J. Agric. Sci. Mansoura Univ., 27 (9): 6243 - 6265, 2002

EFFECT OF DORCY 50 (*Hydrogen cyanamide*) SPRAY ON YIELD AND PEACH FRUIT QUALITY AFTER HARVEST AND DURING COLD STORAGE

El-Shiekh, A. F. and M.T. Wahdan
Horticultural Department, College of Agriculture, Suez Canal University, Ismailia, Egypt

ABSTRACT

'EarliGrande' peach [*Prunus persica* (L.) Batsch] trees were sprayed before budbreak in the last week of Dec with 0.5, 1.0, 1.5, and 2.0 % Dorcy 50 (hydrogen cyanamide 49% w/w; HC) in two successive seasons (2000 & 2001). In the first season, 2.5% HC was used and was excluded in the second season because of the excessive thinning. Fruits were stored at 2 or 4 °C and 80-85% RH. Fruits were sampled at harvest (zero time) and at 10-day intervals up to 40 days. The objective was to determine the effect of pre-budbreak HC spray on peach (growing in Ismailia) yield and quality at harvest and after cold storage at different temperatures.

In the first season, fruit number/tree decreased by HC treatments while the average weight (in both seasons) of the individual fruit was increased. The control fruit (no HC treatments) had the lowest fruit weight in both seasons. HC treatments at 1.5, 2.0 (in both seasons), and 2.5% (in the first season) revealed the highest fruit weight. HC at high concentrations (1.5 – 2.5%) increased fruit length and diameter over the control and lower HC concentrations. Also, fruit acidity and 'L' and 'b' colour values were maintained. However, SSC and 'a' colour values were increased by HC treatments while firmness decreased by increasing HC concentration.

Storage at 2°C resulted in a reduction in fruit weight loss, phenolic acids (%), 'a' colour value, and a higher fruit firmness than storage at 4°C. No differences were noticed in fruit acidity, SSC, 'L' and 'b' colour values between storage at 2 or 4°C.

During storage for 40 days, weight loss, SSC, phenolic acids, and 'a' colour values increased while fruit length, diameter, firmness, acidity, and 'b' colour values were decreased.

The combination of 2 or 2.5% HC and fruit storage at 2°C resulted in a reduction of weight loss (%) than using the same HC concentrations and storage at 4°C. In addition, HC treatments in combination with 2°C storage temperature resulted in higher fruit firmness and SSC and a reduction in 'L' and 'a' colour values than using the same HC concentrations and 4°C storage temperature in both seasons.

INTRODUCTION

Peach fruits [*Prunus persica* (L.) Batsch] production in Egypt is increasing especially in Ismailia and Sinai Governorates. The total area of peaches grown in Ismailia and North Sinai is 61500 feddan with a productive area of 61134 feddan and a total production of 97335 Ton (Ministry of Agriculture, 2001).

As a result of increasing the supply of peach fruits, some methods need to be developed to distribute this production over a long period of time during the season. One of these methods is planting early, mid, and late season cultivars. Another method is using cold storage to prolong the shelf life of the fruits.

'EarliGrande' peach is an early season cultivar and if it is possible to get trees breaking their dormancy one or two weeks earlier and in an uniform way, that would benefit the growers to supply the markets with peach fruits early and get better prices. In addition to that, hot weather and the lack of irrigation water could be avoided in summer especially in Sinai. One of the methods to break bud dormancy is by using hydrogen cyanamide (Dormex; HC).

On a worldwide basis, HC has been used for a number of years on fruit crops to supplement lack of winter chilling, induce uniform budbreak and increase yield plus providing several other desirable changes in plant performance.

Studies by Powell (1999) have clearly established that rate of 0.5 to 2.0% HC are the most effective for use on peaches.

HC has been reported to be a useful dormancy breaking agent for peaches (Diaz *et al.* (1987). Shulman *et al.* (1986) reported that when HC applied several weeks before natural budbreak in peaches, the most consistent and complete bloom development was seen.

Fallahi *et al.* (1992) found that prebloom application of HC at > 0.75% reduced fruit set and yield in 'Friar' plum. Similarly, Lloyd and Firth (1993) reported that when HC applied in early winter, it was ineffective in promoting floral budbreak, induced significant floral bud abscission and reduced yield. In addition, Aksoy *et al.* (1995) stated that 3 or 5% HC prior to bud burst had no effect on yield. However, 3% HC reduced SSC and pH values indicating delayed maturity

El-Kassas *et al.* (1996) reported that the initial fruit set (after 2 weeks of full bloom) was high in 1 or 2% HC treatment (just after winter pruning), but while the fruit set of control trees decreased gradually until harvest, that of HC declined sharply in this time. Ultimate fruit set of peach and nectarine was significantly reduced by 1 or 2% HC. Fruit weight, diameter and length, SSC, and SSC/acid ratio were increased in comparison to the control. However, fruit firmness and total acidity were decreased

Rodrigues *et al.* (1999) sprayed peach trees with 0, 0.15, 0.3, 0.45, or 0.6% HC at full bloom. The percentage of flower thinning increased as HC concentration increased. Fruit weight increased as percentage thinning increased. No changes in SSC, colour, or flesh firmness were observed due to thinning.

Abdel-Hamid (1999) found that 100 or 200 *ppm* HC at close pink bud stage of 'Flordaprince' peaches had no effect on fruit firmness, SSC, or acidity. Similar results were reported by Powell *et al.* (2000) who found that HC sprays replace the lack of chilling and improve cropping of Kiwifruits. Rates of 1, 1.5, and 2% of HC significantly increased yield with the highest rate providing the maximum yield when applied 3-4 weeks before normal bud break. Fruit size and overall fruit quality were good but the treatments had no effect on fruit size, shape, SSC or firmness.

Depending upon the time of application, HC can cause uniform peach budbreak which results in saving harvest time and labor. Little information is available about the effect of winter-sprayed HC before budbreak on 'EarliGrande' peach fruit quality after harvest and during cold storage. Therefore, the objective of this study was to determine the effect of pre-budbreak HC spray on peach (growing in Ismailia) yield and quality at harvest and after cold storage at different temperatures.

MATERIALS AND METHODS

'EarliGrande' peach trees 15 years old, grown in a sandy soil at Abou-Sweer, Ismailia were used. The selected trees were sprayed before bud break in the last week of Dec. with 0.5, 1.0, 1.5, and 2.0 % Dorcy 50 (hydrogen cyanamide; HC) in two successive seasons (2000 and 2001). In the first season, 2.5% HC was used and was excluded in the second season because of the excessive thinning. Control trees were sprayed with regular water. All treatments were applied with a handgun to the run off.

One hundred and fifty fruits from each treatment were hand harvested in the last week of April. The fruits were at the optimal commercial fresh market flavour development (76.70, 4 33, and 52.90 for 'L', 'a', and 'b' colour values, respectively; 66.66 N for firmness; 10.00% for SSC; 0.736% for acidity in 2001 season. In the second season, 71.53, 2.57, and 53.77 were the fruit 'L', 'a', and 'b' colour values, respectively; 53.07 N for firmness; 12.67% for SSC; 0.721% for acidity. The fruits were transported to the lab within 1 hr of harvest.Fruits were sorted to eliminate defects. Sound fruit were washed by chlorine solution, 100 ppm, and air dried. Three individual fruits were used per replicate. Three replicates were used per treatment. Fruits were put in perforated colourless plastic 36.5 x 24.5 cm bags (1 mm in diameter hole per 16 cm bag area). All bags from each treatment were divided into two groups. Each group was stored at 2 or 4 °C and 80-85% RH. Fruits were sampled at harvest (zero time) and at 10-day intervals. Fruits were analyzed upon removal from the cooler up to 40 days

Parameters evaluated at harvest were fruit yield (number/tree) and individual fruit weight. Fruit weight , length, diameter, length/diameter ratio, firmness, soluble solids content (SSC), titratable acidity (TA), phenolic acids and colour intensity of fruit pulp were determined at harvest and at 10-day intervals.

Fresh weight loss evaluation: Fruits were weighed individually after harvest, labeled, and stored. At each sampling time (10-day intervals up to 40 days) the same fruit were reweigh. Weight loss was expressed as a percentage of the original fresh weight of the fruit.

Fruit shape: Fruit length, diameter, and length/diameter ratio were evaluated.

Firmness: It was measured on two sides of the fruit using Effegi penetrometer (McCormick, Yakima, Washington) with 0.7 cm plunger.

For chemical analysis, peel and seed of the fruits were removed and the remaining tissues were pulped into purees (using a blender).

Soluble solids content (SSC): They were determined in the purees using Milton Roy (Japan) refractometer.

Acidity: It was determined by titrating 10 g of purees using 0.1N NaOH until pH 8.0 and expressed as % citric acid.

Total phenolic acids: They were quantitatively determined by the methods of Weurman and Swain (1955) at 640 nm with chlorogenic acid as the standard (Coseteng and Lee, 1987).

Colour intensity. Pulp colour evaluation was done for each treatment at two opposite sides of each fruit in each replicate using a Minolta CR 10 Chromameter (Minolta Crop , Japan) measuring CIE L. 'a', and 'b' coordinates (Francis, 1980). 'L' colour value (brightness, used as browning intensity, Kuczynski *et al.*, 1992 and Lee *et al.*, 1990), which measures relative white (100) to black (0) colour, 'a' colour value, which indicates relative green (-) or red (+) colour, and 'b' colour value, which measures relative yellow (+) to blue (-) colour. Average values were determined for individual replicate for subsequent statistical analyses

The statistical analysis was done between all the effects, HC treatments, storage temperatures, and storage duration. The experimental design was completely randomized with a factorial arrangement of HC treatments, storage temperatures and storage duration (Steel and Torrie, 1980). Analyses of variance and means comparison (LSD, 5%) were performed using Statistix 4.1 (Analytical Software, Inc., Tallahassee, FL). The model used for analysis contained HC treatments, storage temperatures, and storage duration effects and their interactions.

RESULTS AND DISCUSSION

In the first season, fruit number/tree decreased by HC treatments and the decreases were the highest with the 2% HC but the data failed to show significant differences (Table 1). In the second season, no significant differences were noticed between the different HC concentrations although HC at 1, 1.5 and 2% resulted in lower fruit number/tree than 0.5 % (Table 1) In the contrary, HC treatments increased the average weight of the individual fruit in both seasons. The control fruit (no HC treatments) had the lowest fruit weight in both seasons. HC treatments at 1.5, 2.0 (in both seasons), and 2.5% (in the first season) revealed the highest fruit weight. Similarly, El-Kassas *et al.* (1996) reported that HC at 1 or 2% resulted in a sharp reduction in fruit set and ultimate peach fruit yield was declined. Also, Rodrigues *et al.* (1999) reported that sprays HC at 0.15, 0.30, 0.45, or 0.60% on peaches at full bloom increased fruit weight.

Weight loss (%).

Interactions of hydrogen cyanamide (HC) x storage temperature (ST) x storage periods (SP) were not significant in both seasons (Table 1).

Table 1. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit yield (number/tree), average fruit weight (gm.), and fruit weight loss (%) in 2001 & 2002 seasons.

Parameter	Storage period (SP, days)	Storage temp (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
Weight Loss (%)	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	10		3.16	3.13	3.30	6.30	6.58	6.53	4.87	6.43	5.27	6.73	4.59	—		
	20		7.63	3.27	7.90	6.70	8.30	8.20	8.92	11.70	9.25	5.90	5.71	—	9.24	7.07
	30		15.98	11.67	11.80	6.17	14.07	12.20	14.92	12.47	11.94	9.77	17.57	—		
	40		20.31	11.47	16.81	9.80	18.20	14.17	19.62	11.77	19.83	12.37	20.49	—		
	0	[illegible]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—		
	10		2.92	5.60	5.51	5.96	8.54	6.13	6.26	5.43	3.71	7.30	9.98	—		
	20		9.38	8.00	12.29	4.90	14.02	5.47	13.16	8.70	13.57	9.77	12.95	—	10.97	7.57
	30		16.03	11.37	15.90	5.83	15.36	8.20	14.63	6.27	14.09	10.47	16.34	—		
	40		19.78	14.80	21.24	12.87	20.56	11.27	17.51	17.77	21.71	23.17	21.56	—		
CEHC[Y]			9.52	6.93	9.47	5.85	10.56	7.22	10.19	8.05	9.94	8.55	10.92	—		
CESP[X]							**2001**		**2002**							
	0						0.00		0.00							
	10						5.56		5.95							
	20						10.26		7.26							
	30						14.89		9.44							
	40						19.80		13.94							
	LSD 5%						**2001**		**2002**							
		HC / ST / SP					1.29 / 0.74 / 1.18		1.31 / 0.83 / 1.31							
		HC x ST / HC x SP / ST x SP					NS / NS / 1.66		1.86 / 2.94 / 1.86							
		HC x ST x SP					NS		NS							

[1] *Harvest time.*
[2] 2.5% HC was excluded in the second season.
[z] Composite effect of storage temperature
[Y] *Composite effect of HC concentration*
[X] Composite effect of storage period

In the first season, HC x ST and HC x SP interactions were not significant while ST x SP interaction was significant. In the second season, interactions of HC x ST, HC x SP and ST x SP were significant.

In the first season, the only significant increases in weight loss was obtained from 2.5% HC relative to the control and 0.5% HC. No significant differences were noticed between 0, 0.5, 1.0, 1.5, and 2% HC treatments. In the second season, no differences were noticed in weight loss between 1.5 and 2% HC treatments. However, 2% HC resulted in higher fruit weight loss than 0, 0.5, 1.0, or 1.5% HC.

In both seasons, 2°C stored fruits had lower weight loss than 4°C stored ones. This could be explained by the fact that storage at 2°C minimizes the different metabolic process activities, which include respiration and results in less weight loss than storage at 4°C.

During storage for 40 days, fruit weight loss increased significantly. The highest losses were obtained at 30 and 40 days of storage at either 2 or *4°C in* both seasons. *Loss of moisture from the fruits during 30 – 40 days of* storage might explain the increases in fruit weight loss.

The combination of 2 or 2.5% HC and fruit storage at 2°C resulted in a reduction of weight loss (%) than using the same HC concentrations and storage fruits at 4°C.

Fruit shape.

a- Fruit length.

The interaction of HC x ST x SP was significant in the first season while it was not significant in the second season for fruit length (Table 2). Also, HC x ST and ST x SP interactions were not significant and HC x SP interactions were significant in both seasons.

In the first season, HC resulted in significant increases in fruit length and the higher the HC concentrations, the higher the fruit length in comparison with 0, 0 5, and 1% HC treatments. No significant differences were noticed in fruit length between 0.5 and 1% or between 1.5 and 2% HC treatments. HC treatment at 2 5% and 2% revealed the highest fruit length value in the first and second seasons, respectively. In the second season. the control treatment had the lowest fruit length value relative to the other HC treatments.

No significant differences were noticed in fruit length as a result of storage at 2°C or 4°C. During storage, fruit length decreased significantly at 30 and 40 days in the first season while the significant reduction started at 10 days of storage in the second season.

b-Fruit diameter.

Interaction effects of HC x ST x SP, HC x SP and ST x SP were significant while HC x ST interaction was not significant for fruit diameter in the first season (Table 3). All the interactions were not significant in the second season.

The diameter of the fruits increased significantly by increasing HC concentration in both seasons. No major differences were noticed in fruit diameter between 0.5 and 1.0% HC concentrations in the first season.

Table 2. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit length (cm; 2001& 2002 seasons).

Parameter	storage period (SP, days)	Storage temp. (°C; ST)	HC concentration (%) 0		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[t]	01	02
Fruit Length (cm)	0[1]	2	5.30	5.40	5.27	6.07	5.27	5.47	5.30	5.70	5.33	6.07	5.77	—		
	10		4.84	5.37	5.08	5.27	5.02	5.80	5.72	5.57	5.56	5.77	5.85	—		
	20		5.33	4.87	5.20	5.63	5.50	5.97	5.50	5.50	5.30	5.33	5.57	—	5.21	5.57
	30		5.03	5.40	5.27	6.07	4.90	5.47	5.40	5.70	5.10	6.07	4.83	—		
	40		4.00	4.67	4.60	5.93	4.73	5.13	5.40	5.50	5.00	6.07	5.47	—		
	0	4	5.30	5.40	5.27	6.07	5.27	5.47	5.30	5.70	5.33	6.07	5.77	—		
	10		5.13	5.10	5.05	5.07	5.06	5.57	5.56	5.57	5.56	5.43	6.14	—		
	20		4.57	5.40	4.83	5.07	4.87	5.23	5.50	5.80	5.70	5.37	5.43	—	5.16	5.47
	30		4.43	5.40	4.67	5.23	4.97	5.83	5.13	5.80	5.20	5.47	5.53	—		
	40		4.03	4.70	5.43	4.97	4.80	5.67	4.63	5.13	5.33	6.23	5.07	—		
CEHC[Y]			4.80	5.17	5.07	5.46	5.04	5.56	5.35	5.59	5.34	5.82	5.54	—		
CESP[X]							2001			2002						
	0						5.37			5.74						
	10						5.38			5.45						
	20						5.28			5.42						
	30						5.04			5.58						
	40						4.88			5.40						
	LSD 5%						2001			2002						
		HC / ST / SP					0.18 / 0.10 / 0.16			0.20 / 0.13 / 0.20						
		HC x ST / HC x SP / ST x SP					NS / 0.39 / NS			NS / 0.45 / NS						
		HC x ST x SP					0.55			NS						

[1] Harvest time.
[t] 2.5% HC was excluded in the second season
[Z] Composite effect of storage temperature
[Y] Composite effect of HC concentration
[X] Composite effect of storage period

Table 3. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit diameter (cm; 2001 & 2002 seasons).

Parameter	storage period (SP; days)	Storage temp. (°C; ST)	HC concentration (%) 0		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
Fruit diameter (cm)	0[T]	2	4.92	5.03	5.23	5.70	5.17	5.60	5.67	6.13	5.27	6.07	5.73	—		
	10		5.06	5.03	5.22	5.50	5.22	5.83	5.66	5.73	5.27	5.83	5.67	—		
	20		4.90	5.00	5.37	5.60	5.50	5.77	5.77	5.80	5.40	5.20	5.73	—	5.24	5.62
	30		4.23	5.03	5.07	5.70	5.40	5.60	5.10	6.13	5.47	6.07	5.23	—		
	40		4.03	5.07	4.57	5.47	4.83	5.27	5.47	6.30	5.30	5.93	5.87	—		
	0	4	4.92	5.03	5.23	5.70	5.17	5.60	5.67	6.13	5.27	6.07	5.73	—		
	10		4.90	4.63	4.77	4.77	5.09	5.73	5.47	5.83	5.25	5.57	5.87	—		
	20		4.33	4.93	4.87	5.03	5.07	5.57	5.73	6.17	5.37	5.93	5.60	—	5.13	5.49
	30		4.07	5.33	4.43	5.17	4.77	5.57	5.57	5.97	4.83	5.40	5.40	—		
	40		4.07	4.90	5.53	4.93	5.03	5.80	4.90	5.70	5.40	5.83	5.57	—		
CEHC[Y]			4.54	5.01	5.03	5.36	5.13	5.65	5.50	5.99	5.28	5.79	5.64	—		
CESP[X]							2001			2002						
	0						5.33			5.71						
	10						5.29			5.45						
	20						5.30			5.55						
	30						4.96			5.58						
	40						5.05			5.52						
	LSD 5%						2001			2002						
		HC / ST / SP					0.18 / 0.09 / 0.14			0.18 / 0.11 / 0.18						
		HC x ST / HC x SP / ST x SP					NS / 0.33 / 0.19			NS / NS / NS						
		HC x ST x SP					0.47			NS						

[T] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperature.
[Y] Composite effect of HC concentration
[X] Composite effect of storage period

It is obvious that HC at high concentrations (1.5 – 2.5%) increased fruit length and diameter over the control and lower HC concentrations. This might be explained by the reduction of fruit number /tree and the increments of fruit size as it was reported previously under fruit number and weight

Storage at 4°C revealed less fruit diameter than storage at 2°C in *both seasons. As mentioned before,* 4°C *resulted in shrank fruits and* reduced diameter. During storage, fruit diameter decreased and the highest reduction was after 30 and 40 days in the first season. However, the reduction in fruit diameter started at 10 days of storage similar to what happened to fruit length in the second season.

c- Fruit length/diameter ratio.

In the first season, all the interaction effects were not significant (Table 4). In the second season, the only significant interaction was HC x SP for the length/diameter ratio.

The ratio decreased by the HC treatments in comparison with the control and the highest reduction was obtained by 1.5% HC treatment in both seasons. Then, the ratio increased with 2 and 2.5% HC and almost reached 1.00 (0.98 – 1.01) which means that the fruit had round shape.

In general. although the changes in fruit length/diameter ratio were significant, they were almost around the 1.00 value (ranged from 0.98 to 1.06) for the control, 0.5, 1.0, 2.0 and 2.5% HC. HC treated fruits at 1 5% had the ratio between 0.97 and 0.94 in the first and second seasons, respectively.

Storage temperature had no significant effect on the length/diameter ratio. During storage, the ratio was similar up to 30 and 40 days in the first and second seasons. respectively. In the first season, the reduction of the ratio was significant after 40 days of storage. Although the changes in fruit length/diameter ratio during storage were sometimes significant, they were around 1.00 value (ranged from minimum 0.97 to maximum 1.03 values). in both seasons, which indicates that the fruits were almost round in shape and the storage periods had slight effect on the ratio. Similar results were reported by Powell *et al.* (2000) on kiwifruits where HC at 1, 1 5, or 2% had no effect on fruit size or shape

Firmness.

In the first season, the interaction effects of HC x ST x SP, HC x SP, and ST x SP were significant for fruit firmness (Table 5). However, HC x ST interaction was not significant. In the second season, the interaction effects *of HC x ST x SP and HC x ST were not significant while HC x SP and ST x SP* were significant.

In both seasons, fruit firmness decreased as HC concentration increased In the first season. the significant reduction in fruit firmness was obtained by 2 and 2.5% HC over 0. 0.5, 1.0, and 1.5% HC treatments No significant differences in fruit firmness were noticed between 0, 0.5, 1 0, and 1.5% HC and between 0.5, 1 0, 1 5, and 2% HC in the first and second seasons, respectively. On the other hand, Abdel-Hamid (1999) reported that HC sprayed at close pink bud stage of 'Flordaprince' peaches had no effect of fruit firmness.

Table 4. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit length/diameter ratio (2001 & 2002 seasons).

Parameter	storage period (SP; days)	Storage temp. (°C; ST)	HC concentration (%) 0		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[Z]	01	02
Fruit	0[Y]	2	1.08	1.07	1.01	1.06	1.02	0.98	0.94	0.93	1.01	1.00	1.01	—		
Length/	10		0.96	1.07	0.97	0.96	0.96	1.00	1.01	0.97	1.06	0.99	1.03	—		
diameter	20		1.09	0.97	0.97	1.01	1.00	1.03	0.95	0.95	0.98	0.94	0.97	—	1.01	0.99
	30		1.19	1.07	1.04	1.06	0.91	0.98	1.06	0.93	0.94	1.00	0.92	—		
	40		0.99	0.92	1.01	1.09	0.98	0.98	0.99	0.87	0.94	1.02	0.93	—		
	0	4	1.08	1.07	1.01	1.06	1.02	0.98	0.94	0.93	1.01	1.00	1.01	—		
	10		1.05	1.10	1.06	1.07	0.99	0.97	1.02	0.96	1.06	0.98	1.05	—		
	20		1.06	1.09	0.99	1.01	0.96	0.94	0.96	0.94	1.06	0.91	0.97	—	1.01	1.00
	30		1.09	1.01	1.06	1.01	1.05	1.05	0.92	0.97	1.08	1.02	1.03	—		
	40		0.99	0.96	0.98	1.01	0.95	0.98	0.95	0.90	0.99	1.07	0.91	—		
CEHC[X]			**1.06**	**1.03**	**1.01**	**1.02**	**0.99**	**0.98**	**0.97**	**0.94**	**1.01**	**0.99**	**0.98**	—		
CESP[X]							2001			2002						
	0						**1.01**			**1.01**						
	10						**1.02**			**1.01**						
	20						**1.00**			**0.98**						
	30						**1.03**			**1.00**						
	40						**0.97**			**0.98**						
	LSD 5%						2001			2002						
		HC / ST / SP					**0.03/ 0.02 / 0.03**			**0.03 / 0.02 / 0.03**						
		HC x ST / HC x SP / ST x SP					NS / NS / NS			NS / 0.07/ NS						
		HC x ST x SP					NS			NS						

[Y] Harvest time

[Z] 2.5% HC was excluded in the second season.

[Z] Composite effect of storage temperature

[X] Composite effect of HC concentration.

[X] Composite effect of storage period

Table 5. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit firmness (N; 2001 & 2002 seasons).

Parameter	Storage period (SP, days)	Storage temp. (°C, ST)	HC concentration (%) 0		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
Firmness (N)	0[1]	2	66.66	53.07	75.53	45.09	73.75	45.88	78.12	49.15	66.65	52.74	79.60	—		
	10		64.42	53.56	68.86	42.37	63.21	48.00	70.72	46.05	64.79	40.17	68.13	—		
	20		67.01	47.84	58.87	29.51	63.36	33.66	64.50	31.92	63.90	34.85	64.79	—	58.43	36.43
	30		63.68	35.02	52.28	28.07	63.68	27.17	46.94	31.35	45.17	24.45	42.95	—		
	40		41.84	22.74	48.58	22.83	37.77	21.52	41.69	22.58	18.44	21.04	27.03	—		
	0	4	66.66	53.07	75.53	45.09	73.75	45.88	78.12	49.15	66.65	52.74	79.60	—		
	10		66.64	51.76	65.54	37.72	62.20	30.62	73.83	36.38	55.54	42.18	61.02	—		
	20		59.98	35.92	61.01	20.06	43.32	25.23	60.28	25.23	25.03	17.63	31.33	—	44.18	27.06
	30		31.84	14.12	26.66	8.57	25.18	15.35	12.89	12.35	21.11	10.29	17.40	—		
	40		13.77	10.78	18.73	11.61	12.44	9.74	11.92	7.94	16.44	7.06	10.89	—		
CEHC[Y]			54.25	37.79	55.17	29.09	51.87	30.30	53.90	31.21	44.37	30.31	48.27	—		
CESP[X]							2001			2002						
	0						73.39			49.19						
	10						65.41			42.88						
	20						55.29			20.18						
	30						37.48			20.67						
	40						24.96			15.78						
	LSD 5%						2001			2002						
		HC / ST / SP					4.87/ 2.81 / 4.45			2.94 / 1.86 / 2.94						
		HC x ST / HC x SP / ST x SP					NS / 10.89 / 6.29			NS / 6.95 / 4.40						
		HC x ST x SP					15.40			NS						

1 Harvest time.
2 2.5% HC was excluded in the second season.
Z Composite effect of storage temperature
Y Composite effect of HC concentration
X Composite effect of storage period

Similar data was obtained by Rodrigues *et al.* (1999) who found that peach fruit firmness was not affected by full bloom treatments with HC at 0.15, 0.3, 0.45, or 0.6%.

Fruit stored at 2°C had higher firmness than those stored at 4°C. In addition, fruit firmness decreased during storage for 40 days and the lowest value was obtained after 40 days of storage in both seasons. Storage at 4°C may not stop or reduce the catabolism reactions, resulting in a progress in the ripening process, and a reduction in fruit firmness.

The combination of HC treatments and 2°C storage temperature resulted in higher fruit firmness than using the same HC concentrations and 4°C storage temperature in both seasons.

Acidity.

In both seasons, the interactions of HC x ST x SP, HC x ST, and ST x SP were not significant for fruit acidity (Table 6). However, HC x SP interaction was significant.

HC treatments had no major effect on fruit acidity. Slight increases in acidity was revealed by 2% HC in the first season while a reduction was obtained by the same concentration in the second season Other than that, no significant differences were noticed in fruit acidity between the different HC concentrations and the control, HC helped in maintaining fruit acidity. Similarly, Abdel-Hamid (1999) stated that HC treatments on peaches at close pink bud stage had no effect on fruit acidity.

Also, storage temperature had no effect on fruit acidity. However, fruit acidity increased was after 10 days of storage in both seasons then decreased thereafter, in the first season, but not significantly. In the second season, fruit acidity decreased significantly after 10 and 40 days of storage

Soluble solids content (SSC).

The interaction effects of HC x ST x SP, HC x ST, HC x SP, and ST x SP were not significant in the first season (Table 7). In the second season, HC x ST x SP and HC x ST interactions were not significant while HC x SP and ST x SP were significant.

HC treatments resulted in increasing fruit SSC over the control. No significant differences in SSC were noticed between 1.0, 1.5, 2.0, and 2.5% HC treated fruits in the first season. However, in the second season, the highest significant increases in fruit SSC were obtained from 2% HC treatment. No significant increments were revealed in fruit SSC as a result of 0.5, 1.0, or 1.5% HC. Aksoy *et al.* (1995) found that fruit SSC was reduced by 3-5% HC treatments prior to bud burst. However, Abdel-Hamid (1999), Rodrigues *et al.* (1999) and Powel *et al.* (2000) reported no changes in fruit SSC in response to HC treatments

Storage temperatures had no effect on fruit SSC in both seasons. During storage, fruit SSC increased significantly after 20 days then decreased significantly thereafter, in the first season. In the second season, fruit SSC decreased significantly after 10 days of storage and thereafter up to 40 days.

HC treatments in addition to fruit storage at 2°C had higher fruit SSC than using the same HC concentrations and storage fruits at 4°C.

Table 6. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit acidity (%; 2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
Acidity (%)	0	2	0.736	0.721	0.731	0.800	0.791	0.672	0.828	0.872	0.779	0.672	0.810	---		
	10		0.757	0.864	0.776	0.832	0.768	0.821	0.843	0.896	0.907	0.875	0.928	---		
	20		0.779	0.757	0.853	0.811	0.907	0.725	0.853	0.779	0.779	0.843	0.800	---	0.813	0.790
	30		0.821	0.867	0.843	0.896	0.853	0.717	0.800	0.779	0.885	0.800	0.829	---		
	40		0.764	0.811	0.821	0.683	0.839	0.763	0.779	0.715	0.853	0.747	0.672	---		
	0	4	0.736	0.721	0.731	0.800	0.791	0.672	0.828	0.872	0.779	0.672	0.810			
	10		0.789	0.893	0.907	0.875	0.848	0.693	0.853	0.843	0.871	0.785	0.885	---		
	20		0.800	0.785	0.864	0.715	0.757	0.768	0.811	0.789	0.832	0.757	0.725	---	0.818	0.770
	30		0.800	0.925	0.821	0.811	0.821	0.779	0.800	0.747	0.811	0.896	0.871	---		
	40		0.928	0.811	0.832	0.672	0.875	0.640	0.823	0.715	0.843	0.619	0.757			
CEHC[Y]			**0.791**	**0.816**	**0.818**	**0.789**	**0.825**	**0.728**	**0.822**	**0.801**	**0.834**	**0.767**	**0.804**			
CESP[X]							**2001**		**2002**							
	0						**0.779**		**0.748**							
	10						**0.844**		**0.838**							
	20						**0.813**		**0.773**							
	30						**0.826**		**0.825**							
	40						**0.816**		**0.717**							
	LSD 5%						**2001**		**2002**							
			HC / ST / SP				**0.040/ 0.023 / 0.036**		**0.042 / 0.026 / 0.042**							
			HC x ST / HC x SP / ST x SP				**NS / 0.088 / NS**		**NS / 0.094 / NS**							
			HC x ST x SP				**NS**		**NS**							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperature.
[Y] Composite effect of HC concentratio
[X] Composite effect of storage period

Table 7. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on *'EarliGrande' peach fruit soluble solids content* (SSC; %, 2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp. (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
SSC (%)	0	2	10.00	12.67	11.33	14.33	11.00	14.00	11.33	14.00	11.17	16.67	11.67	—		
	10		9.67	11.33	13.00	12.00	10.00	11.33	11.33	11.33	11.67	10.00	10.67	—		
	20		12.67	11.33	12.17	12.00	12.33	12.33	13.33	13.00	11.50	11.33	11.00	—	11.52	12.45
	30		10.67	15.33	12.67	13.33	11.33	15.33	11.67	12.00	12.33	14.67	12.33	—		
	40		10.17	10.00	11.67	10.33	11.17	10.67	11.50	10.33	10.83	10.67	13.33	—		
	0	4	10.00	12.67	11.33	14.33	11.00	14.00	11.33	14.00	11.17	16.67	11.67	—		
	10		10.83	10.67	11.00	12.00	12.00	11.33	10.33	11.33	11.17	10.67	10.83	—		
	20		12.17	16.00	14.33	14.00	11.33	11.33	13.33	13.33	13.33	15.33	12.67	—	11.43	12.55
	30		10.33	16.67	10.67	11.33	10.33	11.33	11.33	10.67	10.83	13.33	10.67	—		
	40		11.33	10.67	11.00	10.33	10.50	10.00	12.33	10.66	12.33	11.00	11.33	—		
CEHC[Y]			**10.78**	**12.73**	**11.92**	**12.46**	**11.10**	**12.17**	**11.78**	**12.07**	**11.63**	**13.03**	**11.62**	—		
CESP[X]							**2001**		**2002**							
	6						**11.08**		**14.33**							
	10						**11.04**		**11.20**							
	20						**12.51**		**13.00**							
	30						**11.26**		**13.40**							
	40						**11.46**		**10.47**							
	LSD 5%						**2002**		**2002**							
		HC / ST / SP					**0.69 / 0.40 / 0.63**		**0.87 / 0.55 / 0.87**							
		HC x ST / HC x SP / ST x SP					**NS / NS / NS**		**NS / 1.96 / 1.24**							
		HC x ST x SP					**NS**		**NS**							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperatnre
[Y] Composite effect of HC concentratio
[X] Composite effect of storage period.

Storage at 4°C may increase the hydrolysis enzyme activities which result in SSC consumption during fruit respiration.

SSC/acid ratio.

The interaction effects of HC x ST x SP and HC x ST were not significant in both seasons (Table 8) while HC x SP and ST x SP interactions were significant.

Fruit SSC/acid ratio was increased by HC treatments in both seasons. The highest increments in the ratio were obtained by 2.5 and 2.0% HC in the first and second seasons, respectively, relative to the control. No significant differences were noticed in fruit SSC/acid ratio between 1.5, 2.0, or 2.5% HC treatments in the first season. The ncrements in the ratio can be explained by the increases in SSC and the maintenance of fruit acidity as a result of high HC concentration.

Fruit SSC/acid ratio was not affected by storage temperature in both seasons. The ratio decreased after 10 days of storage and increased thereafter up to 30 days, in both seasons. At 40 days of storage, fruit SSC/acid ratio maintained in the first season and decreased in the second one.

Phenolic acids (%).

The interaction effects of HC x ST x SP and ST x SP were not significant in the first season (Table 9) while HC x ST and HC x SP interactions were significant. In the second season, HC x ST x SP, HC x ST, HC x SP and ST x SP interactions were not significant.

Fruit phenolic acids increased significantly by HC treatments over the control. No significant differences were revealed in the phenolic acids content between the different HC concentrations in the first season. Similarly, in the second season, 1.0, 1.5, and 2% HC treatments increased fruit total phenolics. No significant differences were noticed between 0 and 0.5% HC or between 1.0, 1.5 and 2.0% HC concentrations

In both seasons, fruit stored at 2°C had less phenolic acids than fruit stored at 4°C but the data showed significant differences in the first season only.

During storage for 40 days, fruit phenolics increased significantly. The increments were the highest after 30 – 40 days of storage in both seasons As moisture loss from the fruits occur during storage, concentration of the other compounds in the cells (including phenolic acids) may increase.

Pulp colour intensity.

The interaction effects of HC x ST x SP, HC x SP and ST x SP were significant for 'L' colour value, which measures relative white (100) to black (0) colour, in the first season (Table 10) while HC x ST interaction was not significant. In the second season, HC x ST x SP, HC x ST and HC x SP interactions were not significant while ST x SP was significant.

HC treatments resulted in a significant reduction in peach pulp 'L' value in the first season, reduction of pulp brightness. However, in the second season, the treatments had no effect on 'L' value of the tissue.

Fruits stored at 2°C had 'L' colour value similar to those stored at 4°C in both seasons.

Table 8. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit SSC/acid (2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp. (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
SSC/acid	0	2	13.64	17.96	15.49	17.99	14.02	20.73	13.80	16.05	14.37	24.86	14.45	—		
	10		12.76	13.16	16.74	14.41	13.03	13.81	13.84	12.85	12.91	11.48	11.50	—		
	20		16.25	15.39	14.27	14.88	13.64	17.03	15.63	16.62	14.83	13.49	13.97	—	14.21	15.96
	30		13.06	17.68	15.05	14.88	13.28	20.56	14.60	15.93	13.93	18.52	14.95	—		
	40		13.37	12.35	14.08	15.15	11.64	14.27	14.80	14.60	12.71	14.37	19.83	—		
	0	4	13.64	17.96	15.49	17.99	14.02	20.73	13.80	16.05	14.37	24.86	14.45			
	10		13.76	12.00	12.19	13.72	14.09	16.37	12.20	13.59	12.93	13.58	13.24	—		
	20		15.25	20.63	16.69	19.43	15.20	14.75	16.43	17.28	16.15	20.35	17.49	—	14.08	16.49
	30		12.93	17.95	13.06	14.01	12.60	14.65	14.28	14.42	13.47	14.89	12.96			
	40		12.23	13.18	13.21	15.47	12.12	15.63	15.05	14.94	14.93	17.77	15.05	—		
CEHC[X]			13.68	15.83	14.63	15.79	13.36	16.85	14.44	15.23	14.86	17.41	14.69	—		
CESP[X]							2001		2002							
	0						14.30		19.52							
	10						13.18		13.50							
	20						15.48		16.99							
	30						13.68		16.35							
	40						14.08		14.77							
	LSD 5%						2001		2002							
		HC / ST / SP					0.89/ 0.51 / 0.81		1.26 / 0.79 / 1.26							
		HC x ST / HC x SP / ST x SP					NS / 1.99 / 1.15		NS / 2.81 / 1.78							
		HC x ST x SP					NS		NS							

[1] Harvest time

[2] 2.5% HC was excluded in the second season.

[Z] Composite effect of storage temperature

[Y] Composite effect of HC concentratio

[X] Composite effect of storage period.

Table 9. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit phenolic acids (%;2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp. (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
Phenolic acids (%)	0	2	0.100	0.129	0.128	0.124	0.132	0.145	0.120	0.130	0.136	0.137	0.113	—		
	10		0.132	0.154	0.124	0.143	0.132	0.146	0.123	0.155	0.148	0.159	0.131	—		
	20		0.120	0.137	0.112	0.147	0.140	0.126	0.128	0.121	0.151	0.155	0.180	—	0.136	0.143
	30		0.116	0.135	0.148	0.135	0.130	0.171	0.144	0.150	0.167	0.147	0.158	—		
	40		0.120	0.129	0.136	0.148	0.137	0.153	0.159	0.150	0.169	0.160	0.154	—		
	0	4	0.100	0.129	0.128	0.124	0.132	0.145	0.120	0.130	0.136	0.137	0.113	—		
	10		0.132	0.155	0.158	0.159	0.142	0.144	0.155	0.130	0.137	0.135	0.127	—		
	20		0.125	0.139	0.164	0.130	0.171	0.152	0.156	0.144	0.154	0.155	0.162	—	0.146	0.146
	30		0.119	0.126	0.180	0.145	0.133	0.160	0.169	0.161	0.134	0.167	0.175			
	40		0.137	0.159	0.161	0.133	0.171	0.169	0.169	0.170	0.160	0.162	0.170			
CEHC[Y]			0.120	0.139	0.144	0.139	0.142	0.151	0.144	0.144	0.149	0.151	0.148	—		
CESP[X]							2001		2002							
	0						0.121		0.133							
	10						0.137		0.148							
	20						0.147		0.141							
	30						0.148		0.150							
	40						0.154		0.153							
	LSD 5%						2001		2002							
		HC / ST / SP					0.011/ 0.006 / 0.010		0.019 / 0.007 / 0.011							
		HC x ST / HC x SP / ST x SP					0.015 / 0.024 / NS		NS / NS / NS							
		HC x ST x SP					NS		NS							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperature.
[Y] Composite effect of HC concentratio
[X] Composite effect of storage period.

In the first season, 'L' colour values increased after 10 days of storage (tissue brightness increased; ripening process in progress) and maintained thereafter up to 40 days. In the second season, 'L' values decreased after 10 days of storage and were maintained thereafter.

The interaction effects of HC x ST x SP and HC x ST for 'a' colour value, which indicate the relative green (-) or red (+) colour, were not significant while HC x SP and ST x SP were significant in the first season (Table 11). In the second season, HC x ST x SP, HC x ST, and ST x SP interactions were not significant. However, HC x SP interaction was significant.

HC treatments had resulted in increasing 'a' colour value of peach pulp in both seasons over the control (fruits advanced more toward ripening). The increments were significant in the second season especially with 2% HC concentration.

Storage at 4°C resulted in significant higher fruit 'a' colour value than the fruits stored at 2°C in both seasons. Storage at 4°C resulted in slowly but surely ripening process more than storage at 2°C.

During storage for 40 days, 'a' colour values increased significantly with the highest value after 30 – 40 days in both seasons.

The HC treatments in combination with fruit storage at 4°C resulted in higher 'L' and 'a' colour values (advanced ripening process) than using the same HC concentrations and fruit storage at 2°C.

The interaction effects of HC x ST X SP and HC x ST were not significant for 'b' colour value in the first season (Table 12). However, HC x SP and ST x SP interactions were significant. In the second season, HC x ST x SP, HC x ST and HC x SP interactions were not significant while ST x SP was significant.

HC treatments resulted in slight fluctuation in 'b' colour value [which measures relative yellow (+) to blue (-) colour] and the highest changes were obtained by 1.0 and 1.5% HC in the first season. In the second season, 'b' value did not change significantly by 0.5% HC over the control while 1.0, 1.5 and 2% HC resulted in a reduction of 'b' colour value relative to the control and 0.5% HC. No differences were noticed in fruit pulp 'b' value between 1.0, 1.5, and 2% HC treatments. Rodrigues *et al.* (1999) found that HC at 0.15, 0.30, 0.45 or 0.60% at peach full bloom had no effect on fruit colour

Storage temperatures had no significant effect on 'b' colour value and there were no differences between 2°C and 4°C on affecting 'b' value. During storage, fruit pulp 'b' value decreased in both seasons.

The beneficial effects of pre-budbreak HC treatments (1.5 – 2.5%) on peach fruits after harvest and during cold storage were in the reduction of fruit number/tree (thinning) which accompanied with fruit weight increases (better prices for better grades) and maintaining fruit acidity It worth to mention too that HC treatments increased fruit SSC and 'a' colour values while 'L' and 'b' pulp colour values were maintained.

Table 10. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit 'L' colour value (2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[Z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
'L' colour value	0	2	76.70	71.53	67.87	71.70	65.60	70.77	66.50	70.67	65.27	71.67	67.73	—		
	10		68.30	69.57	72.93	70.63	72.50	68.30	70.93	70.63	72.87	64.40	73.80	—		
	20		76.90	71.27	72.33	69.00	71.40	65.17	71.37	71.73	71.73	69.90	72.80		71.23	70.88
	30		70.80	69.90	71.03	71.67	69.90	73.50	68.97	71.43	72.70	71.90	69.03	—		
	40		74.43	74.70	71.67	71.80	72.90	72.70	72.87	73.40	71.50	74.03	73.60	—		
	0	4	76.70	71.53	67.87	71.70	65.60	70.77	66.50	70.67	65.27	71.67	67.73	—		
	10		68.97	68.70	74.73	67.53	76.03	65.87	74.23	67.47	73.33	69.43	72.87	—		
	20		75.70	69.60	72.43	72.40	72.07	70.33	70.70	70.73	74.20	72.83	72.50	—	71.85	70.17
	30		77.57	70.50	76.70	68.67	68.93	70.43	69.70	72.67	74.60	69.97	76.17	—		
	40		70.37	71.53	75.87	71.87	66.27	68.70	67.63	71.03	74.63	67.73	69.70	—		
CEHC[Y]			73.64	70.88	72.34	70.70	70.12	69.65	69.94	71.04	71.61	70.35	71.59	—		
CESP[X]							2001		2002							
	0						68.28		71.27							
	10						72.63		68.25							
	20						72.84		70.30							
	30						72.18		71.06							
	40						71.79		71.75							
	LSD 5%						2001		2002							
			HC / ST / SP				1.26/ 0.73 / 1.15		1.40 / 0.88 / 1.48							
			HC x ST / HC x SP / ST x SP				NS / 2.82 / 1.63		NS / NS/ 1.97							
			HC x ST x SP				3.98		NS							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperature.
[Y] Composite effect of HC concentratio
[X] Composite effect of storage period.

Table 11. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit 'a' colour value (2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[x]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
'a' colour value	0	2	4.33	2.57	4.93	5.13	3.77	1.27	5.17	1.50	3.53	2.27	3.40	---		
	10		6.83	3.40	4.20	5.13	5.27	5.87	5.47	2.20	6.63	8.33	4.93	---		
	20		4.50	6.27	5.70	9.73	5.87	10.03	2.80	5.93	5.20	7.10	4.93	---	6.51	6.45
	30		5.80	7.03	9.43	7.50	8.47	7.73	9.93	7.33	6.40	9.67	9.97	---		
	40		9.53	8.27	9.77	9.20	8.67	10.00	6.77	8.83	10.23	8.90	10.77	---		
	0	4	4.33	2.57	4.93	5.13	3.77	1.27	5.17	1.50	3.53	2.27	5.40	---		
	10		7.05	3.17	4.40	5.23	3.87	9.30	3.73	6.17	4.83	6.53	5.23	---		
	20		5.50	7.13	6.10	7.43	8.83	8.27	4.90	8.77	6.50	6.30	9.20	---	7.44	7.34
	30		7.93	7.87	8.97	8.47	10.83	9.33	12.60	9.83	10.63	10.53	8.43	---		
	40		11.67	10.27	9.30	10.50	15.30	11.87	9.13	11.27	9.83	12.40	11.17	---		
CEHC[Y]			6.75	5.85	6.77	7.35	7.46	7.49	6.57	6.33	6.73	7.45	7.54	---		
CESP[X]							2001		2002							
	0						4.52		2.55							
	10						5.20		5.53							
	20						5.84		7.72							
	30						9.12		8.53							
	40						10.18		10.15							
	LSD 5%						2001		2002							
			HC / ST / SP				1.06/0.61 / 0.97		1.05 / 0.67 / 1.05							
			HC x ST / HC x SP / ST x SP				NS / 2.38 / 1.37		NS / 2.36 / NS							
			HC x ST x SP				NS		NS							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[Z] Composite effect of storage temperature.
[Y] Composite effect of HC concentratio
[X] Composite effect of storage period

Table 12. Effect of Dorcy 50 (Hydrogen cyanamide; HC) treatments, storage temperatures, and storage period on 'EarliGrande' peach fruit 'b' colour value (2001 & 2002 seasons).

Parameter	storage period (SP, days)	Storage temp (°C) (ST)	HC concentration (%) 0[1]		0.5		1.0		1.5		2.0		2.5		CEST[z]	
			01	02	01	02	01	02	01	02	01	02	01	02[2]	01	02
'b' colour value	0	2	52.90	53.77	58.33	54.30	59.20	52.87	58.70	53.27	57.20	51.67	60.00	—		
	10		52.47	52.43	52.97	50.07	51.93	49.40	51.10	49.90	55.20	51.10	51.67	—		
	20		50.93	51.27	55.87	52.23	54.77	49.60	54.93	50.53	54.90	49.17	51.57	—	54.49	50.82
	30		53.63	50.73	55.03	50.70	54.90	51.07	52.60	50.33	53.57	49.70	53.10	—		
	40		55.43	50.50	54.80	52.13	51.43	47.07	57.60	48.53	53.90	48.10	54.17	—		
	0	5	52.90	53.77	58.33	54.30	59.20	52.87	58.70	53.27	57.20	51.67	60.00	—		
	10		52.43	51.43	48.23	52.07	50.17	52.17	50.93	51.13	50.03	50.07	52.27	—		
	20		54.10	51.50	52.17	49.20	54.20	47.73	52.37	50.40	51.23	48.47	52.17	—	54.07	51.37
	30		49.10	50.60	51.53	49.57	51.77	50.90	53.70	50.23	49.97	53.17	50.83	—		
	40		60.70	52.27	57.03	49.47	57.77	52.17	59.93	53.53	55.33	52.37	54.43	—		
CEHC[y]			53.49	51.83	54.43	51.40	54.83	50.59	55.06	51.12	53.87	50.55	54.02			
CESP[x]							2001		2002							
	0						57.72		53.17							
	10						51.62		50.98							
	20						53.27		50.01							
	30						52.75		50.70							
	40						56.06		50.61							
	LSD 5%						2001		2002							
		HC / ST / SP					1.33 / 0.77 / 1.31		1.56 / 0.74 / 1.16							
		HC x ST / HC x SP / ST x SP					NS / 2.96 / 1.71		NS / NS / 1.65							
		HC x ST x SP					NS		NS							

[1] Harvest time.
[2] 2.5% HC was excluded in the second season.
[z] Composite effect of storage temperature.
[y] Composite effect of HC concentratio
[x] Composite effect of storage period.

The controversy between the different literatures and also between the data reported herein and the data reported elsewhere might be due to the differences in application time, HC concentrations used, and also the cultivar used in the study. Delayed or advanced spray (even a few days from bud break) could make a big difference in tree response and data obtained.

REFERENCES

Abdel-Hamid, N. (1999). Effect of chemical thinning and thinning pattern on yield and quality of 'Flordaprince' peach. Arab Univ. J. Agric. Sci., 7(1):159-177.

Aksoy, U.; A. Kora; A. Misirli; H. Z. Can; G. Seferoglu and R. Gulcan (1995). Effect of potassium nitrate and hydrogen cyanamide on apricot. Acta Hort., 384:431-434.

Coseteng, M. Y. and C. Y. Lee (1987). Changes in apple polyphenoloxidase and polyphenol concentrations in relation to degree of browning. J. Food Sci., 52:985-989.

Diaz, D. H.; A. Alvarez and J. Sandoval (1987). Cultural and chemical practices to induce uniform budbreak of peach and apple under warm climates in Mexico. Acta Hort., 199:129-136.

El-Kassas, S. E.; M. A. El-Sese; A. M. El-Salhy and M. M. El-Wasfy (1996). Physiological studies on flowering and fruit setting of some peach and nectarine cultivars under Assiut environment. Assiut J. Agric. Sci., 27(2):23-36

Fallahi, E.; B. R. Simons; J. K. Fellman and W. M. Colt (1992). Use of hydrogen cyanamide for apple and plum thinning. Plant Growth Regulation, 11(4):435-439.

Francis, F. J. (1980). Colour quality evaluation of horticultural crops. Hort. Science,15:58-59.

Kuczynski, A.; P. Varoquax and F. Varoquax (1992). Reflectometric method to measure the initial colour and browning rate of white peach pulps. Sci. Aliments, 12:213-221.

Lee, C. Y.; V. Kagan; A. W. Jaworski and S. K. Brown (1990). Enzymatic browning in relation to phenolic compounds and polyphenol-oxidase activity among peach cultivars. J. Agr. Food Chem., 38:99-101.

Lloyd, J. and D. J. Firth (1993). Effect of hydrogen cyanamide and promalin on flowering, fruit set and harvest time of 'Flordaprince' peach in subtropical Australia. J. Hort. Sci., 68(2):177-183.

Powell, A. A. (1999). Action program for dormex application on peaches Dormex Application Information, Dept. of Hort. Sci., Auburn Univ., Auburn, Al., USA pp1-5.

Powell, A. A.; D. G. Himelrick and Ed Tunnell (2000). Effect of hydrogen cyanamide (Dormex) on replacing lack of chilling in kiwifruit. Small Fruits Review, 1(1):79-92.

Rodrigues, A. C.; V. C Ferri; E. Schwartz and J. C. Fachinello (1999) Hydrogen cyanamide in chemical thinning of peach. Ciencia-Rural, 29(4):625-628.

Shulman, Y.; G. Nir and S. Lavee (1986). Oxidative process in bud dormancy and the uses of hydrogen cyanamide in breaking dormancy. Acta Hort., 179:141-148.

Steel, R G. D. and J H. Torrie (1980). Principles and procedures of Statistics. McGrow-Hill Publishing Company, pp. 336-376, NY, USA.

Weurman, C. and T. Swain (1955). Changes in the enzymic browning of Bramley's seedling apples during their development. J. Food Sci. Agric., 6:186-192.

تأثير الرش بدورسي ٥٠ (سياناميد الهيدروجين) على المحصول وجودة ثمار الخوخ بعد الحصاد وأثناء التخزين المبرد

احمد فتح الله الشيخ و محمد طه وهدان
قسم البساتين – كلية الزراعة – جامعة قناة السويس – الإسماعيلية – مصر

تم رش أشجار الخوخ صنف "ايرلي جراند" وذلك قبل تفتح البراعم في الأسبوع الأخير من ديسمبر بمحلول دورسي ٥٠ (سياناميد الهيدروجين ٤٩% وزن لوزن) بتركيزات ٥و ، ١ ، ٥و ١ ، ٢ % خلال موسمي ٢٠٠٠ ، ٢٠٠١ . في الموسم الأول تم استخدام تركيز ٥و٢ % من سياناميد الهيدروجين ولكن تم استبعاده في الموسم الثاني حيث أنه تسبب في الزيادة الشديدة لنسبة الخف. تم تخزين الثمار بعد الجمع علي درجتي حرارة ٢ ، ٤ °م ورطوبة نسبية ٨٠ – ٨٥ % وقد تم تحليل الثمار عند الجمع وكذلك كل ١٠ أيام من التخزين لمدة ٤٠ يوم. وكان الهدف من الدراسة هو التعرف علي تأثير الرش بسياناميد الهيدروجين قبل تفتح البراعم علي المحصول وجودة ثمار الخوخ عند الجمع وبعد التخزين المبرد.

في الموسم الأول عمل سياناميد الهيدروجين علي انخفاض عدد الثمار / شجرة بينما زاد متوسط وزن الثمرة (في كلا الموسمين) ولقد كان أقل وزن للثمار من الأشجار التي لم تعامل بسياناميد الهيدروجين بينما أعطت التركيزات ٥و١ ، ٢ ، ٥و٢ % أعلي وزن للثمرة. كذلك فقد نتج عن المعاملات (٥و١ – ٥و٢ %) زيادة في طول وقطر الثمار بالمقارنة بالأشجار التي لم تعامل وكذلك التركيزات المنخفضة من سياناميد الهيدروجين. ولقد ساعدت المعاملة بسياناميد الهيدروجين علي احتفاظ الثمار بحموضتها أثناء التخزين وكذلك الاحتفاظ بقيم اللون "L"و"b" بينما زادت قيم اللون "a" وكذلك محتوي الثمار من المواد الصلبة الذائبة وقلت كذلك صلابة الثمار بزيادة تركيز سياناميد الهيدروجين.

التخزين علي درجة حرارة ٢ °م نتج عنه قله في فقد الوزن الطازج للثمار ، انخفاض محتوى الثمار من الأحماض الفينولية ، انخفض قيمة اللون "a" وكذلك زيادة صلابة الثمار عن الثمار المخزنة علي ٤ °م بينما لم يتغير محتوي الثمار من الحموضة ، المواد الصلبة الذائبة ، قيم اللون "L"و"b" باختلاف حرارة التخزين.

أثناء تخزين الثمار لمدة ٤٠ يوم حدث زيادة في فقد الوزن الطازج للثمار ، المواد الصلبة الذائبة ، الأحماض الفينولية وكذلك قيم اللون "a" بينما انخفضت قيم طول وقطر الثمار ومحتواها من الحموضة بالاضافة إلي انخفاض قيم اللون "b".

ولقد اتضح أن استخدام سياناميد الهيدروجين بتركيزات ٢ ، ٥و٢ % بالإضافة إلي تخزين الثمار علي درجة ٢ °م نتج عنة انخفاض في فقد الوزن الطازج للثمار وقيم اللون "L" وزيادة صلابة الثمار ومحتواها من المواد الصلبة الذائبة عنه في حالة استخدام نفس تركيزات سياناميد الهيدروجين مع تخزين الثمار علي ٤ °م. .