

Enhancement of Canino Apricot Fruit Quality, Storability and Shelf Life via Calcium Sprays

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Abstract: The present investigation was carried out for two successive seasons i.e. 2008 and 2009 on mature uniform Canino apricot trees grown in a private orchard located at El Bostan region in Behera Governorate. Selected trees were sprayed at 15 or 30 days before anticipated maturity stage or on both dates with CaO at 3.5, 7 or 14% using one of the following commercial compounds: Tradecorp-Ca (containing Ca EDTA 14%W/W CaO), Boramine-Ca (containing 10.4% w/v CaO, 6.5% w/v amino acids and 0.27% w/v B) or Klover-Cal-Bor (containing 9%CaO, 1% B and 5% total N). Basic fruit characteristics have been assessed at harvest, 40 days after cold storage and 5 days of shelf life at room temperatures 20 -25°C. Both peel and flesh calcium% has also been estimated. As a general trend best results were due to double sprays of highest CaO concentration using Klover Cal- Bor and this was accompanied with significantly the highest peel and flesh calcium content. It was concluded from the results, that source of calcium affected the calcium absorption and that the presence of boron at high concentration in Klover Cal -Bor could be enhanced the calcium effect in addition to the positive effects of boron on the considered fruit quality parameters.

Key words: Canino apricot • Calcium • Fruit quality • Cold storage • Shelf life

INTRODUCTION

Apricots are of the most important stone fruits grown in Egypt basically due to their desert taste and multi usages. Yet, its spread is met with some constrains. One of the most important is that of the climacteric fruits characterized by a very rapid ripening phase [1]. This is reflected on the quick degradation of the fruits and their low storability (2-4 weeks) and shelf life (3-5days) [2]. An inverse relation exists between fruit tissue calcium level and the rate of respiration. Thus calcium sprays during fruit development decreased the respiration rate at harvest, reducing senescence and retarding fruit softening [3, 4]. Calcium deficiency has been associated with postharvest fruit quality disorders [5, 6]. Whereas, increasing its' concentration in flesh and skin reduces the fungal infection [7]. Calcium as a constituent of the cell wall plays an important role in forming cross-bridges which influences cell wall strength and is regarded as the last barrier before cell wall separation [8]. Exogenously applied of calcium stabilizes the cell wall protection against the degrading enzymes [9, 10]. The efficiency of exogenously applied calcium varies according to calcium

source Manganaris *et al.* [11], on peach, Lanauskas and Kvikliene [12] and Satour [13] on apple, also calcium concentration Peryea and Neilsen [14], Lotze *et al.* [15] on apple and time of application Lanauskas and Kvikliene [12], Eilham *et al.* [16] and Satour [13] on apple. Boron functions include sugar transport, cell wall synthesis and lignifications, cell wall structure and decrease respiration which, are all reflected on basic fruit quality Blevins and Lukaszewski [17]. Polyamines have positive roles in extending shelf life and reducing mechanical damage during postharvest storage [18-20].

The scope of the present investigation is on the comparative evaluation of foliar sprays with three calcium sources using three CaO concentrations applied at two timings on fruit quality of Canino apricot at harvest, after cold storage and shelf life.

MATERIALS AND METHODS

The current study was carried out for two successive seasons i.e.2008 and 2009 seasons in a private orchard located at El Bostan region in Behera Governorate. Eighty four Canino apricot trees grafted on

seedling rootstock were considered. Trees were seven years old at the beginning of the investigation, of uniform vigor and bore almost the same number of fruits. They were planted in sandy soil, vase trained and subjected to cultural practices recommended by the ministry of agriculture. The randomized complete blocks design was adopted in this investigation. At 15, 30 days or on both days before the anticipated maturity stage as described by Mohsen [21]. Three different trees of the considered ones (i.e. each tree acting as a separate replicate) were sprayed with one of the following CaO concentrations: 3.5, 7 or 14 % from one of the following commercial compounds: Tradecorp-Ca (containing Ca EDTA 14% w/w CaO), Boramine-Ca (containing 10.4% w/v CaO, 6.5% w/v amino acids and 0.27% w/v B) or Klover-Cal-Bor (containing 9% CaO, 1% B and 5% total N). Three trees were left untreated for comparison i.e. serving as control. When control fruits reached the considered maturity stage fruits from each considered tree, they were harvested separately, placed in field containers and transferred to the laboratory. After discarding broken or infected fruits, a representing sample of 10 fruits/tree was chosen to assess the effect of treatments on attained fruit quality. The measured parameters were: fruit firmness (lb/inch²) by Magnes and Taylor apparatus using 5/16 plunger, juice TSS (%) by a hand refractometer, juice acidity (%) as malic acid according to A.O.A.C [22], vitamin C content (mg/100 ml juice) according to A.O.A.C [23] and total sugars (mg/g) according to Smith *et al.* [24] for fruits at harvest stage. Samples of fruit peel and flesh were taken at harvest stage and their content of calcium (%) was estimated by the method described by A.O.A.C [25]. The remaining fruits were placed in a carton box and transferred to cold storage at 0 °C and 90-95% relative humidity for forty days to assess the effect of treatments on fruit quality after cold storage. A representing sample of 10 fruits that were cold stored was selected and placed in the laboratory at room temperature 20- 25°C for 5 days to assess the affect of treatments on fruit shelf life. Where, weight loss (%), decay (%) according to McCormack and Broun [26], fruit firmness, juice TSS (%) and juice acidity (%), were determined after cold storage and after 5 days of shelf life.

The obtained data were tabulated and statistically analyzed according to Snedecor and Cochran [27]. The mean values were compared by using Duncan's multiple range test at 5% level [28].

RESULTS AND DISCUSSION

Effect of Conducted Treatments on Fruit Quality at Harvest:

Fruit firmness was significantly higher when trees were sprayed twice times compared with spraying for only time (Table 1). Compared with control the conducted treatments significantly increased this parameter. The effect of Klover Cal-Bor at 14% CaO was significantly the highest in both seasons. Interaction results clarify that in both seasons the highest significant effect was due to spraying Klover Cal- Bor at 14% CaO for twice. Comparable results were attained due to Klover Cal- Bor at 7% CaO spraying for two times and spraying Klover Cal- Bor at 14% CaO at 15 days before the anticipated maturity.

On the average significantly the highest juice TSS% was attained by spraying for two times (Table 2). Whereas significantly the least juice TSS% was due to spraying at 30 days before anticipated maturity date. The average treatment effect clarify that, the conducted treatments resulted in increasing this parameter significantly compared with the control. Spraying Klover Cal-Bor at 14% CaO resulted in significantly the highest juice TSS% in both seasons of the investigation. Comparable results were attained due to Boramine Ca at 14% CaO in the second season only. Interaction results clarify that, in general for the same treatment results of two sprays were higher than that of spraying for one time at any of the considered dates. Juice acidity wasn't affected significantly by any of the considered treatments in both seasons (Table 3).

The highest significant vitamin C was dedicated to the double sprays in both seasons (Table 4). Comparable results were attained due to spraying at 15 days before anticipated maturity. On the average all of the considered treatments significantly increased this parameter compared with control. Superiority was detected due to the Klover Cal-Bor at 14% CaO treatment. Insignificant differences were attained by the Klover Cal-Bor at 7% CaO treatment. The interaction data show that, the highest vitamin C content was attained due to the double Klover Cal- Bor at 14% CaO treatment. Total sugars were significantly higher due to the double sprays compared with any of the single ones (Table 5). Klover Cal- Bor at 14% CaO in both seasons and Boramine Ca at 14% CaO in the second one resulted in significantly the highest content compared with the control and the remaining treatments. Interaction results illustrate a similar trend.

Table 1: Effect of conducted treatments on fruit firmness (lb/inch²) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Firmness (lb/inch ²)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	10.0 l-n	10.4 k-m	10.8 i-k	10.40 G	10.8 h-k	11.3 g-i	11.7 e-g	11.27 F
Tradecorp Ca 7% CaO	11.6 f-h	12.0 d-g	12.6 b-d	12.07 CD	12.2 de	12.6 cd	13.0 bc	12.60 BC
Tradecorp Ca 14% CaO	11.8 e-g	12.4 b-e	12.8 a-c	12.33 BC	11.8 e-g	12.6 cd	13.0 bc	12.47 CD
Boramine Ca 3.5% CaO	9.4 n	9.9 l-n	10.3 k-m	9.87 H	10.3 k	10.7 i-k	11.4 f-h	10.80 G
Boramine Ca 7% CaO	11.0 h-k	11.3 g-j	11.8 e-g	11.37 EF	11.3 g-i	11.4 f-h	12.0 d-f	11.57 EF
Boramine Ca 14% CaO	11.4 g-i	11.7 e-h	12.2 c-f	11.77 DE	11.7 e-g	12.0 d-f	12.6 cd	12.10 D
Klover Cal-Bor 3.5% CaO	10.6 j-l	11.0 h-k	11.4 g-i	11.00 F	11.0 h-j	11.8 e-g	12.2 de	11.67 E
Klover Cal-Bor 7% CaO	12.0 d-g	12.6 b-d	13.0 ab	12.53 B	12.2 de	13.0 bc	13.4 ab	12.87 B
Klover Cal-Bor 14% CaO	12.4 b-e	13.0 ab	13.5 a	12.97 A	12.6 cd	13.4 ab	13.8 a	13.27 A
Control	9.8 mn	9.8 mn	9.8 mn	9.80 H	10.5 jk	10.5 jk	10.5 jk	10.50 G
Average	11.00 C	11.41 B	11.82 A		11.44 C	11.93 B	12.36 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 2: Effect of conducted treatments on juice TSS (%) of Canino fruit apricot at harvest during 2008 and 2009 seasons.

Treatments	Total soluble solids (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	8.9 qr	9.4 pq	10.5 mn	9.60 G	10.7 l	12.3 d-g	12.8 c-e	11.93 E
Tradecorp Ca 7% CaO	11.2 kl	11.7 jk	12.9 e-g	11.93 D	11.4 i-k	11.8 g-i	13.4 a	12.20 D
Tradecorp Ca 14% CaO	11.7 jk	12.8 e-g	14.2 ab	12.90 BC	11.6 h-j	13.2 ab	13.5 a	12.77 AB
Boramine Ca 3.5% CaO	9.7 p	10.0 n-p	10.9 lm	10.20 F	11.0 kl	11.6 h-j	12.0 f-h	11.53 F
Boramine Ca 7% CaO	11.6 gh	12.0 h-j	13.4 c-e	12.33 C	11.5 h-k	12.2 e-g	13.6 a	12.43 CD
Boramine Ca 14% CaO	12.0 h-j	13.0 d-f	14.6 a	13.20 B	12.3 d-g	13.5 a	12.8 b-d	12.87 A
Klover Cal-Bor 3.5% CaO	9.8 op	10.4 m-o	11.8 i-k	10.67 E	11.2 j-l	12.3 d-g	13.2 ab	12.23 CD
Klover Cal-Bor 7% CaO	11.7 jk	12.5 f-h	13.7 bc	12.63 C	11.5 h-k	12.4 d-f	13.6 a	12.50 BC
Klover Cal-Bor 14% CaO	12.4 f-i	13.6 b-d	14.8 a	13.60 A	12.3 d-g	13.6 a	13.1 a-c	13.00 A
Control	8.4 r	8.4 r	8.4 r	8.40 H	9.3 m	9.3 m	9.3 m	9.30 G
Average	10.74 C	11.38 B	12.52 A		11.28 C	12.22 B	12.73 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 3: Effect of conducted treatments on juice acidity (%) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Acidity (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	1.89 a	1.86 a	1.82 a	1.85 A	1.90 a	1.88 a	1.85 a	1.87 A
Tradecorp Ca 7% CaO	1.85 a	1.82 a	1.78 a	1.81 A	1.88 a	1.84 a	1.82 a	1.84 A
Tradecorp Ca 14% CaO	1.82 a	1.79 a	1.76 a	1.79 A	1.85 a	1.82 a	1.79 a	1.82 A
Boramine Ca 3.5% CaO	1.85 a	1.83 a	1.79 a	1.82 A	1.87 a	1.84 a	1.82 a	1.84 A
Boramine Ca 7% CaO	1.80 a	1.76 a	1.74 a	1.76 A	1.84 a	1.81 a	1.79 a	1.81 A
Boramine Ca 14% CaO	1.78 a	1.76 a	1.73 a	1.75 A	1.82 a	1.78 a	1.74 a	1.78 A
Klover Cal-Bor 3.5% CaO	1.82 a	1.79 a	1.76 a	1.79 A	1.83 a	1.80 a	1.73 a	1.78 A
Klover Cal-Bor 7% CaO	1.78 a	1.75 a	1.72 a	1.75 A	1.80 a	1.77 a	1.72 a	1.76 A
Klover Cal-Bor 14% CaO	1.75 a	1.72 a	1.69 a	1.72 A	1.78 a	1.74 a	1.70 a	1.74 A
Control	1.93 a	1.93 a	1.93 a	1.93 A	1.95 a	1.95 a	1.95 a	1.95 A
Average	1.82 A	1.80 A	1.77 A		1.85 A	1.82 A	1.79 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 4: Effect of conducted treatments on vitamin C (mg/100 ml juice) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Vitamin C (mg/100 ml juice)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	11.0 g-i	11.4 e-h	11.7 c-h	11.37 EF	11.3 m-o	11.8 j-n	12.2 h-n	11.77 EF
Tradecorp Ca 7% CaO	11.7 c-h	12.0 b-g	12.4 a-e	12.03 B-D	12.6 e-k	12.9 c-i	13.2 b-h	12.90 BC
Tradecorp Ca 14% CaO	11.8 c-h	12.3 a-f	12.7 a-c	12.27 BC	12.8 d-j	13.3 a-g	13.6 a-e	13.23 B
Boramine Ca 3.5% CaO	10.8 hi	11.2 f-i	11.5 d-h	11.17 F	11.2 no	11.5 l-o	11.9 i-n	11.53 F
Boramine Ca 7% CaO	11.3 e-i	11.6 c-h	12.0 b-g	11.63 C-F	11.9 i-n	12.3 g-n	12.7 e-k	12.30 C-E
Boramine Ca 14% CaO	11.4 e-h	11.9 b-g	12.2 b-f	11.83 C-E	12.2 h-n	12.5 f-l	12.9 c-i	12.53 CD
Klover Cal-Bor 3.5% CaO	11.2 f-i	11.5 d-h	11.8 c-h	11.50 D-F	11.7 k-n	12.0 i-n	12.4 g-l	12.03 D-F
Klover Cal-Bor 7% CaO	12.2 b-f	12.6 a-d	13.0 ab	12.60 AB	13.2 b-h	13.5 a-f	13.9 a-c	13.53 AB
Klover Cal-Bor 14% CaO	12.4 a-e	13.0 ab	13.4 a	12.93 A	13.8 a-d	14.0 ab	14.3 a	14.03 A
Control	10.2 i	10.2 i	10.2 i	10.20 G	10.5 o	10.5 o	10.5 o	10.50 G
Average	11.40 B	11.77 A	12.09 A	--	12.12 B	12.43 Ab	12.76 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 5: Effect of conducted treatments on total sugars (mg/g) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Total sugars (mg/g)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	35.2 o	37.8 mn	39.4 kl	37.47 E	37.6 n	39.8 lm	40.4 lm	39.27 F
Tradecorp Ca 7% CaO	37.4 n	41.2 j	43.6 g-i	40.73 D	39.3 m	40.8 l	45.2 hi	41.77 E
Tradecorp Ca 14% CaO	40.3 jk	43.5 g-i	46.7 cd	43.50 C	43.4 jk	46.6 fg	47.3 e-g	45.77 D
Boramine Ca 3.5% CaO	38.6 lm	40.3 jk	42.5 i	40.47 D	40.2 lm	40.8 l	43.5 j	41.50 E
Boramine Ca 7% CaO	40.6 j	43.4 g-i	45.7 de	43.23 C	44.2 ij	47.6 ef	48.3 de	46.70 C
Boramine Ca 14% CaO	42.6 hi	45.8 de	48.6 b	45.67 B	49.0 cd	49.8 bc	52.3 a	50.37 A
Klover Cal-Bor 3.5% CaO	42.7 hi	43.6 g-i	45.3 ef	43.87 C	44.3 ij	46.6 fg	47.8 d-f	46.23 CD
Klover Cal-Bor 7% CaO	43.7 gh	44.5 fg	47.6 bc	45.27 B	46.2 gh	48.4 de	50.8 b	48.47 B
Klover Cal-Bor 14% CaO	45.6 d-f	48.3 b	50.4 a	48.10 A	47.8 d-f	50.6 b	53.2 a	50.53 A
Control	40.3 jk	40.3 jk	40.3 jk	40.30 D	42.2 k	42.2 k	42.2 k	42.20 E
Average	40.70 C	42.87 B	45.01 A	--	43.42 C	45.32 B	47.10 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 6: Effect of conducted treatments on peel Ca (%) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Peel Ca (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	62.3 kl	64.7 jk	70.3 hi	65.77 G	66.4 p	70.6 o	74.7 m	70.57 H
Tradecorp Ca 7% CaO	73.4 h	78.3 g	82.4 ef	78.03 D	83.3 i	87.5 gh	92.6 f	87.80 D
Tradecorp Ca 14% CaO	79.6 fg	83.2 e	87.6 cd	83.47 C	88.7 g	92.6 f	95.4 e	92.23 C
Boramine Ca 3.5% CaO	59.4 lm	63.3 k	67.7 ij	63.47 H	62.3 q	65.6 p	70.3 o	66.07 I
Boramine Ca 7% CaO	67.3 ij	73.4 h	77.5 g	72.73 E	74.3 mn	79.2 k	83.5 i	79.00 F
Boramine Ca 14% CaO	69.6 i	73.2 h	78.7 g	73.83 E	78.4 k	82.7 i	87.4 h	82.83 E
Klover Cal-Bor 3.5% CaO	63.5 k	69.6 i	73.3 h	68.80 F	73.2 n	76.5 l	80.7 j	76.80 G
Klover Cal-Bor 7% CaO	82.2 ef	86.5 d	90.3 bc	86.33 B	92.6 f	97.3 d	100.6 c	96.83 B
Klover Cal-Bor 14% CaO	90.3 bc	93.4 b	98.7 a	94.13 A	98.4 d	103.6 b	109.4 a	103.80 A
Control	56.4 mn	56.4 mn	56.4 mn	56.40 J	58.3 r	58.3 r	58.3 r	58.30 J
Average	70.40 C	74.20 B	78.29 A	--	77.59 C	81.39 B	85.29 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 7: Effect of conducted treatments on percentage flesh Ca (%) of Canino apricot fruit at harvest during 2008 and 2009 seasons.

Treatments	Flesh Ca (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	47.3 q	50.4p	54.6 n	50.77 H	50.4 l	53.3 jk	58.5 hi	54.07 G
Tradecorp Ca 7% CaO	61.2 j	65.8 g	68.5 e	65.17 D	62.6 g	66.4 f	70.7 e	66.57 D
Tradecorp Ca 14% CaO	64.7 h	67.3 f	72.4 c	68.13 C	67.3 f	71.5 de	75.3 b	71.37 C
Boramine Ca 3.5% CaO	43.6 r	46.5 q	50.2 p	46.77 I	47.2 m	52.4 k	54.6 j	51.40 H
Boramine Ca 7% CaO	50.6 p	54.8 n	60.3 r	55.23 F	53.5 jk	58.2 i	62.4 g	58.03 F
Boramine Ca 14% CaO	54.6 n	59.3 l	63.5 i	59.13 E	58.3 hi	62.6 g	66.5 f	62.47 E
Klover Cal-Bor 3.5% CaO	50.4 p	53.3 o	57.7 m	53.80 G	49.2 l	53.4 jk	59.6 h	54.07 G
Klover Cal-Bor 7% CaO	68.5 e	72.3 c	75.4 b	72.07 B	70.6 e	73.5 c	76.2 b	73.43 B
Klover Cal-Bor 14% CaO	70.4 d	72.6 c	77.3 a	73.43 A	72.3 cd	75.4 b	79.4 a	75.70 A
Control	40.6 s	40.6 s	40.6 s	40.60 J	42.3 n	42.3 n	42.3 n	42.30 I
Average	55.19 C	58.29 B	62.05 A	--	57.37 C	60.90 B	64.55 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 8: Effect of conducted treatments on weight loss (%) of Canino apricot fruit after 40 days of cold storage during 2008 and 2009 seasons.

Treatments	Weight loss (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	14.6 b	10.8 de	7.6 i	11.00 C	16.2 bc	14.4 cd	10.2 g-i	13.60 B
Tradecorp Ca 7% CaO	10.3 ef	5.7 k	4.2 m-o	6.73 G	11.5 e-g	6.8 k-n	5.6 m-p	7.97 D-F
Tradecorp Ca 14% CaO	9.8 fg	5.0 kl	3.9 no	6.23 H	10.3 g-i	6.3 l-o	4.3 op	6.97 E-G
Boramine Ca 3.5% CaO	15.3 b	12.8 c	8.9 h	12.33 B	17.6 ab	13.5 de	10.8 f-h	13.97 B
Boramine Ca 7% CaO	12.8 c	7.2 ij	4.9 lm	8.30 E	13.2 h-j	8.9 h-k	6.7 k-n	9.60 D
Boramine Ca 14% CaO	11.2 d	6.8 j	4.6 ln	7.53 F	12.7 d-f	7.5 j-m	6.2 m-o	8.80 DE
Klover Cal-Bor 3.5% CaO	13.3 c	8.7 h	5.3 kl	9.10 D	14.8 cd	10.6 f-i	8.5 i-l	11.30 C
Klover Cal-Bor 7% CaO	9.3 gh	4.6 l-n	3.7 o	5.87 H	10.6 f-i	5.8 m-p	4.0 op	6.80 FG
Klover Cal-Bor 14% CaO	8.7 h	3.8 o	2.4 p	4.97 I	10.0 g-i	4.7 n-p	3.6 p	6.10 G
Control	16.4 a	16.4 a	16.4 a	16.40 A	19.3 a	19.3 a	19.3 a	19.30 A
Average	12.17 A	8.18 B	6.19 C	--	13.62 A	9.78 B	7.92 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Effect of Conducted Treatments on the Calcium Content:

Peel content of calcium was significantly the highest with double sprays (Table 6). Meanwhile, early spray i.e 30 days prior to anticipated maturity resulted in the least significant content. On the average, all of the sprayed compounds significantly increased this parameter compared with the control. Klover Cal-Bor at 14% CaO resulted in significantly the highest peel content compared with the remaining treatments. Interaction data show that, significantly the peel content of calcium was due to the double sprays of Klover Cal-Bor at 14% CaO. Single spray of this component at same concentration at 15 days before anticipated maturity followed. As for flesh content of calcium, only the average the double sprayed treatment resulted in significantly the highest content while the early spray resulted in the least content

(Table 7). Results attained by late spray were significantly higher than those attained by the early one. On the average, the calcium content of the fruits was significantly increased by all of the treatments as compared with the control. Results attained by Klover Cal-Bor at 14 % CaO were significantly the highest in both seasons. Interaction results show that double sprays of Klover Cal-Bor at 14 % CaO resulted in the highest flesh calcium content in both seasons of the investigation.

Effect of Conducted Treatments on Fruit Quality after 40 Days of Cold Storage:

Double calcium sprays resulted in significantly the least weight loss percentage (Table 8). On the average, weight loss percentage was significantly the highest in control fruits, while all of the treatments reduced this percentage significantly. In this respect,

Table 9: Effect of conducted treatments on decay (%) of Canino apricot fruit after 40 days of cold storage during 2008 and 2009 seasons

Treatments	Decay (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	29.3 c	28.4 d	24.2 hi	27.30 C	32.3 c	30.4 d	30.6 d	31.10 C
Tradecorp Ca 7% CaO	25.6 f	22.4 k	19.3 no	22.43 G	27.7 gh	26.3 i	23.4 j	25.80 F
Tradecorp Ca 14% CaO	23.7 ij	23.2 jk	18.5 op	21.80 H	25.6 i	22.7 jk	21.3 l	23.20 G
Boramine Ca 3.5% CaO	30.8 b	30.5 b	24.6 gh	28.63 B	33.9 b	32.5 c	32.4 c	32.93 B
Boramine Ca 7% CaO	27.5 e	25.2 fg	21.4 l	24.70 E	29.7 de	28.8 ef	28.3 f-h	28.93 D
Boramine Ca 14% CaO	25.7 f	25.2 fg	20.5 m	23.80 F	28.6 fg	27.5 h	25.4 i	27.17 E
Klover Cal-Bor 3.5% CaO	28.4 d	28.4 d	23.3 j	26.70 D	32.5 c	30.4 d	28.9 ef	30.60 C
Klover Cal-Bor 7% CaO	19.5 n	16.4 q	13.5 s	16.47 I	21.9 kl	21.3 l	17.4 n	20.20 H
Klover Cal-Bor 14% CaO	17.8 p	15.2 r	12.4 t	15.13 J	19.2 m	16.3 o	15.5 o	17.00 I
Control	32.6 a	32.6 a	32.6 a	32.60 A	35.4 a	35.4 a	35.4 a	35.40 A
Average	26.09 A	24.75 B	21.03 C	--	28.68 A	27.16 B	25.86 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 10: Effect of conducted treatments on fruit firmness (lb/inch²) of Canino apricot after 40 days of cold storage during 2008 and 2009 seasons

Treatments	Firmness (lb/inch ²)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	7.5 kl	8.4 h-j	9.3 fg	8.40 G	8.3 o-q	8.7 m-p	10.2 g-i	9.07 F
Tradecorp Ca 7% CaO	9.3 fg	10.0 ef	11.5 bc	10.27 CD	9.4 jk	10.0 hi	11.8 bc	10.40 C
Tradecorp Ca 14% CaO	9.4 fg	10.2 e	11.7 a-c	10.43 BC	10.2 g-i	10.3 gh	12.0 bc	10.83 B
Boramine Ca 3.5% CaO	7.3 l	8.0 j-l	8.9 g-i	8.07 G	8.0 q	8.2 pq	10.0 hi	8.73 G
Boramine Ca 7% CaO	8.9 g-i	9.0 gh	10.3 de	9.40 E	8.8 l-o	8.9 k-n	10.5 f-h	9.40 E
Boramine Ca 14% CaO	9.0 gh	9.4 fg	11.2 c	9.87 D	9.2 j-m	9.7 ij	11.5 cd	10.13 C
Klover Cal-Bor 3.5% CaO	7.8 j-l	8.5 h-j	10.3 de	8.87 F	8.5 n-q	9.3 j-l	10.7 e-g	9.50 DE
Klover Cal-Bor 7% CaO	10.0 ef	10.3 de	12.2 ab	10.83 AB	10.2 g-i	11.0 d-f	12.3 ab	11.17 A
Klover Cal-Bor 14% CaO	10.2 e	11.0 cd	12.4 a	11.20 A	10.3 gh	11.2 de	12.7 a	11.40 A
Control	8.2 i-k	8.2 i-k	8.2 i-k	8.20 G	9.7 ij	9.7 ij	9.7 ij	9.70 D
Average	8.76 C	9.30 B	10.60 A	--	9.26 C	9.70 B	11.14 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 11: Effect of conducted treatments on juice TSS (%) of Canino apricot fruit after 40 days of cold storage during 2008 and 2009 seasons

Treatments	TSS (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	11.5 i	12.7 f-h	13.2 e-g	12.47 F	13.2 k	14.6 e-h	15.0 c-f	14.27 CD
Tradecorp Ca 7% CaO	11.8 hi	12.4 g-i	13.8 de	12.67 EF	13.5 i-k	14.0 g-k	15.3 b-e	14.27 CD
Tradecorp Ca 14% CaO	12.3 g-i	13.7 de	15.2 ab	13.73 BC	13.8 h-k	15.0 c-f	15.7 a-d	14.83 B
Boramine Ca 3.5% CaO	12.0 hi	13.2 e-g	13.8 de	13.00 DE	13.4 jk	13.8 h-k	14.2 f-j	13.80 D
Boramine Ca 7% CaO	12.5 gh	13.8 de	14.2 cd	13.50 CD	13.8 h-k	14.4 e-i	15.7 a-d	14.63 BC
Boramine Ca 14% CaO	12.7 f-h	14.2 cd	15.2 ab	14.03 B	14.5 e-h	15.7 a-d	16.0 ab	15.40 A
Klover Cal-Bor 3.5% CaO	12.6 gh	13.6 d-f	14.0 c-e	13.40 CD	13.2 k	14.5 e-h	15.3 b-e	14.33 B-D
Klover Cal-Bor 7% CaO	13.2 e-g	14.3 b-d	14.8 a-c	14.10 AB	13.7 h-k	14.8 d-g	15.8 a-c	14.77 BC
Klover Cal-Bor 14% CaO	13.6 d-f	14.8 a-c	15.4 a	14.60 A	14.2 f-j	15.8 a-c	16.3 a	15.43 A
Control	9.8 j	9.8 j	9.8 j	9.80 G	10.3 l	10.3 l	10.3 l	10.30 E
Average	12.20 C	13.25 B	13.94 A	--	13.36 C	14.29 B	14.96 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 12: Effect of conducted treatments on juice acidity (%) of Canino apricot fruit after 40 days of cold storage during 2008 and 2009 seasons

Treatments	Acidity (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	1.68 ab	1.43 a-e	1.21 e-h	1.44 B	1.60 b	1.37 c-f	1.14 g-j	1.37 B
Tradecorp Ca 7% CaO	1.64 a-c	1.40 b-g	1.17 e-h	1.40 B	1.57 b	1.33 d-f	1.11 h-j	1.33 B
Tradecorp Ca 14% CaO	1.61 a-d	1.38 b-h	1.15 e-h	1.38 B	1.54 bc	1.31 e-g	1.08 ij	1.31 B
Boramine Ca 3.5% CaO	1.64 a-c	1.42 a-f	1.18 e-h	1.41 B	1.56 b	1.32 d-f	1.11 h-j	1.33 B
Boramine Ca 7% CaO	1.60 a-d	1.35 c-h	1.13 e-h	1.36 B	1.53 bc	1.30 e-g	1.08 ij	1.30 B
Boramine Ca 14% CaO	1.57 a-d	1.32 d-h	1.10 gh	1.33 B	1.51 bc	1.27 f-h	1.03 j	1.27 B
Klover Cal-Bor 3.5% CaO	1.61 a-d	1.38 b-h	1.15 e-h	1.38 B	1.52 bc	1.29 fg	1.02 j	1.27 B
Klover Cal-Bor 7% CaO	1.57 a-d	1.34 c-h	1.12 f-h	1.34 B	1.49 b-d	1.26 f-h	1.02 k	1.25 BC
Klover Cal-Bor 14% CaO	1.54 a-d	1.31 d-h	1.09 h	1.31 B	1.47 b-e	1.23 f-i	0.98 j	1.22 BC
Control	1.72 a	1.72 a	1.72 a	1.72 A	1.89 a	1.89 a	1.89 a	1.89 A
Average	1.61 A	1.40 B	1.20 C	--	1.56 A	1.35 B	1.15 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 13: Effect of conducted treatments on weight loss (%) of Canino apricot fruit after 5 days of shelf life during 2008 and 2009 seasons

Treatments	Weight loss (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	2.96 bc	2.04 d-f	1.88 e-g	2.29 B	3.76 bc	2.97 d-f	2.03 g-k	2.92 C
Tradecorp Ca 7% CaO	1.75 e-h	1.43 f-j	0.96 h-k	1.38 DE	1.94 i-n	1.76 h-l	1.39 j-o	1.70 E
Tradecorp Ca 14% CaO	1.46 f-j	0.96 h-k	0.74 i-k	1.05 EF	1.82 h-k	1.58 i-n	1.28 k-o	1.56 E
Boramine Ca 3.5% CaO	3.46 b	2.53 c-e	1.96 d-g	2.65 B	4.53 b	3.62 cd	2.24 f-i	3.46 B
Boramine Ca 7% CaO	2.02 d-g	1.76 e-h	1.53 f-i	1.77 CD	2.93 d-f	2.46 e-h	1.84 h-k	2.41 D
Boramine Ca 14% CaO	1.86 e-g	1.43 f-j	1.14 g-k	1.48 DE	2.14 g-j	1.94 g-k	1.63 i-m	1.90 E
Klover Cal-Bor 3.5% CaO	2.82 b-d	1.95 d-g	1.84 e-h	2.20 BC	3.23 c-e	2.68 e-g	1.96 g-k	2.62 CD
Klover Cal-Bor 7% CaO	0.47 k	0.40 k	0.38 k	0.42 G	0.92 m-o	0.83 no	0.65 o	0.80 F
Klover Cal-Bor 14% CaO	0.68 i-k	0.58 jk	0.52 k	0.59 FG	0.99 l-o	0.86 m-o	0.74 o	0.86 F
Control	5.46 a	5.46 a	5.46 a	5.46 A	7.23 a	7.23 a	7.23 a	7.23 A
Average	2.29 A	1.85 B	1.64 B	--	2.95 A	2.59 B	2.09 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 14: Effect of conducted treatments on decay (%) of Canino apricot fruit after 5 days of shelf life during 2008 and 2009 seasons.

Treatments	Decay (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	8.3 bc	6.5 d-f	4.5 h-j	6.43 C	9.2 b	8.3 cd	6.7 f	8.07 B
Tradecorp Ca 7% CaO	6.2 ef	3.6 i-k	3.1 k	4.30 FG	7.3 e	4.5 j	3.4 k	5.07 G
Tradecorp Ca 14% CaO	5.9 fg	3.5 jk	2.5 k	3.97 G	6.2 fg	4.3 j	3.2 k	4.57 H
Boramine Ca 3.5% CaO	8.7 ab	7.6 b-d	5.4 f-h	7.23 B	8.4 c	6.4 fg	6.5 fg	7.10 C
Boramine Ca 7% CaO	7.4 c-e	4.8 g-i	3.4 jk	5.20 DE	7.8 de	5.6 hi	4.5 j	5.97 E
Boramine Ca 14% CaO	6.6 d-f	4.5 h-j	3.2 k	4.77 EF	7.6 e	4.6 j	4.3 j	5.50 F
Klover Cal-Bor 3.5% CaO	7.6 b-d	5.4 f-h	3.5 jk	5.50 D	8.4 c	6.3 fg	5.2 i	6.63 D
Klover Cal-Bor 7% CaO	5.6 f-h	3.3 jk	0.0 0	2.97 H	6.4 fg	4.2 j	0.0 0	3.53 I
Klover Cal-Bor 14% CaO	5.4 f-h	2.5 k	0.0 0	2.63 H	6.1 gh	3.4 k	0.0 0	3.17 J
Control	9.6 a	9.6 a	9.6 a	9.60 A	11.2 a	11.2 a	11.2 a	11.20 A
Average	7.13 A	5.13 B	3.52 C	--	7.86 A	5.88 B	4.50 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

the least percentage of weight loss was attributed to the Klover Cal-Bor at 14 % CaO in both seasons. Comparable results were conducted due to Klover Cal-Bor at 7 % CaO and Tradecorp Ca at 14% in the second season only. Interaction data illustrate that, the double sprays of Klover Cal-Bor at 14 % CaO showed the least weight loss percentage in both seasons. The percentage of decayed fruits was significantly the lowest in double sprayed fruits (Table 9). Control fruits on the average attained significantly the highest percentage of decay. This parameter was reduced statistically as a result of the sprayed treatments. Superiority in this respect was due to the Klover Cal-Bor at 14 % CaO. The interaction results declare that double sprays of Klover Cal-Bor at 14 % CaO resulted in the least decay percentage in both seasons. Insignificant differences were attained by late spray of the same treatment in the second season only.

Significantly the highest flesh firmness was attained by fruits that were sprayed twice (Table, 10). Compared with all treatments in clouded the control Klover Cal-Bor at 14 or 7 % CaO resulted in significantly the highest flesh firmness. The interaction data revealed that double sprays of Klover Cal-Bor at 14 or 7 % CaO led to significantly the firmest fruits in both seasons. Insignificant differences in this respect were observed due to the Tradecorp Ca at 14% CaO treatment in the first season only. On the average, significantly the highest juice TSS% was attained by fruits that were sprayed twice (Table 11). Compared with the control and other treatments the Klover Cal-Bor at 14 % CaO treatment resulted in significantly the highest juice TSS%. Statistically, equal results were due to Klover Cal-Bor at 7 % CaO in the first season and Boramine Ca at 14% CaO in the second one. As for the interaction, in general all sprayed compounds at high concentration when sprayed twice resulted in significantly higher juice TSS%. Significantly the highest juice acidity percentage was attained by fruits sprayed at 30 days before anticipated maturity date (Table 12). Whereas, significantly the least acidity was recorded due to the double sprays. The conducted treatments reduced the juice acidity compared with control but differences between treatments were insignificant. Interaction results reveal that least acidity was detected due to the Klover Cal-Bor at 14 % CaO treatment.

Effect of Conducted Treatments on Fruit Shelf Life:

Double sprays resulted in significantly the least percentage of weight loss in both seasons of the investigation (Table 13). Insignificant differences were observed due to spraying at 15 days before the

anticipated maturity date in the first season only. Untreated fruits attained significantly the highest percentage of weight loss. All of the considered treatments reduced this percentage significantly. Klover Cal-Bor at 14 or 7% CaO resulted in the highest significant reduction with insignificant differences between them. Interaction data show that the least weight loss percentage was due to the Klover Cal-Bor at 14 or 7% CaO regardless the time of spray, the double sprays of Tradecorp Ca at 7 or 14% in both seasons and the late spray of Tradecorp Ca at 14% CaO in the first season only. The percentage of decayed fruit was significantly at the least value with the double calcium spray (Table 14). On the average control fruits were significantly the highest in this respect. Whereas fruits treated with Klover Cal-Bor at 14% CaO were significantly the least. Statistical equal results were due to the Klover Cal-Bor at 7% CaO in the first season only. Interaction data demonstrate that the double sprays of Klover Cal-Bor at 14 or 7% CaO showed no decayed fruits at 5 days of shelf life. Fruit firmness was significantly the highest with the double calcium sprays on the average (Table, 15). On the average, Klover Cal-Bor at 14 % CaO in both seasons and at 7% CaO in the first one resulted in significantly the highest fruit firmness compared with the control and the remaining treatments. The interaction results reveal that double sprays of Klover Cal-Bor at 14 or 7% CaO and Tradecorp Ca at 14% CaO had significant utmost effect in this respect.

Juice TSS% was at the utmost significant magnitude with the double sprays (Table 16). On the average fruits treated with any of the considered treatments were significantly higher than control in this respect. Significantly the highest percentages were due to Klover Cal-Bor at 14 or 7% CaO and Boramine Cal at 14% CaO in the both seasons and Boramine Ca at 7% CaO and Tradecorp Ca at 14% CaO in the second one. Interaction results demonstrate that, the highest juice TSS% was recorded due to Klover Cal-Bor at 14% CaO. Juice acidity was significantly the lowest with the double sprays (Table 17). On the other hand, early spray resulted in the significantly the highest juice acidity after 5 days of room temperature storage. The conducted treatments resulted in reducing this percentage significantly compared with the control. The most pronounced effect was due to Klover Cal-Bor at 14 or 7% CaO in both seasons. The significantly highest interaction effects were attributed to the double sprays of Klover Cal-Bor at 14 or 7 or 3.5% CaO in both seasons and both Boramine Ca and Tradecorp Ca at 14 or 7% CaO in the first season.

Table 15: Effect of conducted treatments on fruit firmness (lb/inch²) of Canino apricot after 5 days of shelf life during 2008 and 2009 seasons.

Treatments	Firmness (lb/inch ²)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	6.5 o	7.3 mn	8.8 g-i	7.53 EF	6.8 o	7.6 l-n	9.8 f-h	8.07 F
Tradecorp Ca 7% CaO	8.0 j-l	9.5 ef	11.5 bc	9.67 B	8.2 kl	9.3 h-j	11.6 bc	9.70 C
Tradecorp Ca 14% CaO	8.2 i-k	9.7 e	11.6 a-c	9.83 B	9.4 hi	9.8 f-h	11.8 ab	10.33 B
Boramine Ca 3.5% CaO	6.3 o	7.6 k-m	8.4 h-j	7.43 F	6.7 o	7.3 m-o	9.5 g-i	7.83 F
Boramine Ca 7% CaO	7.8 j-m	8.2 i-k	9.8 e	8.60 C	7.7 l-n	7.8 l-n	10.2 e-g	8.57 E
Boramine Ca 14% CaO	7.5 lm	8.3 ij	10.7 d	8.83 C	8.0 k-m	8.6 jk	11.0 cd	9.20 D
Klover Cal-Bor 3.5% CaO	6.8 no	7.4 l-n	9.8 e	8.00 D	7.2 no	8.2 kl	10.2 e-g	8.53 E
Klover Cal-Bor 7% CaO	9.0 fh	10.0 cd	11.9 ab	10.30 A	9.0 ij	10.4 d-f	12.0 ab	10.47 B
Klover Cal-Bor 14% CaO	9.4 e-g	10.7 d	12.2 a	10.77 A	9.7 f-i	10.7 de	12.5 a	10.97 A
Control	7.8 j-m	7.8 j-m	7.8 j-m	7.80 DE	8.6 jk	8.6 jk	8.6 jk	8.60 E
Average	7.73 C	8.65 B	10.25 A	--	8.13 C	8.83 B	10.72 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 16: Effect of conducted treatments on juice TSS (%) of Canino apricot fruit after 5 days of shelf life during 2008 and 2009 seasons

Treatments	TSS (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	12.3 j	13.2 g-j	13.4 f-j	12.97 E	14.0 g	15.2 b-g	15.4 a-f	14.87 BC
Tradecorp Ca 7% CaO	12.5 j	12.9 h-j	14.0 e-h	13.13 E	14.2 fg	14.5 d-g	15.6 a-e	14.77 BC
Tradecorp Ca 14% CaO	12.9 h-j	14.2 d-g	15.4 a-c	14.17 B-D	14.4 e-g	15.4 a-f	15.9 a-c	15.23 AB
Boramine Ca 3.5% CaO	12.8 ij	13.8 e-i	14.0 e-h	13.53 DE	14.0 g	14.4 e-g	14.6 d-g	14.33 C
Boramine Ca 7% CaO	13.2 g-j	14.3 c-g	14.4 b-f	13.97 CD	14.5 d-g	14.9 c-g	16.0 a-c	15.13 AB
Boramine Ca 14% CaO	13.3 f-j	14.6 a-e	15.5 ab	14.47 A-C	15.0 b-g	16.0 a-c	16.2 ab	15.73 A
Klover Cal-Bor 3.5% CaO	13.4 f-j	14.2 d-g	14.3 c-g	13.97 CD	14.0 g	15.0 b-g	15.7 a-d	14.90 BC
Klover Cal-Bor 7% CaO	13.9 e-i	14.8 a-e	15.2 a-d	14.63 AB	14.2 fg	15.3 a-f	16.2 ab	15.23 AB
Klover Cal-Bor 14% CaO	14.2 d-g	15.2 a-d	15.6 a	15.00 A	14.8 c-g	16.2 ab	16.5 a	15.83 A
Control	10.7 k	10.7 k	10.7 k	10.70 F	11.4 h	11.4 h	11.4 h	11.40 D
Average	12.92 C	13.79 B	14.25 A	--	14.05 C	14.83 B	15.35 A	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

Table 17: Effect of conducted treatments on juice acidity (%) of Canino apricot fruit after 5 days of shelf life during 2008 and 2009 seasons

Treatments	Acidity (%)							
	2008 Season				2009 Season			
	Date of spray				Date of spray			
	30 DBAM*	15 DBAM*	DS**	Average	30 DBAM*	15 DBAM*	DS**	Average
Tradecorp Ca 3.5% CaO	1.57 ab	1.22 e	0.91 h	1.23 B	1.53 b	1.16 fg	0.86 i	1.18 B
Tradecorp Ca 7% CaO	1.50 b-d	1.21 ef	0.87 h-j	1.19 B-D	1.46 bc	1.12 fg	0.81 i	1.13 C
Tradecorp Ca 14% CaO	1.49 b-d	1.17 e-g	0.85 h-j	1.17 C-E	1.43 c-e	1.10 fg	0.78 ij	1.10 CD
Boramine Ca 3.5% CaO	1.53 bc	1.23 e	0.88 hi	1.21 BC	1.45 cd	1.11 fg	0.80 i	1.12 C
Boramine Ca 7% CaO	1.47 cd	1.15 e-g	0.83 h-j	1.15 D-F	1.42 c-e	1.10 g	0.78 ij	1.10 CD
Boramine Ca 14% CaO	1.46 cd	1.11 g	0.80 ij	1.12 EF	1.40 c-e	1.16 fg	0.83 i	1.13 C
Klover Cal-Bor 3.5% CaO	1.48 cd	1.17 e-g	0.85 h-j	1.17 C-E	1.42 c-e	1.18 f	0.72 jk	1.11 CD
Klover Cal-Bor 7% CaO	1.46 cd	1.13 fg	0.82 ij	1.14 EF	1.38 de	1.15 fg	0.70 k	1.08 D
Klover Cal-Bor 14% CaO	1.43 d	1.10 g	0.79 j	1.11 F	1.36 e	1.02 h	0.67 k	1.02 E
Control	1.64 a	1.64 a	1.64 a	1.64 A	1.76 a	1.76 a	1.76 a	1.76 A
Average	1.50 A	1.21 B	0.92 C	--	1.46 A	1.18 B	0.87 C	--

Mean separation by Duncan Multiple Range (0.05). DBAM* = Days Before Anticipated Maturity DS** = Double Spray

In general double calcium sprays had the most pronounced effect on fruit quality at harvest, after cold storage and after 5 days of shelf life, while spraying at 15 days before anticipated maturity followed. Similar increments in both peel and flesh calcium content were also detected. Other studies, Raese and Drake [29], Conway *et al.* [30] and Satour [13] showed that, fruit quality of apple was more affected by later than early calcium spray. In addition, similar enhancements in fruit quality as a result of calcium sprays were detected by Brown *et al.* [5], Raese *et al.* [31], Crisosto *et al.* [32] and Hernandez-Fuentes [33] on peach, Lanauskas and Kvikliene [12] on apple, Rizk-Alla *et al.* [6] on grapes. Calcium sprays reduced fruit decay, weight loss and reducing the rate of fruit softening Hernandez-Fuentes [33], Saure [34] and Hafez and Haggag [35] on apple. These enhancements might be due to calcium effects on the cell wall as previously mentioned by Conway *et al.* [30], White and Broadly [10], Brummell *et al.* [36], Fry [8] also could be reducing the fruit respiration [3]. The considered treatments differed comparatively in their effects and the concentrations used and this was also associated with calcium concentrations in both the peel and flesh of the fruits. Also, Crisosto *et al.* [32], Serrano *et al.* [37] and Manganaris *et al.* [11] on peach, Wojcik and Szwonek [38], Lanauskas and Kvikliene [12] and Satour [13] on apple demonstrated that, the source of calcium differed in the attained effect. Also Manganaris *et al.* [11] on peach, Wojcik and Szwonek [38], Peryea and Neilsen [14], Lotze *et al.* [15] on apple pointed out that, calcium concentrations had different effects with more pronounced effects due to higher concentration Klover Cal Bor at 14% CaO resulted in general the highest effects and this was accompanied by highest Ca content in peel and flesh of the fruits. The afore mentioned compound is high in boron and this might be the reason for this superior effects of boron which is known to play important roles in fruit quality as mentioned [17].

In conclusion, timing of calcium spray affects the fruit quality at harvest, storage and shelf life. This in our opinion is due to relative accumulations in the fruit. Source of calcium differs in its' effect and this in our opinion might be due to the effects of other substances in the compound directly in enhancing fruit quality or indirectly by affecting the calcium absorption.

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