effect of Biozyme alone at 1500 and 3000 ppm or com-

bined with GA_3 at 25 ppm or GA_3 alone at 25 ppm on vield/tree during the two seasons of study 1996 and 1997. All treatments increased significantly the yield/tree as compared with the control. The best yield/tree was recorded as a results or Biozyme at 3000 ppm combined with 25 ppm GA3 (51.85 and 56.51 Kg). as compared with the control (20.95 and 25.99 Kg) for the 1st and 2nd seasons, respectively. There was a high positive correlation (r) between fruit set and yield/tree.

The present results are in harmony with those reported by Stutte andGage (1990) using GA3 and GA4+7 on "Loring" peach; and Hasegawa, *et al.* (1991) using GA3 on persimmon cvs "Saijo" and "Hiratanenashi" at full bloom or 10 days after. Similar results were also reported by several workers (Siviero, 1989 on pepper; Sharma, *et al.*, 1991, on soybean; Kumar, *et al.*, 1991 on tea plants; Hewedy, *et al.*, 1994, on common bean; and Makarem and Mokhtar, 1996, on apple).

Retaned fruit percentage:

Results shown in Fig. 1. indicate the effect of Biozyme alone at 1500 and 3000 ppm or combined with GA_3 Table at 25 ppm or GA_3 alone at 25 ppm on the percentage of retained fruits during the period from 1st May till 1st October during the season 1996 and 1997. A sharp decrease in percentage of retained fruits at the first of June was indicated where the highest percentage of retained fruits was recorded by the treatment 3000 ppm Biozyme + 25 ppm Biozyme + 25 ppm GA3 (31.77 and 50.51%) as compared as compared with the control (20.55 and 34.23%) in the two seasons, respectively. At the first of October, the final highest percentage of retained fruits was recorded by the sametreatment (31.43 and 29.35%) as compared with control (16.33 and 15.38%) in the two seasons, respectively.

The present results are in line with those of Stutte and Gage (1990) using GA3 and GA4+7 on "Loring" peach; and Hasegawa *et al.* (1991) using GA3 on persimmon cvs "Saijo" and "Hiratanenashi" at full bloom or 10 days after. Also the present results agree with those of Siviero, 1989 on pepper, Sharma *et al.*, 1991, on soybean; Kumar *et al.*, 1991 on tea plants; Hewedy *et al.*, 1994, on common bean; and Makarem and Mokhtar, 1996, on apple.

Physical Characteristics of Fruirs:

Physical characteristics of fruits as affected by different concentrations of Biozyme alone or combined with GA3 or GA3 alone at 25 ppm are presented in Table 2. As regard to fruit weight, the highest fruit weight (107.67 and 103.01 g) result-

Table_1. Effect of Biozyme and GA3 on fruit set and yield of "Costat" persimmon during 1996 and 1997 seasons.

Treatment	Fruit Weight (g)		Fruit volume (ml)		Fruit diame-ter (g)		Fruit height (cm)		Fruit fimness (lb/inch2)	
	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
1500 ppm Biozyme	98.86	94.03	113.38	106.54	5.48	5.30	5.35	5.18	18.10	18.15
3000 ppm Biozyme	102.04	95.53	111.52	111.52	5.55	5.48	5.35	5.28	18.16	18.13
25 ppm GA3	95.10	89.53	100.25	104.45	5.15	5.08	4.96	4.98	21.83	21.90
1500 ppm Biozyme + 25 ppm GA3	90.2	85.08	96.48	100.62	4.95	4.78	4.78	4.66	21.11	20.95
3000 ppm Biozyme + 25 ppm GA3	93.10	88.21	98.62	103.66	4.94	4.83	4.94	4.71	19.20	19.11
Control	107.67	103.01	112.03	112.91	5.86	5.39	5.7	5.27	18.95	18.93
L.S.D. at 5%	0.31	0.40	0.46	0.29	0.09	0.30	0.20	0.01	0.34	0.40

ed from untreated trees followed by the treatment 3000 ppm Biozyme (102.04 and 96.53 g) in the first and second seasons, respectively. The other treatments reduced fruit weight as compared with the control. Concerning fruit volume, the results showed a similar trend, where all treated trees produced smaller fruits than those of the untreated ones. All treated produced fruits with smaller dimensions than in the untreated. Regarding fruit fimness, the highest fruit fimness (21.83 and 21.90 lb/Inch2) as compared with the control (18.95 and 18.93 lb/Inch2) in the first and second seasons, respectively.

Total soluble solids:

As shown in Table 3, it is clear that all treatments of Biozyme at 1500 and 300 ppm alone or combined with GA3 at 25 ppm or GA3 alone at 25 ppm during the two seasons did not affect significantly fruit juice total soluble solids percentages (T.S.S. %) as compared with the untreated trees.

Tannin content:

Table 3 demonstrates that all treatments did not affect percentage of tannin content compared with the control.

Acidrry:

As shown in Table 3 all treatments did not affect total acidity % compared with the control. The total acidity % ranged from 0.47 to 0.5% for the first season and from 0.43 to 0.49% in the second season.

Table 3. Effect of Biozyme and GA3 on fruit chemical characteristics of "Costata" persimmon during 1996 and 1997 seasons.

Treatment	T.S.S. (%)		Tannin content (%)		Acidity (%)	
	1996	1997	1996	1997	1996	1997
1500 ppm Biozyme	18.79	17.73	3.78	3.85	0.47	0.46
3000 ppm Biozyme	17.46	18.06	3.83	3.93	0.49	0.45
25 ppm GA3	18.90	18.61	4.02	3.90	0.49	0.43
1500 ppm Biozyme + 25 ppm GA3	18.30	18.26	3.92	3.86	0.50	0.45
3000 ppm Biozyme + 25 ppm GA3	17.33	18.37	3.70	3.91	0.48	0.47
Control	17.21	18.14	3.98	3.85	0.51	0.49
L.S.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

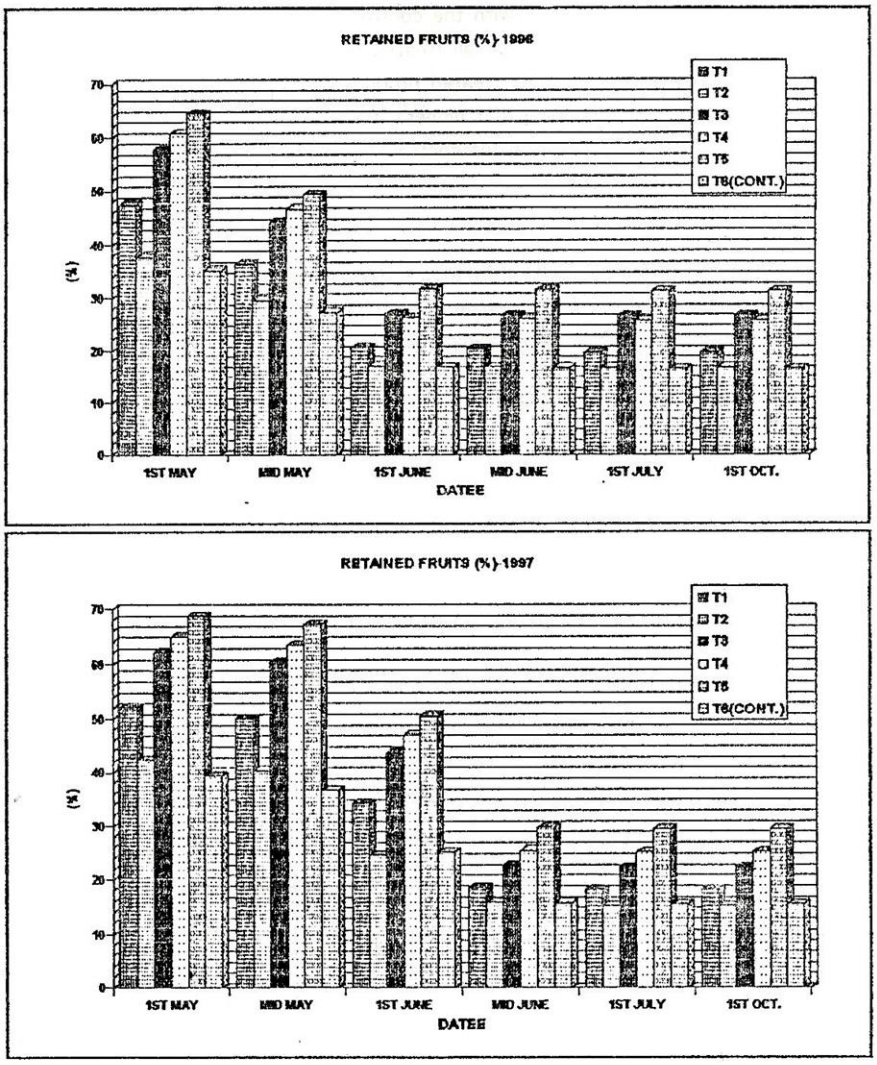

Fig. 1. Effect of Blozyme at 1500 ppm (T1), 3000 ppm (T2), GA3 at 25 ppm (T3), 1500 ppm Biozyme + 25 ppm GA3 (T4) and 3000 ppm Biozyme + 25 ppm GA3 (T5) on retained fruits (%) during 1996 and 1997 seasons. Control = T6

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تأثير البيوزيم وحمض الجبريليك على عقد ومحصول وصفات ثمار الكاكى صنف "كوستاتا"

عبد الفتاح سليمان محمد والى، حامد مختار، عزت محمود الفخرانى

معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة.

تم رش البيوزيم بتركيزين ١٥٠٠ ، ٣٠٠٠ جزء فى المليون منفرداً أو مخلوطاً بحمض الجبريليك بتركيز ٢٥ جزء فى المليون عند مرحلة الإزهار الكامل لأشجار الكاكى صنف "كوستاتا".

وقد نتج عن إستخدام جميع المعاملات زيادة النسبة المئوية للعقد والمحصول لكل شجرة عند مقارنتها بالأشجار المقارنة الغير معاملة. وقد تم الحصول على أعلى عقد ومحصول ونسبة مئوية للثمار المتبقية من الرش بالبيوزيم بتركيز ٣٠٠٠ جزء فى المليون مخلوطا بحمض الجبريليك بتركيز ٢٥ جزء فى المليون عند المقارنة بالمعاملة القياسية (الكنترول). ومن ناحية أخرى فان جميع المعاملات أدت إلى صغر حجم الثمرة ووزنها وأبعادها عند المقارنة بالمعاملة القياسية. وقد زادت صلابة الثمار معنويا نتيجة لمعاملات حمض الجبريلك منفرداً أو مخلوطاً مع البيوزيم بتركيز ١٥٠٠ جزء فى المليون عند المقارنة بالكنترول. ولم تتأثر الصفات الكيمائية للثمار معنوياً نتيجة رش جميع المعاملات.