

STUDY ON THE EFFECT OF TWO DORMANCY BREAKING AGENTS ON ANNA APPLE TREES

EI-Sheikh, A.A.

Horticultural Research Institute, Agricultural Research Center

ABSTRACT

The effect of (Dorcy 50%) and Buddy** was studied on percentage of developing buds, diameter of fruits and fruit characters of Anna apple trees budded on MM.106 during two seasons of (1998-1999) and (1999-2000).

Treatments of Dorcy 50% and Buddy separately or together accelerated bud burst comparing with untreated trees (control).

Results were obtained treatments by Buddy 5%, Buddy 5% plus 0.5 % (Dorcy 50%) or 3 % (Dorcy 50%) showed increase in fruit set, in the two seasons of the experiment.

The last three treatments caused an increase in fruit weight, size, diameter, and height.

The treatments Buddy 5% and Buddy 5% plus 0.5 % (Dorcy 50%) gave highest value of total soluble solids, while control gave the lowest value.

Untreated trees gave fruits with highest value of firmness and percentage of acidity, while fruits of trees treated with 3 % (Dorcy 50), and Buddy 5% alone or together were less in firmness and percentage of acidity.

INTRODUCTION

Apple is the most important deciduous fruit grown in the world. Recently, in Egypt, apple trees have been extensively planted in more than (64.019 feddans), and the main cultivar planted is Anna, which requires 300 to 400 chilling hours equal or less than 7.2°C (Croker and Sherman, 1981). When chilling is less than 300 hours, time of bud burst, blooming and ripening will be delayed (Miller and Sherman, 1980). Under the Egyptian weather conditions, insufficient chilling hours in winter lead to delay leaf drop as well as many buds remain dormant and the blooming period is extended for a long time, thus using dormancy breaking agents is a must. One of those materials is Hydrogen Cyanamide, which help in breaking apple rest period.

Shulman *et al.* (1986) reported that hydrogen Cyanamide is applied several weeks before natural budbreak in peaches, the most consistent and complete bloom development was seen. On the other hand, Dozier *et al.* (1990) found that 2% rate of Dormex (Hydrogen Cyanamide), being more effective than other rates for 17 insufficient chilled peach and nectarine cultivars. North *et al.*, (1993) noticed that bud break of three almond cultivars (Neplus Ultra, Non Pareil and Texas Mission), was increased and the yield of Non Pareil was enhanced.

Finetto (1993) observed that in the earliest treatment, the concentration of 2% H₂CN₂ is more efficient, and in the latest, there were no

* Dorcy 50% : a trad name of hydrogen cyanamide 49%.

** Buddy : 2-chloroethylphosphonic acid 10 g/l Adjuvants and oil to 1000 ml.

differences between the effect of other concentrations. He demonstrated the usefulness of hydrogen cyanamide to break the endo-dormancy of buds in mid chilling apple cultivars. Under Yemen climate conditions there is a need to select the right spraying time according to the chilling accumulation of the trees.

El-Sabagh (1995) reported that spraying 3% Dormex at various dates gave significant results for Anna apple cultivar. All treatments at various dates from 8 to 30 December resulted in the same effect concerning budbreak, which was highly significant than the control. Makarem, (1996) stated the best results from the early application of Dormex (3% at the first week of December with covering by polyethylene film, on Anna apple trees). This application led to increase and earliness of yield and better fruit quality.

Stino (1997) reported that hydrogen cyanamide at 1.5% resulted in advancing and increasing bud burst percentage, enhancing floral bud burst activity and accelerated full blooming of Anna apple trees, however, mixing H_2CN_2 at 0.75% with 4% mineral oil also gave nearly similar results.

The aim of this investigation is to study the effect of two new compounds on bud burst of Anna apple trees and fruit quality.

MATERIALS AND METHODS

This study was carried out in a private orchard located at desert road (Cairo- Alexandria) in Giza governorate, during the two successive seasons (1998 -1999) and (1999- 2000) on trees of "Anna" apple cultivar grafted on MM. 106 rootstock, planted in year 1989. Trees of uniform size were chosen grown in sandy soil, at 4x3 meters apart, using drip irrigation system, and treated with normal agricultural practices. Forty five trees were selected and grouped under five treatments. Nine trees were taken for each treatment (three trees for each replicate). Trees under treatments, were sprayed at 2 January in both experimental seasons with: Dorcy 50, 5% (hydrogen cyanamide 49%) at 3%, Buddy (an emulsion concentrate containing 2-chloroethylphosphonic acid 10g/l in oil. Consists of 2-chloroethylphosphonic acid 10g/l mixed with Adjuvants and oil to 1000 ml) at 3%, Buddy at 5%, Buddy at 5% Buddy plus 0.5% Dorcy 50% and control (trees were sprayed with water). The complete randomized design was arranged, and the following parameters were determined:

- A. Number of vegetative and flower buds on five branches of each tree were recorded on certain dates at different stages of apple bud development. Westwood (1978) classified stages of apple bud opening as : Dormant, silver tip, green tip, half-inch green, tight cluster, first pink, full pink, first bloom and post bloom. These stages were classified in this study as : 1- Dormant buds 2- vegetative bud (which include green growth without flowers) 3- Pallon stage (which include tight flowers in any stage) 4- Full opening (which include opened flowers) 5- Petal fall: (which include flowers after petals drop). The percentage of each developing stage of bud was calculated.

- B. Diameter of each fruit setting on five branches per every treated tree were recorded at (10 May) of the two seasons, main diameter of fruit was calculated.
- C. Sample of 25 matured fruits (7 June in the two seasons) were examined to study the effect of the sprayed materials on fruit characteristics such as : fruit weight and size, diameter, height, circumference and chemical properties (T.S.S% by hand refractometer and juice acidity according to: A.O.A.C. (1965).

Data were statistically analysed according to Snedcor and Cochran (1990). Means were compared using L.S.D values at 5% level.

RESULTS AND DISCUSSION

Table (1) Shows the effect of different treatments on bud break of Anna apple trees in (1998-1999). It is clear that spraying with 3% Dorcy 50%, 5% Buddy and 5% Buddy plus 0.5%, Dorcy respectively, enhanced bud burst and reduced after 34 days from spraying breaking agent (6/2/1999) without significant differences among them. The highest percentage of dormant buds were of trees spraying with water (control) and trees sprayed by Buddy 3% with high significant differences with those of other three treatments.

Data recorded in Table (1) showed that after 50 days from spraying breaking agent (22/2/1999) that highest percentage of buds in petal fall stage (primary fruit set) were on the trees treated with Buddy 5% plus 0.5% Dorcy followed by those treated with 3% Dorcy 50%, followed by those treated with 5% Buddy respectively without significant differences among them. On the other hand trees treated with 3% Buddy were less than the last treatments but more than those of control trees with significant difference.

Control trees had the lowest percentage of buds in petal fall stage with high significant differences with the first three treatments.

By observing percentage of bud burst untreated trees reached petal fall stage four weeks after those treated with Buddy 5% plus 0.5% Dorcy 50%. Data also showed that 3% Dorcy 50% and Buddy 5% treatments were reduced the period of blooming for treated trees than those of untreated trees more than 4 weeks.

The results of second season (1999-2000) which recorded in Table (2) showed the same trend of the first season with slight difference. Thus, trees which treated with 5% Buddy, 3% Dorcy50%, and 5% Buddy plus 0.5% Dorcy50%, respectively had the highest percentages of buds in petal fall stage without significant differences among values, and they followed by those treated with Buddy 3% and untreated trees (control) . The lowest were control trees with high significant differences with the first three treatments. These results were after 84 days from treatment.

Table (1): Effect of spraying Dorcy 50% and Buddy at different concentrations on percentage of developing buds of Anna apple trees at different dates in (1998-1999) season.

Date	Treatment	Percentage of developing buds				
		Dormant %	Vegetative %	Pallon %	Bloom %	Petal fall %
6-2-99	3% Dorcy50%	18.645	60.909	20.445	--	--
	3% Buddy	78.498	12.737	8.765	--	--
	5% Buddy	32.872	54.121	13.006	--	--
	0.5%Dorcy50% + 5%Buddy	36.314	45.192	18.494	--	--
	Control	95.947	0.983	3.069	--	--
	L.S.D. at 5%	18.479	12.314	12.610		
13-2-99	3% Dorcy 50%	2.334	57.718	11.484	28.464	
	3% Buddy	46.607	35.563	11.685	6.145	
	5% Buddy	3.449	63.528	18.720	14.303	
	0.5%Dorcy50% + 5%Buddy	10.261	49.852	6.830	33.056	
	Control	84.816	8.435	3.6590	3.089	
	L.S.D. at 5%	19.045	10.854	10.904	12.59	
22-2-99	3% Dorcy 50%	2.232	56.710	1.528	2.396	37.134
	3% Buddy	36.271	33.254	10.534	9.044	10.896
	5% Buddy	3.035	28.246	28.600	8.294	41.826
	0.5%Dorcy50% + 5%Buddy	9.736	47.885	0.648	2.041	39.69
	Control	80.776	10.23	2.385	3.471	3.136
	L.S.D. at 5%	18.931	11.708	8.599	N.S	7.388
14-3-99	Control	68.263	4.415	11.691	4.721	7.91
21-3-99	Control	31.671	35.562	6.721	13.415	12.631

Table (2): Effect of spraying Dorcy 50% and Buddy at different concentrations on percentage of developing buds of Anna apple trees at different dates in (1999-2000) season.

Date	Treatment	Percentage of developing buds				
		Dormant %	Vegetative %	Pallon %	Bloom %	Petal fall %
5-2-2000	3% Dorcy50%	19.636	80.11	0.253	0.0	0.0
	3% Buddy	21.572	67.815	1.613	0.0	0.0
	5% Buddy	25.955	74.045	0.0	0.0	0.0
	0.5%Dorcy50%+5%Buddy	12.039	87.961	0.0	0.0	0.0
	Control	32.707	67.293	0.0	0.0	0.0
	L.S.D. at 5%	8.356	N.S	N.S		
13-2-2000	3% Dorcy50%	16.32	60.177	22.448	1.053	0.0
	3% Buddy	21.573	66.643	10.109	1.675	0.0
	5% Buddy	25.955	58.641	14.034	1.370	0.0
	0.5%Dorcy50% + 5%Buddy	12.039	72.000	13.503	2.458	0.0
	Control	32.707	67.293	0.0	0.0	0.0
	L.S.D. at 5%	6.795	N.S	13.360	N.S	
20-2-2000	3% Dorcy50%	16.122	57.492	4.177	21.828	0.38
	3% Buddy	21.573	55.779	10.900	10.394	1.354
	5% Buddy	24.928	45.678	15.704	12.662	1.028
	0.5%Dorcy50% + 5%Buddy	12.039	66.214	7.952	12.824	1.367
	Control	32.707	66.652	0.641	0.0	0.0
	L.S.D. at 5%	4.832	N.S	6.437	13.788	N.S
27-2-2000	3% Dorcy50%	15.849	56.460	1.125	6.830	20.735
	3% Buddy	21.573	45.164	16.093	3.970	13.200
	5% Buddy	24.928	36.820	8.885	6.135	23.232
	0.5%Dorcy50% + 5%Buddy	12.039	62.819	3.300	2.209	19.632
	Control	32.386	62.274	4.843	0.497	0.0
	L.S.D. at 5%	6.542	N.S	N.S	7.012	14.405
12-3-2000	Control	31.771	47.759	15.210	2.952	2.308
21-3-2000	Control	31.771	41.087	3.530	7.881	15.732

It is clear that control trees delayed petal fall stage for more than 4 weeks in reaching petal fall stage than trees which treated with 5% Buddy, or 3% Dorcy50% or 5% Buddy plus 0.5% Dorcy50%.

These results are in agreement with the findings of EL-Sabagh (1995); Makarem (1996) and Stino (1997).

Data in Table (3) showed that trees treated with 3% Dorcy50%, 5% Buddy and 5% Buddy plus 0.5 Dorcy50% respectively had the largest fruit diameter in the first season (1998- 1999) without significant differences among them. They differed significantly with those of trees treated with Buddy 3% and Control trees, which was the lowest in fruit diameter. In second season (1999- 2000) results were in the same trend of the first season with slight differences in sequence of the first three treatments with insignificant differences among them. They differed significantly with those of results for Buddy 3% treatment and Control treatment, which showed the same results of the first season. These results are in harmony with results of bud burst stages which recorded in Tables (1) and (2).

Table (3): Effect of spraying Dorcy50% and Buddy at different concentrations on diameter of fruits at 10 May in the two seasons (1998-1999) and (1999-2000).

Treatment	1998-1999		1999-2000	
	Date	Diameter (cm)	Date	Diameter (Cm)
3% Dorcy50%	10-5-1999	44.617	10-5-2000	41.545
3% Buddy		39.611		43.925
5% Buddy		44.447		44.74
0.5%Dorcy50% + 5%Buddy		43.13		45.024
Control		29.088		33.078
L.S.D. at 5%		2.833		1.384

Data presented in Table (4) showed that spraying trees with 5% Buddy 3% Dorcy 50% and 5% Buddy plus 0.5% Dorcy0.5%, respectively enhanced fruit weight, fruit size, fruit Diameter and fruit circumference than those treated with Buddy 3%. Fruits of control trees were the lowest in this regard with significant differences.

On the other hand, concerning fruit firmness, fruits of control trees had the highest value followed by those of trees treated with 3% Buddy without significant differences. They were higher than those treated with 5% Buddy plus 0.5% Dorcy 50%, 5% Buddy and 0.5% Dorcy 50%, respectively.

Treatment of 5% Buddy plus 0.5% Dorcy 50%, 5% Buddy, 3% Buddy and 0.5% Dorcy 50%, increased percentages of total soluble solids in fruit juice than of control trees significantly. The highest percentage of T.S.S was realized with 5% Buddy plus 0.5% Dorcy50%, treatment.

Treatments of 5% Buddy, 3% Dorcy50% and 5% Buddy plus 0.5% Dorcy50%, reduced juice acidity significantly less than in the control tree fruits.

From the above mentioned results it can be concluded that dormant spray of 5% Buddy plus 0.5% Dorcy50% during January gave the best results in high fruit set percentage and consequently early and good crop of Anna apple trees.

Table 4

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دراسة تأثير مادتين من كاسرات السكون على أشجار التفاح الآنا

عبد الرحمن احمد الشيخ

معهد بحوث البساتين - مركز البحوث الزراعية

أجريت هذه الدراسة على أشجار تفاح انا مثمرة بمرزعة خاصة بالطريق الصحراوي (مصر اسكندرية) بأرض رملية تروى بالتنقيط حيث رشنت الأشجار في 2 يناير بالمواد الآتية: دورسي 50%* بتركيز 3% وبضى** بتركيز 3% وتركيز 5% وبضى بتركيز 5% مخلوطا بدورسي بتركيز 5% وقد أدت المعاملات الى زيادة تفتح البراعم خلال موسم التجربة وكان أعلاها نتيجة استخدام البضى 50% او البضى 5% مخلوطا مع دورسي 5% او دورسي 3% التي لم تختلف معنويا عن بعضها في التأثير على تفتح البراعم .

وقد أدت هذه المعاملات الثلاث الى وصول الأشجار لاعلى نسبة عقد للثمار قبل أشجار الكنترول بحوالى 4 أسابيع في الموسمين. وقد تأكد ذلك بقياس قطر الثمار في 10 مايو للأشجار المعاملة حيث لم تختلف أقطار ثمار أشجار المعاملات الثلاث معنويا بالنسبة لقطر الثمار بينما زادت عن قطر ثمار الأشجار المعاملة بالبضى 3% والتي زادت أيضا عن اقطار ثمار الأشجار غير المعاملة (الكنترول) معنويا .

وقد أدت المعاملة بالمعاملات الثلاث الى زيادة وزن وحجم وقطر وطول ومحيط الثمرة عن مثيلاتها للأشجار المعاملة بمعاملة بضى 3% وكذلك عن اشجار المعاملة معنويا.

وأدت المعاملة بالبضى 5% والبضى 5% مخلوط بالدورسي 5% الى زيادة نسبة المواد الصلبة في عصير الثمار عن المعاملات الأخرى وكان أقلها في الثمار غير المعاملة (الكنترول) وبالنسبة لنسبة الحموضة كان أعلاها في ثمار الأشجار الغير معاملة وأقلها في الثمار المعاملة بالدورسي 3% والمعاملة بالبضى 5% وكذلك المعاملة بالبضى 5% مخلوطا بالدورسي 5% وبالنسبة لصلابة الثمار فكان أعلاها في الثمار الغير معاملة وأقلها في الثمار المعاملة بالبضى 5% والمعاملة بالدورسي 3% والمعاملة بالبضى 5% مخلوطا بالدورسي 5% والتي لم تختلف عن بعضها معنويا ولم تختلف ثمار الأشجار المعاملة بالبضى 3% عن اشجار الكنترول في هذا الصدد معنويا.

* مادة دورسي 50% : 49% سيناميد الهيدروجين .
** مادة بضى : 2- كلوروايثايل فوسفونك 10 جرام/ لتر زيت الى 1000 مل

Table (4): Effect of spraying Dorcy50% and Buddy at different concentrations on fruit characters in the two seasons of (1998 -- 1999) and (1999 - 2000)

Treatment	Fruit weight Gm.		Fruit size Cm ³		Fruit diameter Cm		Fruit height Cm		Fruit Circumference cm		Firmness (Lb./inch ²)		T.S.S (%)		Acidity (%)	
	98-99	99-2000	98-99	99-2000	98-99	99-2000	98-99	99-2000	98-99	99-2000	98-99	99-2000	98-99	99-2000	98-99	99-2000
3% Dorcy50%	96.967	88.200	109.900	100.000	6.100	5.800	6.433	6.167	18.700	17.833	9.700	10.033	11.333	11.200	0.333	0.347
3% Buddy	74.000	66.733	73.267	67.700	5.933	5.600	5.600	5.633	17.367	16.367	11.033	10.900	11.733	11.667	0.507	0.507
5% Buddy	120.670	110.030	124.500	114.200	6.667	6.367	6.833	6.567	20.300	19.467	9.933	9.767	12.700	12.667	0.333	0.347
0.5%Dorcy50%+ 5%Buddy	83.867	76.467	83.400	88.333	6.367	6.067	6.200	5.900	19.533	18.433	10.300	10.267	13.333	13.250	0.460	0.487
Control	60.600	62.533	63.933	66.333	5.500	5.300	5.167	4.900	17.100	16.600	11.333	11.233	11.200	11.367	0.553	0.553
L.S.D. at 5%	10.379	11.376	12.604	14.707	0.180	0.194	0.638	0.939	0.797	1.223	0.601	1.315	0.519	0.960	0.031	0.026