

## EFFECT OF SOME DORMANCY BREAKING AGENTS ON PRODUCTIVITY, FRUIT QUALITY AND POWDERY MILDEW SEVERITY OF APRICOT

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### ABSTRACT

Mature apricot trees cv.'Amar' were sprayed on 10<sup>th</sup> of January using three different dormancy breaking agents i.e. zinc sulphate 5%, Dormex 1% (49% Hydrogen Cyanamide) and Urea5%. Zinc sulphate showed superiority over all other treatments included as it was more effective in advancing bud burst by 17 and 12 days compared to the control in the first and second season, respectively. Moreover, it induced the highest bud opening percentage compared with the other two treatments or the control. In addition, zinc sulphate significantly increased fruit set and yield. Also zinc sulphate clearly increased fruit weight, diameter, firmness and T.S.S., meanwhile it decreased fruit acidity when compared with other treatments and control.

Concerning the effect of tested chemicals of severity powdery mildew disease on apricot, results revealed that all the used materials decreased the disease severity percentage when compared with the untreated trees. Zinc sulphate was the most effective in decreasing the infection with powdery mildew to 6.29 and 6.67% accompanied with a high yield/ tree in the first and second season, respectively.

**Keywords:** Apricot, dormancy breaking, fruit quality and Powdery mildew.

### INTRODUCTION

Apricot (*Prunus armeniaca L.*) is considered one of the most popular fruit crops to the Egyptians. The cultivate area of concentrated in Nobarria, Fayoum and Kalyoubia governorates. The total grown areas of apricot in ARE was reached 18044 feddans during 1999 season. Which produced 43042 tons on the average. The future of apricot cultivation mainly depends on planting in the new reclaimed areas with the new introduced cultivars. Powdery mildew disease caused by *Podosphaera oxyacanthae* (D.C.) De Bary var. *tridactyla* (wallr.) is the most serious apricot disease on several of the 80 apricot cultivars. Apricots affected by this disease lose their market value. The pathogen had a and a perithecial phase, which served to protect the fungus. Most of deciduous trees exhibit a period of dormancy in winter. This dormancy needs sufficient chilling accumulation to overcome it (Chandler *et al.* 1937), chilling requirements are usually not fulfilled under Egyptian conditions. So, the use of dormancy breaking agents is becoming an essential treatment for proper and earlier bud break. Several workers used different dormancy breaking agents successfully in order to flowering, vegetation and hence provide protection against many foliar pathogens, including both obligate and facultative parasites (Kamp, 1985; Ziv and Frederiksen, 1987 and Zekaria, *et al.* 1991). The present investigation aimed

mainly to investigate effect of some dormancy breaking agents on bud behaviour, fruit quality, yield and the severity of apricot powdery mildew disease.

## MATERIALS AND METHODS

The study was conducted during two successive seasons, i.e. 1998 and 1999 on mature apricot trees (15 years old) cv. "Amar" grafted on apricot seedlings and grown in a private orchard at Kasr – Bayad locality; Fayoum governorate. Forty-eight uniform trees of this cultivar were devoted for this investigation. The trees were received the usual horticultural practices of irrigation, fertilization and pruning. The trees were distributed in a completely randomized block design at which twelve trees have received either of the following treatments: (1) control (sprayed with water), (2) zinc sulphate ( $Zn\ So_4$ ) at the rate of 5%; (3) hydrogen cyanamide (HC) at 1%, commercially known as Dormex (49%  $CH_2\ N_2$ ) and (4) urea [ $CO\ (NH_2)_2$ ] at the rate of 5%. On 10<sup>th</sup> January of each season, the trees were individually sprayed with the previous chemicals and resprayed with micronized sulphur at bud swelling (prior to bud burst) and after fruit set. Four individual branches in all tree directions were tagged on each tree. The following parameters were determined to evaluate the tested treatments:

1. **Bud behaviour:** Start of bud burst was recorded for each treatment. The number of opened buds was then counted and the percentage of bud burst was calculated.
2. **Fruiting parameters:** Fruit set on the tagged branches was counted and fruit set percentage was recorded for each treatment. The yield per tree (in Kg.) was also weighted.
3. **Fruit physical and chemical properties:** At the time of harvesting, ten fruits were randomly taken from each tree, the fruits were weighed to determine fruit weight, the fruit diameters were measured using a vernier caliper, and fruit firmness was determined using a hand (Ballout, MEQCO) pressure tester. Fruit chemical properties included determination of total soluble solids (T.S.S.) percentage in fruit juice using a hand refractometer, the total acidity as malic acid in 100 C<sup>3</sup> fruit juice according to (A.O.A.C., 1960).
4. **Disease severity:** The incidence and disease severity percentages of apricot powdery mildew were recorded every two weeks according to Townsed and Huberger (1943). Statistical analyses. Data were statistically analysed according to Snedecor and Cochran (1967) and treatment averages were compared at 5% level of probability using L.S.D procedure (Fisher, 1948).

## RESULTS AND DISCUSSION

1. **Bud behaviour:** results of both seasons show that all dormancy breaking agents used in this study markedly advanced bud opening of Amar



culivar (Table .1) Among the tested chemicals, zinc sulphate at 5% induced the earliest bud break in both seasons (1998 & 1999) by 17 and 12 days, in relation to the control, respectively, Doonerbos , 1953 reported that mineral salts (e.g. nitrate and sulphate salts) have been found to be active in breaking the rest in dormant organs. In addition to, potassium nitrate acts as rest breaking agent (Erez, 1987). Hydrogen cyanamide at 1% or urea at 5% advanced bud burst by 11 days in 1998 season and by 10 and 8 days in 1999 season, respectively. Shulman *et al.*, 1983 reported that the effect of hydrogen cyanamide in advancing bud burst in the grapevines might have relation to respiratory rate of the bud tissues as expressed by  $CO_2$  evaluation. The obtained results are in agreement with that recorded by Erez *et al* (1971) and Dozier *et al* (1980) in advancing bud opening date of peach and nectarins.

**Table (1): Effect of some dormancy breaking agents on bud behaviour of apricot trees in 1998 and 1999 seasons.**

Treatments	Date of bud burst beginning		Gained earliness, (days)		Bud burst, %	
	1998	1999	1998	1999	1998	1999
	Control (water)	18-Feb.	13- Feb.			25.0
Zinc sulphate 5%	1-Feb.	1-Feb.	17	12	61.7	56.0
Hydrogen Cyanamide 1%	7-Feb.	3- Feb.	11	10	58.5	54.0
Urea 5%	7-Feb.	5- Feb.	11	8	44.5	49.0
L.S.D. at 5%	-	-	-	-	8.1	6.4

Also, data in table (1) indicate that the bud breaking was delayed in 1998 season than that recorded in the other one (1999). This might be due to late prolonged chilling hours which induced arrested bud break or could be correlated with the nil of chilling hours at the time of application. In this respect, Shulman *et al.* (1986) stated that the effectiveness of the used chemicals depend on rate and time of application, stage of bud development, post application temperature and amount of chilling accumulated. The bud burst percentage was significantly affected by the tested chemicals (Table, 1). The percentage of opened control buds was 25.0 and 32.0 % in 1998 and 1999 season, respectively. Zinc sulphate at 5% was the most effective treatment since it induced the highest bud opening percentage (61.7 & 56.0 %) in the first and second season, respectively. There was no significant difference between this treatment and hydrogen cyanamide usage at 1%. Meanwhile, spraying with urea at 5% was the least effective chemical on bud burst percentage, being 44.5 and 49.0% in the two seasons, respectively. A significant difference was detected between either zinc sulphate or hydrogen cyanamide treatment and urea applies. The present results are in the line with those recorded by Samish, 1954, Erez, 1987 and Jorge *et al.* 1992. Moreover, Wang *et al.*, 1985 demonstrated that dormancy breaking agents increased both respiration rate and activity of apple buds significantly.

**2. Fruiting parameters:** Table (2) reveals that the percentage of fruit set was generally increased by the tested chemicals in comparison with the control,

this was true in both seasons. The highest percentage of fruit set in the first and second season was obtained when zinc sulphate was used at 5%, being 17.0 and 18.0 % accompanied with a yield of 123.3 and 120.0 Kg /tree, respectively. The corresponding values for control treatment were 9.0 and 10.0% for fruit set and a yield of 65.7 and 75.5 Kg / tree in 1998 and 1999 season respectively. On the other hand, usage of hydrogen cyanamide was intermediate in this concern, while urea was less effective, the difference in the yield between all the treatments was significant. It could be concluded that, in general, the increment of the yield may be due to the higher percentage of fruit set, The significant increase in the yield / tree obtained by hydrogen cyanamide at 1% is in agreement with that reported by Shulman *et al* (1983) Eres (1987) and EL. Shall *et al* (1993). They demonstrated that HC treatment enhanced both vegetative and floral bud break, which in turn could resulted higher yield. On the other hand, the significant reduction in the yield resulted by urea application at 5% could possibly be due to toxicity of urea at considerably high tested concentration. On contrary, the obtained results concerning urea are disagreement with those reported by Taha and Abbass (1987). They stated that urea application increased fruit set and fruit yield at the highest concentration; the difference between these results may be due to the different tested cultivars, time of application and / or methodology used.

Table (2): Effect of some dormancy – breaking agents on fruiting potentiality and yield of apricot per tree (in Kg) in 1998 and 1999 seasons.

Spraying Treatments	Fruit set, %		Yield / tree ( in Kg)	
	1998	1999	1998	1999
Control (water)	9.0	10.0	65.7	75.5
Zinc sulphate5%	17.0	18.0	123.3	120.0
Hydrogen Cyanamide1%	15.0	15.0	109.0	110.0
Urea 5%	14.0	15.0	85.3	98.0
L.S.D. at 5%	1.0	0.96	8.5	3.9

2. Fruit physical and chemical characters: Concerning the effect of dormancy breaking chemicals on apricot fruit characters, Table (3) show that hydrogen cyanamide did not affect the fruit diameter at the two seasons, meanwhile zinc sulphate and urea significantly increased it at the second season. All tested chemicals significantly increased total soluble solids (T.S.S) at the two seasons. On the contrary, they decreased fruit acidity but the reduction was only significant with zinc sulphate as compared to the control in both seasons.



**Table (3): Effect of some dormancy – breaking agents on physical / and chemical properties of apricot fruits in 1998 and 1999 seasons.**

Spraying Treatments	Fruit diameter(cm)		Total soluble solids %		Acidity,%	
	1998	1999	1998	1999	1998	1999
Control (water)	3.80	3.23	15.0	15.0	1.80	1.83
Zinc sulphate 5%	3.93	3.50	18.0	18.0	1.50	1.53
Hydrogen Cyanamide 1%	3.90	3.30	17.4	17.0	1.60	1.63
Urea 5%	3.70	3.65	17.2	17.0	1.60	1.65
L.S.D. at 5%	0.2	0.2	1.1	0.9	0.21	0.21

The use of zinc sulphate caused much increase in total soluble solids content (T.S.S.) and the greatest reduction in total acidity in both seasons compared with either other treatments or the control one. The highest T.S.S. and lowest acidity in fruit juice resulted from this treatment could be due to the stimulating effect of zinc sulphate on bud break, so it induced the earliest bud open and the longest growing season which in turn stimulate carbohydrate accumulation in the growing fruits. In parallel to the present results Shaltout *et al* (1993) indicated that hydrogen cyanamide had no effect on fruit characteristics of Santa Rose plum and Canio apricot. The somewhat difference between these results may be due to the used concentration and / or the tested cultivars of a given host Klinac *et al.*, (1991).

**Effect on powdery mildew disease severity:** The disease severity percentage of apricot powdery mildew was estimated under the effect of different dormancy breaking agents as mentioned before. Data in table (4) show that all the used chemicals decreased the disease severity percentage as compared with the control. Among the tested agents, zinc sulphate at 5% caused a significant decrease of infection in either 1998 or 1999 season, being 6.29 and 6.67 %, respectively. The corresponding figures of the infection in the control treatment were 68.34 and 68.95 % in the first and second season, respectively. The recorded disease severity percentages caused by utilize of hydrogen cyanamide at 1% was 7.31 and 7.87 % in both seasons, respectively, while it was 7.59 and 8.26 % in the urea (5%) treatment trees.

**Table (4): Effect of some dormancy – breaking agents on the incidence and disease severity percentage of apricot powdery mildew in 1998 and 1999 seasons.**

Treatments	Disease incidence, %		Disease severity percentage, %	
	1998	1999	1998	1999
Control (water)	87.33	85.00	68.34	68.95
Zinc sulphate 5%	30.67	35.50	6.29	6.67
Hydrogen Cyanamide 1%	42.33	45.00	7.31	7.87
Urea 5%	46.33	48.50	7.59	8.26
L.S.D. at 5%	2.4	2.09	0.81	0.71

Powdery mildew infection remarkably reduced the weight of the yield (untreated) control as compared with zinc sulphate, Hydrogen cyanamide and Urea. The average weights of yield harvested from trees treated with zinc sulphate, hydrogen cyanamide, Urea and from untreated control. Trees were 123.3, 109.0, 85.3 and 65.7 kg respectively in the first season. In the second season, it is clear from the data in Table (4) that all treatment were taken the same trend of the data which it was obtained in the first season.

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### تأثير بعض المواد الكاسرة للسكون على الإنتاجية ونوعية الثمار وشدة الإصابة بالبياض الدقيقي لأشجار المشمش

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تم رش أشجار مشمش ناضجة صنف "عمار" في ١٠ يناير خلال الموسمين ١٩٩٨ ، ١٩٩٩ باستخدام ثلاث مواد كاسرة للسكون (سلفات الزنك بتركيز ٥% - دورمكس بتركيز ١% - يوريا بتركيز ٥%) ، وأوضحت المعاملة بسلفات الزنك تفوقاً على جميع المعاملات الأخرى حيث أدت إلى التبريد في خروج البراعم بنحو ١٧ ، ١٢ يوماً مقارنة بمعاملة الكونترول في الموسم الأول والثاني على الترتيب. كما أدت إلى زيادة نسبة البراعم المتفتحة مقارنة بالمعاملتين الأخرين أو الكونترول. بالإضافة إلى ذلك فقد أدت المعاملة بسلفات الزنك إلى زيادة معنوية في عقد الثمار والمحصول ، كما حسنت من وزن وقطر وشكل الثمار وكذلك نسبة المواد الصلبة الذاتية ، وفي ذات الوقت قللت من حموضة الثمار مقارنة بالمعاملات الأخرى والكونترول.

وفيما يتعلق بتأثير المواد الكيماوية المختبرة على شدة إصابة المشمش بالبياض الدقيقي أوضحت النتائج أن كل المواد المستخدمة قللت نسبة الإصابة بالمرض مقارنة بالأشجار غير المعاملة. كانت سلفات الزنك أكثر المواد تأثيراً في تقليل الإصابة بالبياض الدقيقي إلى ٦,٢٩ ، ٦,٦٧% مقترنة بزيادة محصول الشجرة في الموسم الأول والثاني على التوالي.