

RESPONSE OF "LE-CONTE" PEAR TREES TO SOME DORMANCY BREAKING AGENTS

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Abstract

Productive "Le-Conte" pear trees at El-Kanater Horticultural Research Station, Egypt, were sprayed at the end of January in 1996 and 1997 seasons with 250 ppm GA₃, 0.5% and 1% thiourea, 3% potassium nitrate and 2%, 3% and 4% Dormex. All treatments increased percentage of vegetative and flower bud break. High percentages and significant differences more than the control were obtained as a result of spraying Dormex at 33% and 4% concentrations. This agent also resulted in advancing bud break for about two weeks in comparison with the control. The increase in fruit set percentage was realized due to 3% Dormex, 3% potassium nitrate and 1% thiourea treatments, respectively. However, all treatments increased yield except 0.5% thiourea treatment. Furthermore, all treatments slightly decreased fruit diameter and firmness and increased total soluble solids, while acidity was not significantly affected.

INTRODUCTION

Dormancy is a phase of development that occurs annually in deciduous fruit trees. Release of dormancy requires accumulated chilling during winter, followed by a rise in temperature in spring (Richardson, *et al.*, 1974; Fuchigami, *et al.*, 1982). The major obstacle to economic production of deciduous fruit trees in subtropics and tropics is the insufficient period of chilling temperature. Inadequate chilling may result in poor and uneven bud break, reduced and delayed foliage development, sparse bloom, abnormal flower development, poor fruit set, and/or early growth cessation (Erez, 1987). Gibberellins induced bud break of peach leaf bud (Hull and Lewis, 1952) and flower bud of some peach cultivars (Erez, *et al.*, 1971). On the other hand, gibberellins had no effect on inducing bud break of apples (Hatch and Walker, 1969, Walker, 1970; Shaltout and Unrath, 1983). Thiourea also has a pronounced effect on breaking dormancy of peach and apple buds (Blommaret, 1965; Wolak and Couvillon, 1976).

Mansour, *et al.* (1986) found that thiourea + KNO₃ had increased fruit set

of some peach cultivars whereas GA3 had no effect. Hermano, *et al.* (1987) found that potassium nitrate at 4% induced flower bud break, thiourea at 2% induced leaf bud break and hydrogen cyanamide (H₂CN₂) and dinitro-O-creasol (DNOC) (winter oil) induced both leaf and flower buds in peaches and apples. Hydrogen cyanamide application increased the floral bud activity and advanced bud burst and full bloom in three Asian pear cultivars. Fruit total soluble solids was increased, while juice acidity and flesh firmness were reduced in some cases (Mokhtar *et al.*, 1994). Jorge *et al.* (1992) found that peach bud break percent and phytotoxicity depended on concentration and timing of application of H₂CN₂. They found that H₂CN₂ gave a higher percent of bud break during the later stages of endo-dormancy. Application of hydrogen cyanamide on Nashi (*Pyrus serotina*, Rohd) advanced the onset of flowering, shortened the flowering period and increased fruit production with no adverse effect on fruit weight and quality; differences occurred due to date of application, concentration and cultivar (Klinac *et al.*, 1991). Dormex at 4% concentration gave better results than 2% in advancing bud break, enhancing bud burst and increasing fruit set of "LeConte" pear (Stino, 1987).

Cyanamide at 0.5% or 1% was applied to three almond cultivars (Neplus Ultra, Non Pareil and Texas Mission) 6 weeks before expected full bloom. Bud break of all cultivars was increased and the yield of Non Pareil was enhanced (North, *et al.*, 1993). 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 H₂CN₂ at 0.75% with 4% mineral oil gave nearly similar results (Stino, 1997).

This study was initiated to study the effect of some dormancy breaking agents on vegetative and mixed bud break; fruit set, fruit characters and yield of "LeConte" pear cultivar.

MATERIALS AND METHODS

This study was carried out during the two successive seasons 1996 and 1997 on 25-years old "LeConte" pear trees grafted on Communis rootstocks and planted at 5 meters apart at El-Kanater Horticultural Research Station, Egypt. All horticultural practices were performed as recommended in Kalubi Governorate. Twenty four trees, uniform in growth and vigour and in good physical condition were selected and grouped under eight treatments. Treatments were replicated three times each represented by a single tree in complete randomized block design. Trees under treatme-

nts were sprayed at the end of January in both experimental seasons with GA3 at 250 ppm, 0.5% thiourea, 1% thiourea, 3% potassium nitrate (KNO₃), and 2%, 3% and 4% Dormex. Control, trees were sprayed with water. Amount of vegetative and flower bud burst on certain dates were determined and expressed as percent of buds that opened out of the total number of buds. Number of buds in each stage of flower bud development "0 = dormant, 1 = swelling, 2 = bud break, 3 = sliver tip, 4 = green cluster, 5 = white bud, 6 = full opening, 7 = petal fall and 8 = fruit set" (Stino, 1987) was recorded and average stage of development was calculated. Percentage of fruit set as well as tree yield in Kg were determined. Samples of 15 matured fruits were examined to study the effect of spraying dormancy agents on fruit characteristics such as: Fruit weight, volume and specific gravity as gm/cm³, Fruit diameter, Fruit firmness was estimated by Magnese-Taylor type pressure tester which has a standard 5/16 of inch plunger and recorded as lb/inch², total soluble solids (%) were estimated using a hand refractometer, total acidity (%) was calculated as gm malic acid/100 gm fresh weight (A.O.A.C., 1960). Obtained data were statistically analysed according to Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

1. Vegetative bud break

Table 1 shows the effect of different dormancy breaking agents on the vegetative bud break of "LeConte" pear. All treatments increased significantly the percentage of bud break over the control during the two experimental seasons 1996 and 1997. The highest percentage was obtained with Dormex at the concentrations 3%, 2% and 4%, respectively. The three treatments resulted in advancing bud break for about two weeks earlier than in the control. Potassium nitrate (KNO₃) at 3% was more effective than thiourea at 0.5% and 1% as well as GA3 at 250 ppm. However, all treatments were better than the control.

These results are in harmony with the findings of Blommart (1965); Erez (1971); Walak and Colvin (1976); Mansour, *et al.* (1986); Hermano *et al.* (1987); Stino (1987) and North *et al.* (1993).

2. Flower bud break

Data presented in Table 1 show that flower bud break was significantly accelerated due to the application of Domex at 4% followed by Dormex at 3%. High percentages of flower bud break (98.53, 87.30) were obtained on the fifth of April

Table 1. Effect of dormancy breaking agents on percentage of vegetative and flower bud break of "LeConte" pear trees.

Treatment	Date of evaluation											
	15/3				27/3				5/4			
	96		97		96		97		96		97	
	V.	F.	V.	F.	V.	F.	V.	F.	V.	F.	V.	F.
GA3 250 ppm	27.36	30.43	24.95	28.18	70.86	49.96	68.15	47.82	75.00	66.43	77.65	68.24
Thiourea 0.5	25.00	20.66	23.27	21.46	59.10	60.43	56.78	64.67	64.13	66.43	68.70	67.16
Thiourea 1%	49.76	23.63	42.16	25.10	64.33	61.40	67.0	52.19	77.33	59.00	80.16	60.20
KNO ₃ 3%	39.3	30.60	35.74	32.46	62.06	61.76	66.47	49.89	84.36	52.26	87.27	54.18
Dormex 2%	48.60	47.70	61.94	46.62	92.03	61.90	90.55	60.09	94.50	63.23	96.19	67.24
Dormex 3%	70.36	76.20	76.12	75.16	93.50	86.53	94.17	84.19	94.83	87.30	98.58	90.82
Dormex 4%	46.83	81.30	60.72	82.64	77.60	94.16	74.65	92.47	84.60	98.53	90.14	98.12
Control	22.73	33.46	26.66	30.36	47.00	60.30	49.15	68.37	55.86	62.50	60.22	67.14
L.S.D. at 5%	3.65	6.16	4.07	6.70	4.26	7.60	4.55	7.46	4.12	5.79	4.76	5.94

V. = Vegetative bud. F. = Flower bud.

1996 due to the previously mentioned treatments, respectively. The corresponding percentages were 98.12 and 90.82 in the next season 1977. Thiourea at 0.5% and 1% and GA3 at 250 ppm did not affect significantly percentage of flower bud break in comparison with the control.

Table 2 reflects the effect of dormancy breaking agents on rate of flower bud development stage. Data indicated that treatment of Dormex at 4% and 3% were the most effective. Higher rates were obtained on march 15 due to those treatments in both seasons. The rates were 5.47, 5.56 and 4.50, 4.47 at 4% and 3%, respectively, while it was only 2.37 and 2.25 in the control. This had resulted in advancing and regulating flowering. Differences between the two treatments were insignificant. Differences between GA3, thiourea, KNO3 and 2% Dormex were insignificant compared with the control.

These results are in agreement with Stino (1987) who found that Dormex at 4% gave better results than at 2% in advancing bud break and enhancing bud burst of "LeConte" pear. However Dormex at 1.5% resulted in advancing and increasing bud burst percentage, enhancing floral bud burst activity and accelerated full blooming of Anna apple trees (Stino, 1997). On the other hand, Hatch and Walker (1969, 1970) and Shaltout and Unrath (1983) mentioned that gibberellins had no effect on advancing bud break of apples.

3. Fruit Set

Table 2 shows the effect of dormancy breaking agents on fruit set percentage which had been estimated on April 12 during 1996 and 1997 seasons. Data clearly showed that all treatments had significantly increased percentage of fruit set except for GA3 and thiourea at 0.5%. The best treatment was attained as a result of spraying Dormex at 3% followed by KNO3 at 3%, and thiourea at 1%, respectively. On the other hand, thiourea at 0.5% had the least effect.

These results are in harmony with the findings of Mansour *et al.* (1986) and Stino (1987) on peaches and pear, respectively.

4. Yield

Fruits were harvested on 10 August in both seasons. Data presented in Table 2 show that all treatments except thiourea at 0.5% had increased significantly tree yield of "LeConte" pear during 1996 and 1997 seasons. Best results were attained by

Table 2. Effect of dormancy breaking agents on average rate of flower bud development stage, percentage of fruit set and tree yield of "LeConte" pear trees.

Treatment	Rate of flower bud development stage Date of evaluation								Fruit set (%)		Fruit set (%)	
	15/3		27/3		5/4							
	96	97	96	97	96	97	96	97	96	97	96	97
GA3 250 ppm	3.00	2.94	4.86	4.74	5.73	5.81	3.95	3.74	24.12	21.48	24.12	21.48
Thiourea 0.5	2.27	2.30	4.93	5.03	5.43	5.46	3.60	3.27	20.73	18.92	20.73	18.92
Thiourea 1%	2.70	2.78	5.10	5.19	5.96	5.91	5.32	4.60	33.81	30.12	33.81	30.12
KNO ₃ 3%	3.48	3.56	5.13	5.08	5.26	5.31	5.83	5.33	42.15	37.06	42.15	37.06
Dormex 2%	3.40	3.39	5.66	5.49	6.16	6.24	4.68	4.47	32.19	27.80	32.19	27.80
Dormex 3%	4.50	4.47	6.30	6.19	6.40	6.80	6.66	6.18	46.32	40.90	46.32	40.90
Dormex 4%	5.47	5.56	6.73	6.67	7.06	7.02	4.62	4.12	35.42	33.76	35.42	33.76
Control	2.37	2.25	5.03	5.01	5.13	5.24	3.15	2.87	19.10	17.85	19.10	17.85
L.S.D. at 5%	1.22	1.34	1.17	1.12	1.08	1.19	1.12	1.20	2.57	3.01	2.57	3.01

Stages of flower bud development :

0 = dormant, 1 = swelling, 2 = bud break, 3 = silver tip, 4 = green cluster, 5 = white bud, 6 = full opening, 7 = petal fall and 8 = fruit set.

Aveg. No. of buds in each stage (bud stage No.)

Rate of flower bud development = $\frac{\text{Total flower buds}}{\text{Total flower buds}}$

using 3% Dormex followed by 3% KNO₃ 4% Dormex, 1% thiourea and 2% Dormex, respectively, whereas GA₃ treatment had the least effect. Increase in fruit production of Nashi pear (*Pyrus serotina*) was found also by Klinac *et al.* (1991) due to hydrogen cyanamide application with no adverse effect on fruit weight and quality.

5. Fruit characters

Data presented in Table 3 indicate that fruit specific gravity had slightly increased than in the control due to Dormex treatment at 3%, whereas no significant differences between specific gravity of the other treatments and the control were observed. Concerning fruit diameter, all treatments slightly decreased fruit diameter than in the control. Such decrease can be attributed to the high yield obtained. These results are in harmony with the findings of Kinac *et al.* (1991) on pear who attributed the differences that occurred in fruit weight and quality to the date of hydrogen cyanamide application, concentration and cultivar. In addition all treatments significantly reduced fruit firmness than in the control (Table 3). The least value obtained during both seasons was that with 3% Dormex.

Data of the effect of different breaking agents on total soluble solids are summarized in Table 3. Treatments of GA₃, KNO₃ Dormex at 2% and 3% increased percentages of total soluble solids in fruit juice, while no effect was noticed with the other treatments. The highest percentage of T.S.S. was realized with 3% Dormex treatment. Thiourea at 1% and Dormex at 2% and 3% treatments reduced juice acidity than in the control with no significant differences. Such results were also revealed by Mokhtar, *et al.* (1994) on three Asian pear cultivars who found that T.S.S. was increased, while juice acidity and flesh firmness were reduced in some cases due to hydrogen cyanamide application.

Table 3. Effect of dormancy breaking agents on fruit quality of "LeConte" pear trees.

Treatment	1996				1996					
	Sp.gr. (g/cm ³)	Fruit diameter (cm)	Firmness (lb/ inch ²)	T.S.S. (%)	Acidity (%)	Sp.gr. (g/cm ³)	Fruit diameter (cm)	Firmness (lb/ inch ²)	T.S.S. (%)	Acidity (%)
GA3 260 ppm	0.94	4.06	9.2	9.3	0.22	0.90	3.92	8.6	10.5	0.24
Thiourea 0.5	0.96	4.12	8.5	8.0	0.24	0.92	3.90	7.3	10.0	0.20
Thiourea 1%	0.96	4.16	8.6	9.0	0.18	0.95	4.10	7.3	10.2	0.16
KNO ₃ 3%	0.94	4.05	9.4	9.1	0.24	0.92	3.98	8.5	10.6	0.23
Thiourea 1%	0.96	4.10	8.8	9.3	0.25	0.95	4.02	8.4	10.8	0.18
KNO ₃ 3%	1.01	4.22	8.4	9.4	0.26	1.00	4.08	6.8	11.0	0.21
Dormex 4%	0.94	4.01	8.7	8.7	0.32	0.91	3.86	7.8	10.3	0.19
Control	0.96	4.28	9.6	8.4	0.26	0.94	4.24	8.7	10.0	0.24
L.S.D. at 5%	0.03	0.05	0.1	0.6	N.S.	0.04	0.08	0.10	0.40	N.S.

Sp. gr. = Specific gravity (density) = Weight (g) / Volume (cm³)

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إستجابة أشجار كمثرى الليكونت لبعض المواد الكاسرة للسكون

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معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة.

أجريت هذه الدراسة على أشجار كمثرى الليكونت المثمرة بمحطة بحوث البساتين بالقناطر الخيرية حيث رشت الأشجار في نهاية شهر يناير بالمواد الآتية: حمض الجبريليك تركيز ٢٥٠ جزء في المليون - ثيوريا بتركيز ١٠٠٠، ١٠٠، ١٠ - نترات البوتاسيوم بتركيز ٣٪ - دورمكس بتركيزات ٢٪ ، ٣٪ ، ٤٪، وقد أدت هذه المعاملات إلى زيادة نسبة التفتح في البراعم الخضرية والزهرية خلال موسمي التجربة وكانت أعلاها نتيجة إستخدام الدورمكس بتركيز ٣٪ ، ٤٪ كما أدت إلى تكيير تفتح كلا من البراعم الزهرية والخضرية عن المقارنة بحوالي أسبوعين. كما أدت معاملة الدورمكس ٣٪ إلى زيادة عقد الثمار تلتها معاملة ٢٪ نترات البوتاسيوم ثم ١٪ ثيوريا. وقد أدت جميع المعاملات إلى زيادة الحصول فيما عدا معاملة ٥٠٠، ١٠٠، ١٠ ثيوريا وفيما يختص بالصفات الثمرية فإنه نتيجة للمعاملات السابقة حدث إنخفاض طفيف في قطر الثمار والصلابة مع زيادة في نسبة المواد الصلبة الذاتية وعدم تأثر نسبة الحموضة في الثمار تأثيرا معنويا.