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Effect of Some Endo-Dormancy Breaking Agents on Flowering, Yield and Fruit Quality of "Canino" Apricot

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THIS INVESTIGATION was conducted during 2005-2006 and 2006-2007 seasons to evaluate the effect of spraying "Canino" apricot (*Prunus armeniaca L.)* trees with 1,2 or 3% Dormex (49% hydrogen cyanamide, HC) and 3 or 5% KNO_3. The present treatments were in combination with 3% light mineral oil (Capl. 2) and applied at 2^{nd}, 9^{th} or 16^{th} Feb. Measurements included dates of: flowering, fruit set, picking, and earliness of picking date than control. Percentages of: flower and vegetative bud burst and retained fruits, were also assessed. Number of matured fruits/tree, fruit yield, crop monetary value and matured fruit characteristics were also estimated. The mentioned components, positively responded to the studied treatments which can be arranged in the following succession: 3% HC > 2% HC> 1% HC > 5% KNO_3 > 3% KNO_3 where we can notice that, HC was more effective than KNO_3 and the effect of HC or KNO_3 increased with concentration increment. Concerning the spray date, 9^{th} Feb. was more effective than 2^{nd} Feb. which was more effective than 16^{th} Feb. It can be concluded that, the best treatment at where 3% Dormex + 3% mineral oil (Capl. 2) was sprayed at 9^{th} Feb. It can be concluded that, the best treatment at where 3% Dormex + 3% mineral oil (Capl. 2) was sprayed at 9^{th} Feb. It attained early production and high yield of good fruit quality of "Canino" apricot which increased grower income.

"Canino" apricot is considered the main cultivar being grown in Egypt. It is characterized by a distinct period of rest (endo-dormancy) which extends from late fall till early spring. Re-growth and flowering in the next season needs overcoming such dormancy (Westwood, 1993).

Many investigators used dormancy breaking agents: Kuden *et al.* (1995 b) used potassium nitrate (KNO_3) to advance apricot flowering and improve fruit TSS. Also, Shakweer (2004) sprayed hydrogen cyanamide (Dormex, HC) + mineral oil to: increase "Canino" apricot flower bud opening, advance flowering and fruit set, increase the percentages of fruit set, fruit retention, number of fruits per tree and fruit yield. Meanwhile, Son and Kuden (2005) showed that HC application advanced flowering of apricot by 2-5 days, while Brunton *et al.* (2006) used HC regularly to advance apricot fruit ripening and achieve higher uniformity of ripening.

Furthermore, treatment of "Amar" apricot trees with Dormex was effective in advancing bud burst and increasing fruit set, yield and fruit diameter, weight, firmness and TSS (Mahrous and El Fakharani, 2006). Moreover, thiourea at 1% + KNO_3 at 3% (Mansour *et al.* 1986) and Dormex at 0.5% + Folk oil at 0.5 (Mansour *et al.* 1999) were the best treatments to terminate endo-dormancy of some peach cultivars. Also KNO_3 at 2% increased yield of peach and nectarine (Kuden *et al.* 1995a), while Dormex or KNO_3 terminated plum winter dormancy, accelerated flower and vegetative bud break and increased the percentages of flower and vegetative bud break, fruit set and yield. Dormex was more effective than KNO_3 (Shahin *et al.*, 1997). Likewise, Dormex at 2% applied to five plum cultivars, increased the percentages of floral and vegetative buds, shortened blooming period, and increased fruit set percentage (Ali *et al.*, 1998).

Other deciduous fruits achieved nearly similar results with the use of HC on "Anna" and "Bericher" apples (Haseeb & El Ezaby, 1995, Petri & Stucker, 1995 and Ali *et al.*, 1997), on "Le-Conte" pear (El Shall *et al.*, 1993) as well as KNO_3 on pear (El Banna *et al.*, 1995).

Therefore, we used endo-dormancy breaking agents at different concentrations and dates to define the best treatment and date that accelerate picking date, improve fruit yield and quality and subsequently increase grower income.

Material and Methods

This research was conducted in a private farm at km 76 Cairo/Alexandria desert road during the 2005-2006 and 2006-2007 seasons on 10-year-old trees of "Canino" apricot (*Prunus armeniaca L.).* Trees, budded on seedling apricot rootstocks and planted 6x6 m in sandy soil, under drip-irrigated and being received similar agricultural practices. Trees used in the experiment were healthy and as uniform as possible.

Endo-dormancy breaking agents used in this study were hydrogen cyanamide (HC, H_2CN_2) in the form of Dormex (Degussa/SKW, Germany; 49%) at 0, 1, 2 or 3% + 3% Capl. 2 light oil. Potassium nitrate was also used at 3 or 5% + 3% Capl. 2 light oil. Both endo-dormancy breaking agents were sprayed at 2nd, 9th or 16th Feb. both studied seasons when chilling hours at the farm location from November till in March for the 2005-2006 and 2006-2007 seasons were estimated and being cleared in the following Table (A):

Spray date	*2005-2006 season		*2006-2007 season	
	≤ 7.2°C	≤ 10°C	≤ 7.2°C	≤ 10°C
2nd Feb.	54	243	68	265
9th Feb.	79	302	98	326
16th Feb.	192	816	213	839

*As climate laboratory of Badr, Tahrir Province metrological station.

Data were recorded on dates of beginning of flowering and fruit set as well as percentages of flower and vegetative bud burst. At harvest time, mature retained fruits, picking date, earliness of harvest date than control, number of fruits/tree and fruit yield were recorded then used to estimating crop monetary value considering a farm-gate price of LE 3 per kg when the yield was sold at 9-11 May, LE 2.5 per kg when sold at 12-14 May, LE 1.5 per kg when sold at 15-17 May and LE 1.0 per kg when sold at 18 May and up. Fruit quality attributes (fruit weight, size, firmness, polar diameter (Pd), equatorial diameter (Ed), Pd/Ed, juice TSS, acidity and TSS/acidity ratio) were recorded on 10 fruits per tree (A.O.A.C., 1990).

The experimental treatments were used in a split plot system in a randomized complete block design with three replicates. Each experimental plot consisted of one tree. Obtained data were subjected to analysis of variance according to Snedecor and Cochran (1990). Means were compared using the LSD test at the 5% level of probability.

Results

Bud burst components

Bud burst components included dates of flowering and fruit set as well as percentages of flower and vegetative bud burst and date (Table 1). Flowering of "Canino" apricot control trees begins at 4^{th} or 2^{nd} March- in the 1^{st} and 2^{nd} seasons respectively. Potassium nitrate caused early flowering at 26.7-27.0 Feb. while Dormex (HC) induced earlier flowering at 22.7-26.0 Feb. However, these differences (4-6 days for KNO_3 and 8-10 days for Dormex), statistically were confirmed. Meanwhile, spraying of dormancy breaking agents at 2^{nd} Feb. produced early flowering than at the other two spray dates (9 or 16 Feb.).

The greatest enhancement of the percentage of flowering was achieved with the application of HC (13.3, 14.3 and 17.6% in the 1^{st} season as well as 36.5, 38.2 and 39.8% in the 2^{nd} season, compared with control 10.7 and 12.4% respectively). Also, KNO_3 increased percentage of flowering but with less percent, while the differences than control were mostly significant. Spraying at 9^{th} Feb. 2006 and at 16^{th} Feb. 2007 induced the highest flowering percent, while the differences were only significant (27.4, 29.2 and 30.6%) in the 2^{nd} season.

Contrary, dormancy breaking agents (Dormex at 1, 2 or 3%, as well as KNO_3 at 3 or 5% all plus 3% Capl 2 oil) significantly decreased the percentage of foliation (vegetative bud burst) from 33.3, to 20.2, to 19.4 and to 18.3% in the 1^{st} season as well as from 33.8, to 18.4, to 18.7 and to 19.2% in the 2^{nd} season respectively. This phenomenon may be as a direct result of increase the percentage of flowering and deduction of dormant buds. However, spraying Dormex or potassium nitrate at 2^{nd}, 9^{th} or 16^{th} Feb. has insignificant effect on percentage of foliation (22.1, 22.2 and 22.5% in the 1^{st} season as well as 24.9, 23.9 and 24.4% in the second season respectively). The interaction effect showed that, the least foliation percent (17.1%) was achieved with 3% Dormex + 3%

Capl 2 oil at 9th Feb. while the highest foliation percent showed with control trees (34.6%).

Date of fruit set is a good indicator for the flowering period. However, early fruit set was obtained by Dormex 2% and 3% + 3% Capl 2 oil (8.3 and 8.3 March as well as 13.7 and 13.0 March) compared with control (16 and 25 March). In this concern, Dormex (HC) was more effective than potassium nitrate with significant differences. Spraying date at 9th Feb. caused the earliest fruit set (10.3 and 16.8 March in the two studied seasons respectively). Furthermore, the interaction of 3 % Dormex + 3% Capl 2 oil sprayed at 9th Feb. was the most effective in fruit set acceleration (7th and 9th March 2006 and 2007 respectively).

Yield components

At harvest time, retained fruits (Table 1), picking date, earliness of picking date than control, number of fruits/tree and fruit yield were recorded being used in estimating crop monetary value (Table 2) considering a farm-gate price of LE 3.0 per kg when the yield was sold at 9-11 May, LE 2.5 per kg when sold a 12-14 May, LE 1.5 per kg when sold at 15-17 May and LE 1.0 per kg when the yield was sold at 18 May and up (Table 2).

All dormancy breaking agent treatments increased the percentage of retained fruits significantly (Table 1). However, the most effective treatments were Dormex at 2% + 3% Capl 2 oil and 3% Dormex + 3% oil (18.7 and 18.0% in the 1st season as well as 22.7 and 30.2% in the second season respectively). However, spraying endo-dormancy breaking agents at 9th Feb. 2006 as well as at 9th and 16th Feb. 2007 induced the highest retained fruit percent (16.3, 21.1 and 20.0% respectively). Furthermore, Dormex at 3% + 3% Capl 2 oil sprayed at 9th Feb. was the most effective interaction in the two studied seasons (24.4 and 36.3%) compared with control (9.6 and 7.2% respectively).

Number of fruits/tree and subsequently fruit yield/tree (Table 2) increased significantly than control (317.0 and 365.3 fruits/tree as well as 10.49 and 8.98 kg/tree) with 1% Dormex (893.0 and 879.0 fruits as well as 37.06 and 40.68 kg), 2% Dormex (925.0 and 891.3 fruits as well as 40.33 and 43.37 kg), 3% Dormex (980.0 and 917.3 fruits as well as 44.98 and 47.17 kg), 3% potassium nitrate (830.0 and 722.0 fruits as well as 30.79 and 30.04 kg) and 5% KNO_3 (871.0 and 784.3 fruits as well as 34.49 and 34.40 kg) respectively. Meanwhile, spraying dormancy breaking agents at 9th Feb. induced more fruits (807.5 and 772.5) and better fruit yield (32.87 and 36.44 kg) than in the other two dates (2nd or 16th Feb.).

All experimental treatments accelerated fruit maturity and harvest date comparing with control (21 or 18 May). The most effective application was 3% Dormex + 3% Capl 2 oil (12.1 and 10.0 May) earlier than control with 8.9 and 8.0 days in the two studied seasons. Moreover, spraying breaking agents at 9th Feb. 2006 (15.2 May) and at 2nd Feb. 2007 (12.5 May) induced the earliest

harvest date than control (5.8 and 5.5 days respectively). However, all these differences were statistically confirmed.

TABLE 1. Effect of endo-dormancy breaking agents (A) at different dates (B) on flowering date, % flowering, % foliation, date of fruit set and % retained fruits.

(A)	(B)	Flowering date		Flowering (%)	Foliation (%)		Date of fruit set			Retained fruits (%)	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	2 Feb.	4 Mar.	2 Mar.	11.7	12.7	32.1	34.1	16 Mar.	25 Mar.	9.8	9.2
	9 Feb.	4 Mar.	2 Mar.	10.0	12.5	34.6	33.4	16 Mar.	25 Mar.	9.6	7.2
	16 Feb.	4 Mar.	2 Mar.	10.3	12.1	33.2	33.8	16 Mar.	25 Mar.	9.7	11.8
Ave. (A)		4 Mar.	2 Mar.	10.7	12.4	33.3	33.8	16 Mar.	25 Mar.	9.7	9.4
1% Dormex	2 Feb.	27 Feb.	23 Feb.	13.2	35.3	20.2	18.8	9 Mar.	12 Mar.	12.1	14.9
	9 Feb.	25 Feb.	21 Feb.	13.8	37.8	19.9	18.1	7 Mar.	11 Mar.	18.1	23.3
	16 Feb.	26 Feb.	28 Feb.	13.0	36.3	20.5	18.4	10 Mar.	21 Mar.	11.7	18.0
Ave. (A)		26 Feb.	24 Feb.	13.3	36.5	20.2	18.4	8.7 Mar.	14.7 Mar.	14.0	18.7
2% Dormex	2 Feb.	26 Feb.	22 Feb.	14.0	37.0	19.5	18.5	8 Mar.	11 Mar.	18.8	17.1
	9 Feb.	25 Feb.	20 Feb.	14.9	39.1	19.1	18.1	7 Mar.	10 Mar.	21.8	28.0
	16 Feb.	27 Feb.	28 Feb.	14.1	38.4	19.6	19.6	10 Mar.	20 Mar.	15.6	22.9
Ave. (A)		26 Feb.	23.3 Feb.	14.3	38.2	19.4	18.7	8.3 Mar.	13.7 Mar.	18.7	22.7
3% Dormex	2 Feb.	26 Feb.	21 Feb.	17.1	38.0	18.4	20.2	9 Mar.	10 Mar.	15.9	24.2
	9 Feb.	24 Feb.	19 Feb.	18.2	41.5	18.1	17.1	7 Mar.	9 Mar.	24.4	36.3
	16 Feb.	26 Feb.	28 Feb.	17.4	40.0	18.5	20.3	9 Mar.	20 Mar.	13.6	30.0
Ave. (A)		25.3 Feb.	22.7 Feb.	17.6	39.8	18.3	19.2	8.3 Mar.	13 Mar.	18.0	30.2
3% KNO_3	2 Feb.	26 Feb.	25 Feb.	9.8	18.4	20.7	29.7	16 Mar.	23 Mar.	9.9	12.0
	9 Feb.	1 Mar.	28 Feb.	10.2	20.3	20.4	27.9	11 Mar.	23 Mar.	11.7	14.0
	16 Feb.	26 Feb.	1 Mar.	10.5	32.1	20.9	27.5	10Mar.	23 Mar.	12.2	17.1
Ave. (A)		27 Feb.	27.3 Feb.	10.2	20.3	20.7	28.4	12.3 Mar.	23 Mar.	11.3	14.4
5% KNO_3	2 Feb.	25 Feb.	23 Feb.	11.3	23.0	21.7	28.2	10 Mar.	24 Mar.	11.1	15.1
	9 Feb.	3 Mar.	28 Feb.	11.9	23.9	21.3	28.9	14 Mar.	23 Mar.	12.2	17.9
	16 Feb.	25 Feb.	1 Mar.	11.6	24.7	22.1	26.8	11 Mar.	23 Mar.	13.2	20.0
Ave. (A)		27 Feb.	26.7 Feb.	11.6	23.1	21.7	28.0	11.7 Mar.	23.3 Mar.	12.2	17.7
Ave. (B)	2 Feb.	27.0 Feb.	24.0 Feb.	12.9	27.4	22.1	24.9	11.3 Mar.	17.5 Mar.	12.9	15.4
	9 Feb.	27.7 Feb.	24.3 Feb.	13.2	29.2	22.2	23.9	10.3 Mar.	16.8 Mar.	16.3	21.1
	16 Feb.	27.0 Feb.	28.7 Feb.	12.8	30.6	22.5	24.4	11.0 Mar.	22.0 Mar.	12.7	20.0
LSD at 5% for:											
Treatments (A)		1.34	1.42	1.29	1.42	1.75	1.91	1.13	1.01	1.86	2.03
Spray date (B)		1.11	1.00	0.87	0.99	1.21	1.35	0.94	0.72	1.20	1.44
Interaction (A x B)		2.62	2.46	2.31	2.44	3.08	3.31	1.89	1.75	3.26	3.52

TABLE 2. Effect of endo-dormancy breaking agents (A) at different dates (B) on number of matured fruits/tree, fruit yield, picking date, earliness of harvest date than control and crop monetary value/tree.

(A)	(B)	Number of fruits/tree		Fruit yield/tree (kg)		Picking Date		Earliness of harvest date than control (days)		Crop monetary value/tree (LE)	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	2 Feb.	316	360	10.55	8.87	21 May.	18 May.	0.0	0.0	10.55	8.87
	9 Feb.	315	365	10.33	9.47	21 May.	18 May.	0.0	0.0	10.33	9.47
	16 Feb.	320	371	10.59	8.60	21 May.	18 May.	0.0	0.0	10.59	8.60
Ave. (A)		317	365.3	10.49	8.98	21 May.	18 May.	0.0	0.0	10.49	8.98
1% Dormex	2 Feb.	898	878	36.96	40.47	14.8 May.	11 May.	6.2	7.0	92.40	121.4
	9 Feb.	900	893	38.43	44.67	12.6 May.	12 May.	8.4	6.0	96.08	111.7
	16 Feb.	884	866	35.80	36.90	17.0 May.	13 May.	4.0	5.0	53.70	92.3
Ave. (A)		893	879	37.06	40.68	14.8 May	12 May.	6.2	6.0	80.73	108.5
2% Dormex	2 Feb.	925	890	40.15	43.26	12.9 May.	10 May.	8.1	8.0	100.83	129.8
	9 Feb.	935	911	41.89	47.43	11.9 May.	12 May.	9.1	6.0	125.67	118.6
	16 Feb.	915	873	38.98	39.43	14.8 May.	13 May.	6.2	5.0	97.45	98.6
Ave. (A)		925	891.3	40.33	43.37	13.2 May.	11.7 May.	7.8	6.3	107.83	115.7
3% Dormex	2 Feb.	980	906	45.08	46.47	11.6 May.	9 May.	9.4	9.0	135.24	139.4
	9 Feb.	990	960	46.33	53.27	10.9 May.	10 May.	10.1	8.0	138.99	159.8
	16 Feb.	970	886	43.55	41.77	13.9 May.	11 May.	7.1	7.0	108.88	125.3
Ave. (A)		980	917.3	44.98	47.17	12.1 May.	10 May.	8.9	8.0	127.70	141.5
3% KNO_3	2 Feb.	810	702	29.48	28.10	19.1 May.	14 May.	1.9	4.0	29.48	70.3
	9 Feb.	835	721	30.90	29.63	18.0 May.	14 May.	3.0	4.0	30.90	74.1
	16 Feb.	845	743	32.03	32.40	17.3 May.	15 May.	3.7	3.0	48.05	48.6
Ave. (A)		830	722	30.79	30.04	18.1 May.	14.3 May.	2.9	3.7	36.14	64.3
5% KNO_3	2 Feb.	863	762	33.48	32.17	17.3 May.	13 May.	3.7	5.0	83.70	80.4
	9 Feb.	870	785	34.63	34.20	16.8 May.	13 May.	4.2	5.0	86.58	85.5
	16 Feb.	880	806	35.38	36.83	16.0 May.	14 May.	5.0	4.0	88.45	92.1
Ave. (A)		871	784.3	34.49	34.40	16.7 May.	13.3 May.	4.3	4.7	86.24	86.0
Ave. (B)	2 Feb.	798.2	749.7	31.85	33.20	16.1 May.	12.5 May.	4.9	5.5	75.29	91.69
	9 Feb.	807.5	772.5	32.87	36.44	15.2 May.	13.2 May.	5.8	4.8	81.43	93.20
	16 Feb.	802.3	757.5	32.01	32.66	16.7 May.	14.0 May.	4.3	4.0	67.85	77.58
LSD at 5% for:											
Treatments (A)		8.32	10.69	2.06	1.22	0.74	0.65	0.83	0.68	5.41	6.69
Spray date (B)		6.11	7.56	1.67	0.86	0.51	0.46	0.62	0.49	3.21	3.56
Interaction (A x B)		13.17	18.52	2.39	2.12	1.26	1.13	1.34	1.21	7.62	8.52

Besides, the earliness of picking date, reflected higher crop monetary value Table 2. The present results can be arranged descendingly as follows: 3% Dormex (LE 127.7 and 141.5), 2% Dormex (LE 107.83 and 115.7), 1% Dormex (LE 80.73 and 108.5), 5% potassium nitrate (LE 86.24 and 86.0), 3% KNO_3 (LE 36.14 and 64.3) and control (LE 10.49 and 8.98) throughout 2006 and 2007 seasons respectively. Moreover, spraying the present treatments at 9th Feb. reflected higher income (LE 81.43 and 93.20) than the other two dates (2nd or 16th Feb.). Meanwhile, the most effective interaction treatment was 3% Dormex at 9th Feb. which get the highest earnings (LE 138.99 and 159.8). The most of these results are significant.

Fruit quality attributes

Fruit weight, size and firmness, polar diameter (P), equatorial diameter (E) Table 3 and P/E ratio as well as juice TSS, acidity and TSS/acidity ratio Table 4 are considered as good indicators to fruit quality attributes. The present data refer

to better fruit weight and size as a result of Dormex (HC) spraying at 1% (41.5 and 46.2 g. as well as 39.8 and 43.8 cm^3), at 2%HC (43.6 and 48.6 g. as well as 41.3 and 44.4 cm^3) and at 3% HC(45.9 and 51.3 g. as well as 43.8 and 46.1 cm^3), also as a result of spray KNO_3 at 3% (37.1 and 41.6 g. as well as 34.9 and 38.5 cm^3) and at 5% (39.6 and 43.8 g. as well as 36.2 and 39.8 cm^3) comparing to control (33.1 and 24.6 g. as well as 30.2 and 33.8 cm^3 in the two studied seasons respectively). However, the present data reveals that, fruit weight and size (Table 3) significantly increased by Dormex treatments than KNO_3 ones as well as by KNO_3 treatments than control. Furthermore, the most effective treatment was 3% Dormex. Concerning the spray date, 9th Feb. was more effective (40.7 and 44.7 g. as well as 38.7 and 42.9 cm^3 respectively) than the other two spraying dates (2nd or 16th Feb.). So, we can get heavier and bigger fruits with the interaction 3% Dormex + 3% Capl 2 oil at 9th Feb. (46.8 and 55.5 g. as well as 44.9 and 48.6 cm^3 respectively).

Contrary, endo-dormancy breaking agents spray decreased fruit firmness Table 3 and gradually with the spray concentration increase. Generally, this phenomenon may be reflect the earliness of harvest date as a result of the above mentioned treatments and subsequently, the earliness of fruit maturity than control. However, the most effective treatment was Dormex 3% (7.5 and 5.6 $lb/inch^2$ through 2006 and 2007 seasons respectively). Meanwhile, spray date get nearby firmness with non significant differences.

We can notice a positive response of fruit dimensions to the present treatments hence apricot fruits enlarged as a result of both Dormex 1, 2 and 3% as well as KNO_3 3 and 5% comparing with control. Also, when dormancy breaking agents sprayed at 9th Feb. apricot fruits have longer polar diameter, P (3.71 and 4.06 cm) as well as equatorial diameter, E (3.62 and 3.94 cm) than the other two spray dates (2nd or 16th Feb.). Besides, P/E ratio increased with all treatments than control (0.98 and 0.99) but with non-significant differences. However, the largest fruits can be gotten by the combination: 3% HC + 3% Capl 2 oil at 9th Feb. when apricot trees have 79-98 °C (≤ 7.2 °C) or 302-326 (≤ 10 °C) chilling hours.

Total soluble solids (TSS), significantly increased by Dormex and KNO_3 treatments comparing to control (9.4 and 8.83%). This increment as ascendingly was parallel to HC concentration (12.3 and 11.50 at 1%), (12.6 and 12.67 at 2%) and (13.0 and 14.83 at 3%) as well as to KNO_3 concentration (11.3 and 10.17 at 3%) and (11.5 and 11.17 at 5%) through 2006 and 2007 seasons respectively. Fruit juice TSS also increased when the breaking agent treatments were sprayed at 9th Feb. (11.9 and 11.58%) than of the other two spray dates (2nd or 16th Feb.).

On the other hand, the present treatments deduced fruit juice acidity than control (1.32 and 1.95%). Moreover, 3% Dormex successfully induced apricot fruits with the least acidity percent (0.82 and 0.66%) in the two studied seasons respectively. Furthermore, all investigated treatments increased TSS/acidity ratio than control (7.12 and 4.53). So this ratio is considered as an indicator to better

fruit quality attributes. When the present treatments were sprayed at 9th Feb. we have higher TSS/acidity ratio (12.51 and 13.24) so the best interaction was 3% Dormex at 9th Feb. (16.54 and 23.98).

TABLE 3. Effect of endo-dormancy breaking agents (A) at different dates (B) on fruit weight, size, firmness and dimensions.

(A)	(B)	Fruit weight (g)		Fruit size (cm^3)		Fruit firmness ($lb/inch^2$)		Polar diameter (P) (cm)		Equatorial diameter (E) (cm)	
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	2 Feb.	31.3	33.4	33.4	24.6	10.8	9.8	3.06	3.51	3.11	3.55
	9 Feb.	30.8	35.8	32.8	25.9	10.4	9.6	3.04	3.48	3.11	3.51
	16 Feb.	28.5	32.1	33.1	23.2	10.6	9.6	3.02	3.53	3.11	3.57
Ave. (A)		30.2	33.8	33.1	24.6	10.6	9.7	3.04	3.51	3.11	3.41
1% Dormex	2 Feb.	39.1	41.7	41.3	46.1	8.7	5.8	3.88	4.26	3.79	4.11
	9 Feb.	41.7	46.3	42.7	50.0	8.4	5.9	3.92	4.35	3.83	4.20
	16 Feb.	38.6	43.1	40.5	42.6	7.8	6.1	3.87	4.18	3.72	4.02
Ave. (A)		39.8	43.8	41.5	46.2	8.3	5.93	3.89	4.26	3.78	4.11
2% Dormex	2 Feb.	41.2	43.8	43.4	48.6	8.6	5.6	4.09	4.37	4.01	4.21
	9 Feb.	42.3	48.5	44.8	52.1	8.0	5.8	4.11	4.42	4.04	4.27
	16 Feb.	40.4	40.9	42.6	45.2	7.1	6.0	4.04	4.31	3.98	4.15
Ave. (A)		41.3	44.4	43.6	48.6	7.9	5.8	4.08	4.37	4.01	4.21
3% Dormex	2 Feb.	44.0	47.3	46.0	51.3	7.4	5.5	4.29	4.45	4.14	4.30
	9 Feb.	44.9	48.6	46.8	55.5	7.2	5.6	4.31	4.53	4.16	4.38
	16 Feb.	42.5	42.4	44.9	47.2	7.9	5.7	4.21	4.38	4.09	4.23
Ave. (A)		43.8	46.1	45.9	51.3	7.5	5.6	4.27	4.45	4.13	4.30
3% KNO_3	2 Feb.	33.8	37.5	36.4	40.0	10.6	6.4	3.25	3.69	3.12	3.60
	9 Feb.	35.1	38.9	37.0	41.1	10.0	6.5	3.30	3.75	3.17	3.68
	16 Feb.	35.8	39.2	37.9	43.6	9.7	7.0	3.30	3.81	3.19	3.70
Ave. (A)		34.9	38.5	37.1	41.6	10.1	6.63	3.29	3.75	3.16	3.66
5% KNO_3	2 Feb.	33.5	39.0	38.8	42.2	9.8	6.2	3.53	3.79	3.37	3.67
	9 Feb.	37.2	39.4	39.8	43.6	9.3	6.3	3.59	3.83	3.41	3.71
	16 Feb.	37.9	41.1	40.2	45.7	9.1	6.5	3.62	3.88	3.48	3.76
Ave. (A)		36.2	39.8	39.6	43.8	9.4	6.33	3.58	3.83	3.42	3.71
Ave. (B)	2 Feb.	37.2	40.4	39.9	42.1	9.3	6.55	3.68	4.01	3.59	3.89
	9 Feb.	38.7	42.9	40.7	44.7	8.9	6.62	3.71	4.06	3.62	3.94
	16 Feb.	37.3	39.8	39.9	41.2	8.7	6.62	3.68	4.02	3.60	3.87
LSD at 5% for:											
Treatments (A)		2.08	2.25	1.39	1.62	5.23	6.55	0.04	0.04	0.06	0.07
Spray date (B)		1.43	1.59	0.98	1.15	4.89	6.12	0.06	0.05	0.06	0.05
Interaction (A x B)		3.38	3.89	1.94	2.82	6.14	6.62	0.08	0.09	0.12	0.13

TABLE 4. Effect of endo-dormancy breaking agents (A) at different dates (B) on P/E ratio, TSS, acidity and TSS/acidity ratio.

(A)	(B)	P/E ratio		TSS (%)		Acidity (%)		TSS/Acidity ratio	
		2006	2007	2006	2007	2006	2007	2006	2007
Control	2 Feb.	0.98	0.99	9.7	8.50	1.32	1.90	7.35	4.48
	9 Feb.	0.98	0.99	9.2	9.00	1.32	2.01	6.97	4.48
	16 Feb.	0.97	0.99	9.3	9.00	1.32	1.95	7.05	4.64
Ave. (A)		0.98	0.99	9.4	8.83	1.32	1.95	7.12	4.53
1% Dormex	2 Feb.	1.02	1.04	12.4	11.50	0.94	0.95	13.19	12.11
	9 Feb.	1.02	1.04	12.9	11.50	0.92	0.89	14.02	12.97
	16 Feb.	1.04	1.04	11.6	11.50	0.93	0.92	12.47	12.53
Ave. (A)		10.3	1.04	12.3	11.50	0.93	0.92	13.23	12.54
2% Dormex	2 Feb.	1.02	1.04	12.5	12.50	0.87	0.81	14.37	15.48
	9 Feb.	1.02	1.03	12.9	13.00	0.85	0.76	15.18	17.12
	16 Feb.	1.02	1.04	12.4	12.50	0.92	0.80	13.48	15.68
Ave. (A)		1.02	1.04	12.6	12.67	0.88	0.79	14.32	16.10
3% Dormex	2 Feb.	1.04	1.03	12.8	15.00	0.83	0.70	15.42	21.56
	9 Feb.	1.04	1.04	13.4	14.50	0.81	0.61	16.54	23.98
	16 Feb.	1.03	1.03	12.8	15.00	0.82	0.67	15.61	22.54
Ave. (A)		1.03	1.03	13.0	14.83	0.82	0.66	15.85	22.70
3% KNO_3	2 Feb.	1.04	1.02	10.8	10.00	1.07	1.11	10.09	9.04
	9 Feb.	1.04	1.02	11.4	10.50	1.05	1.13	10.86	9.30
	16 Feb.	1.04	1.03	11.7	10.00	1.00	1.04	11.70	9.67
Ave. (A)		1.04	1.02	11.3	10.17	1.04	1.09	10.87	9.34
5% KNO_3	2 Feb.	1.05	1.03	11.1	11.00	1.02	1.03	10.88	10.75
	9 Feb.	1.05	1.03	11.5	11.00	1.00	0.95	11.50	11.57
	16 Feb.	1.04	1.03	11.9	11.50	0.98	1.00	12.14	11.53
Ave. (A)		1.05	1.03	11.5	11.17	0.98	0.99	11.73	11.28
Ave. (B)	2 Feb.	1.03	1.03	11.6	11.42	1.01	1.08	11.88	12.24
	9 Feb.	1.03	1.03	11.9	11.58	0.99	1.06	12.51	13.24
	16 Feb.	1.02	1.03	11.6	11.58	1.00	1.06	12.08	12.77
LSD at 5% for:									
Treatments (A)		0.04	0.03	0.41	0.49	0.05	0.06	1.14	1.23
Spray date (B)		0.03	0.02	0.29	0.35	0.05	0.04	0.72	0.87
Interaction (A x B)		0.06	0.05	0.73	0.85	0.09	0.10	2.06	2.13

Discussion and Conclusions

The present results revealed that, "Canino" apricot trees, positively responded to all studied endo-dormancy breaking agents (H_2CN_2: 1,2 and 3% or KNO_3: 3 and 5%) all + 3% Capl 2 oil sprayed at 2nd, 9th or 16th Feb. 2006 and 2007 seasons. Hence, the studied treatments effectively accelerated dates of flowering, fruit set and picking date. Also, the present treatments increased the percentage of flowering, and mature retained fruits, number of fruits/tree and the earliness of harvest date than control which subsequently reflect higher crop monetary value. Fruit quality attributes were also enhanced with all treatments. Contrary, the percentage of foliation significantly decreased with HC and potassium nitrate application may be as a direct result of increase the percentage of flowering and deduction of dormant buds. It is also noticeable that, HC was more effective than KNO_3 treatments, and their effect increased with their concentrations. Generally, many other reports offerd an explanation to the present results. Meanwhile, auxin and GA_3 level increased markedly in control "Canino" apricot trees during the period from bud dormancy (Feb. 10th) to bud break (March 9-20th) and HC treatments achieved 19-fold increase in IAA level within 8 days from application, while that of KNO_3 + urea induced a large increase in GA_3 level, so H_2CN_2 + mineral oil treatments increased flower bud opening, advanced flowering and fruit set, increased the percentage of fruit set, fruit retention, number of fruits per tree and fruit yield (Shakweer, 2004). Also, KNO_3 treatments increased yield of peach and nectarine (Kuden *et al.*, 1995 a) hastened flowering and improved apricot fruit TSS (Kuden *et al.*, 1995 b) terminated winter dormancy, accelerated plum flower and vegetative bud break, and increased the percentage of bud break, fruit set and yield with the HC treatment being the most effective than KNO_3 or other treatments (Shahin *et al.*, 1997).

Furthermore, the statistical analysis of the present results confirmed that, the studied attributes enhanced with spraying hydrogen cyanamide or potassium nitrate at 9th Feb. (after 79 °C and 98 °C hr below 7 °C chill hours through 2006 and 2007 seasons respectively) than the other two dates (2nd or 16th Feb.). However, it has been reported (Bailey *et al.*, 1982) that, "Canino" apricot trees require 570 hr below 7 °C to achieve bud burst. Such chilling requirements were not fulfilled under the conditions of the present study which further indicates the importance of the endo-dormancy breaking treatments that were applied in this investigation. Generally, dormancy actually ends when further chilling no longer effectively hastens bud break. Hence, a critical number of chill units have been accumulated, heat units hasten bud break (Dennis, 1994). Meanwhile, t-zeatin riboside, which remained low throughout the rest period, increased at bud swelling (Ramina, *et al.*, 1995). Opening of pear buds corresponded positively with the increase in chilling units. Bud ABA content decreased rapidly from January to March, while GA_3 content increased during Feb. and that of IAA content increased from its minimum level in February to its maximum at bud burst (Holwah and El Sheikh, 2000).

So, we can recommend "Canino" apricot growers to spray their trees with 3% hydrogen cyanamide +3% Capl 2 mineral oil at 9th Feb. if the location of their orchards accumulated 79-98 °C hr below 7 °C chill hours or 302-326 °C hr below 10 °C chill hours. This treatment attained early production and high yield of good fruit quality which increased income.

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تأثير بعض كاسرات السكون على التزهير والمحصول وجودة ثمار صنف المشمش كانينو

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نُفذت هذه التجربة خلال موسمى ٢٠٠٥ – ٢٠٠٦، ٢٠٠٦ – ٢٠٠٧ لدراسة تأثير رش الأشجار صنف المشمش كانينو (*Prunus armeniaca L.*) ببعض كاسرات سكون البراعم: ١، ٢، ٣٪ دورمكس (سينامید الهيدروجين) أو ٣، ٥٪ نترات البوتاسيوم. كل هذه المعاملات كان يضاف لها ٣٪ زيت كابل ٢ حيث تم الرش فى ثلاث مواعيد: ٢، ٩، ١٦ فبراير من كل سنة بعد تراكم كم من البرودة الشتوية.

إشتملت قياسات هذه التجربة علي مواعيد: التزهير، عقد الثمار، جمع الثمار ومقدار التبكير في ميعاد الجمع عن الكونترول. وأيضاً النسب المئوية للبراعم الزهرية والخضرية وعدد الثمار المُتبقية عند الجمع. كذلك تم تقدير عدد الثمار الناضجة/الشجرة، محصول الشجرة، القيمة النقدية للمحصول وصفات جودة الثمار.

وقد إستجابت هذه القياسات إيجابيا للمعاملات التي يمكن ترتيبها تنازليا كما يلي: ٣٪ دورمكس > ٢٪ دورمكس > ١٪ دورمكس > ٥٪ نترات بوتاسيوم > ٣٪ نترات بوتاسيوم حيث يمكن ملاحظة أن رش سينامید الهيدروجين كان أكثر فاعية من نترات البوتاسيوم و أن تأثير كلّ من المادتين زاد بزيادة التركيز. كما لوحظ أن ميعاد الرش ٩ فبراير كان أكثر فاعليه من الميعادين الآخرين (٢ أو ١٦ فبراير). وهكذا يمكن إستخلاص أن أفضل المعاملات كانت رش ٣٪ دورمكس + ٣٪ زيت معدنى (كابل ٢) يوم ٩ فبراير (بعد تراكم ٧٩-٩٨ ساعة برودة ≤ ٧,٢°م أو ٣٠٢-٣٢٦ ساعة برودة ≤ ١٠,٠°م) وذلك للحصول علي إنتاج مبكر ومحصول عالى له مواصفات جودة كبيرة من المشمش صنف كانينو مما يزيد من دخل المُزارع.