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Studies the Effect of Alternative Dormancy Breaking Agents on "Le-Cont" Pear Cultivar

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ABSTRACT

This study was carried out during two successive seasons of 2013 and 2014, to investigate the effect of alternative dormancy breaking agents on bud break, growth, yield and fruit characteristics of "Le-Cont" pear cultivar. The following treatments were investigated at the dormant bud stage; 2% Garlic extract (GE) + 4% Summer oil; 4% GE + 4% (summer oil); 2% hydrogen cyanamide (H_2CN_2) + 4% (summer oil); 4% H_2CN_2 + 4% (summer oil); 2 % urea phosphite ($CO(NH_2)_2.H_3PO_3$) + 4% (summer oil); 4 % (urea phosphite) + 4% (summer oil); 4% Summer oil alone. The effects of all treatments were compared with the control (untreated trees). It is noticed that the beginning of flowering to all treatments resulted in early flowering and shorter than the control. All treatments increased both bud burst percentage and floral bud percentage; especially garlic extracts at the highest concentration. Garlic extract and urea phosphite concentration gave the highest number of fruits/tree and yield kg/tree also fruit weight, size and their dimensions have been affected. Hydrogen cyanamide 4 % and urea phosphite 2 % gave the softener fruits. In addition, all treatments was affected to increase TSS, total and reducing sugars than control treatment. Hormonal changes during the rest period in flower buds of Le-Conte pear were determined in the 2nd season of the study. The highest levels of IAA and GA_3 contents were found to be in endo-dormancy (on the end of Feb.), while Abscisic acid showed the highest values during the 1st deep dormancy (on the end of Dec.). It was a remarkable increases in IAA and GA_3 occurred at bud swelling stage. Meanwhile, the lowest level of ABA was observed at the same stage.

Keywords: Le-Conte pear cultivar, bud break, hydrogen Cyanamid, urea phosphate, mineral oil, flowering, yield, fruit quality..

INTRODUCTION

Le-Conte pear is the main cultivar grown in Egypt. Le-Conte pear cultivar resulted as a hybrid between (*Pyrus communis* L.) and (*Pyrus serotina* L). It suffers from several problems which have a negative effect on its yield; insufficient chilling requirements. Thus, the use of dormancy breaking agents is very essential to increase bud burst (Finetto 1993, Makarem 1996 and Stino and Rasheed 2002). Moreover the insufficient chilling under Egyptian conditions delays flowering to be extending at period of high relative humidity and high temperature, under these conditions a great infection of fire blight disease occurres, which causes a crop losses of up to 95 percent as what reported in 1985 (Zwet-Van-der and Beer, 1995).

Many compound as (mineral oil, hydrogen cyanamide.. etc) affect bud dormancy release (Petri *et al*. 2002). Hydrogen cyanamide applied to dormant buds of a deciduous fruit trees, inhibits catalase activity and increased H_2O_2 content. Prior to bud break with increase of polyamines such as putrescine spermine, spermidine, histamine and cadarerine. These sharply (Dormex) decrease again at full blooming stage was observed by (Amberger, 2013).

Hydrogen cyanamide was used to enhance fruit maturity of apple (Makarem 1996), El-Ramah *et al*. (2008) on pear, (Khalil *et al*. 1999).

Producers of fruit prefer using natural products in horticultural practices instead of synthetic chemicals since superiority & world market has been growing rapidly for organic fruit products Dimitri and Oberholtzer, (2006). Another reason, is the hazards of H_2CN_2, on human health (Seltimi *et al*. 2005).

Garlic (*Allium sativam* L.) is one of oldest plants used as food and medical applications and also in treatment and prevention of a number of diseases, Koch and Lawson, (1996). These activities are related to the active compounds as, thiosulfinates, volatile sulfur compounds. Besides these low-molecular weight compounds, garlic is characterized by more polar compounds of phenolics (Jirovetz *et al*. 2001 and Omri 2006).

Kubota *et al*. (2000) reported that fresh garlic induces bud breaking, when applied to grapevine buds exposed to insufficient chilling. Botelho and Muller (2007) postulated that the 10% garlic extract plus 2% mineral oil treatment was superior as compared to the others treatments, reaching 95% bud sprouting at 50 days after spraying and was effective in advancing bloom in "Royal Gala" apple trees. Vargas *et al*. (2008) stated that the compounds which contain sulphur may play a role in breaking bud dormancy, of table grape cultivar. Abd El-Razek *et al*. (2011) stated that Canino apricot trees grown under warm winter conditions greatly responded to spraying garlic extract at 4% and their productivity and fruit quality were improved workers (2013) reported that Le-Conte pear trees grown under warm winter conditions greatly responded to spraying garlic extract at 8% and GA at 100 ppm, which improved their flowering behavior, productivity and fruit quality parameters.

Salt of phosphite (H_3P_3) contains higher concentration of P (39 %) and more soluble molecules than traditional phosphate (H_3PO_4) [P (32 %)], quickly absorbed by leaves, roots and branches, it is uniquely able to move in both xylem and phloem resulted in many physiological responses may be related to its effect on sugar metabolism, stimulation of the shikimic acid pathway, or interval hormanol and chemical changes (Lovatt and Mikkelsem, 2006). Also, the same authors investigated the foliar applications of phosphite led to aunique seedling growth bud formation, blossoming, fruit set, plant vigor and significantly reduced summer stress. A method of enhancing break of dormancy in their deciduous plants. Comprising providing a dormancy breaking enhancer comprising urea phosphite to enhance of the physiological processes of plants which are in dormant (Frank, 2011).

A single foliar prebloom application of phosphite on Valencia orange significantly increased both flower number, yield and TSS %. In Navel orange, foliar applications in May and July produced more commercially valuable large fruit without reducing total yield (Albrigo, 1999). Lovatt (1999). Stated that phosphite application in citrus can cause increase of growth, fruit set, fruit size and improved fruit quality.

Walker (1970), stated that if the ratio of gibberellic acid and cytokinin to abscisic acid is high, growth will occur, if the two promoters are low in relation to the inhibitor, growth ceases. Some researchers suggested that endo-dormancy in buds is regulated by a fluctuation, balance between endogenous growth promoters and inhibitors (Walker and Seeley 1973 and Wood 1983). Arafat et al., (1995) stated that concentration of IAA and GA sharply decreased in Le-Conte pear flower buds during endo-dormancy from December to February, whereas ABA slightly decreased from December to January and then increased in February. Also they postulated that a remarkable sudden increases in IAA, GA and total indols at bud swelling stage.

The purpose of the present study was to compare between the effects of garlic extracts, urea phosphite and the standard treatment of using Hydrogen cyanamid (Dormex) at two concentration all treatments mixed with summer oil and their effects on the performance of Le-Conte pear trees.

MATERIALS AND METHODS

This study was conducted in a private farm at 10th of Ramadan, El-Sharkia governorate, during two successive seasons (2013 and 2014). Ten years old trees of "Le-Conte" pear cultivar on P. betulaefolia rootstock were selected planted at 5 x 5 m. They were uniform in size and under drip irrigation system and grown in sandy soil. Normal Agricultural practices were carried out in accordance with the guidance of the Ministry of Agricultural of Egypt.

All trees were sprayed with different treatments of dormancy breaking agents on February 10th the 2013 and 2014 seasons. Foliar sprays treatments were as follows:-

1- Fresh water (Control).
2- Garlic extracts[(1)] 2 % + summer oil[(2)] (Caple $_2$) 4%.
3- Garlic extracts 4 % + summer oil (Caple $_2$) 4%.
4- Hydrogen Cyanamide[(3)] 50 % at 1% + summer oil (Caple $_2$) 4%.
5- Hydrogen Cyanamide 50 % at 2% + summer oil (Caple $_2$) 4%.
6- Urea phosphite[(4)] (CO $(NH_2)2.H_3PO_3$) 2 % + summer oil (Caple $_2$) 4%.
7- Urea phosphite (CO $(NH_2)2.H_3PO_3$) 4 % + summer oil (Caple $_2$) 4%.
8- summer oil (Caple $_2$) 4% alone.

Three trees were used for each treatment, each tree acting as a replicate totaling twenty four trees, five limbes (more than 3 years) were tagged on each tree and the following parameters were recorded at specified periods.

1. Index of flowering bud activity every (twice a week) during flowering period. Bud flowers development stage:- 1) Dormant bud; 2) Swelling bud; 3) Green tip; 4) Green cluster; 5) Balloon stage; 6) Full bloom and 7) Fruit set.
2. Percentage of flowering buds to total number of bud burst of branch.
3. Date bud burst, fruit set and blooming period.
4. Fruit set percentage, number of fruits/tree and yield (kg/tree).
5- Fruit quality: Fruit weight (g), size (cm^3), diameter-length (cm), fruit firmness ($lb/inch^2$) and juice TSS % according to AOAC (1990).
6- Sugar content: total sugars as well as reducing sugars were determined according to the method described by Dubois *et al*. (1956).
7. The levels of endogenous hormones in buds:- At three dates during season (end of December, end of January and end of February) IAA, GA3 and ABA were determined of bud by the method of Wasfy and Orrin, (1975).
8. Statistical analysis: The obtained data were subjected to analysis of variance (ANOVA) according to (Snedecor and Cochran 1972). M-Stat-C program was used. Also, Duncan Multiple Range Test was used to compare between the means of treatments according to (Waller and Duncan 1969) at probability of 5 %.

RESULTS AND DISCUSSION

1- Index of flower bud activity

Data in Table (1) shows that the average of index flower bud values in the two seasons which were corresponding between them. Different treatments accelerated bud activity with pronounced significant effect. It is clear that Hydrogen cyanamide (4 %) was statistically the highest were they reached the stage of fruit set on (24/3) followed by urea phosphite (2 %) with significant differences. The last date (1/4) treatments reached to the fruit set higher than control, summer oil and garlic extract at low concentrations however, the later to two treatments were statistically higher than control and equal to each other.

2- Date of bud break. Presented data in Table (2) show that compared with control all treatments resulted in earliness in date of bud. Hydrogen cyanamide at 4 % were the most affective breaking agent followed by garlic extract at 4 % for the date of bud burst in two seasons.

Furthermore, hydrogen cyanamide at high concentration and urea phosphite treatments had the shortest blooming period which ranged (28-29 days) and (27-29 days) in both seasons, respectively compared with control treatment, which had the blooming periods that ranged from (40-42 days). Date of fruit set should the same trend. These results were in line with the finding of (Shain *et al* 1997) in plum, and (El-Ramah *et al*. 2008) in pear.

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(1) Garlic extract (GE): The product name (Nema stop), this contains thiol compound, (Alkyl cysteine sulphoxides) is produced by Central Lab of Organic Agricultural.
(2) Cable 2: is a trade name compound 96.62 % mineral oil.
(3) Dorcy (H2CN2): 50 % is the commercial production from company Nippon carbide. Japan.
(4) Urea phosphate (UpH): $CO(NH_2)_2.H_3PO_3$.

Table 1. The effect of different dormancy breaking agents on the index of bud activity during 2013 and 2014 seasons.

Treatments	First season				Second season			
	10/3	17/3	24/3	1/4	10/3	17/3	24/3	1/4
Control	2.45e	3.53e	4.30g	6.10c	2.40e	3.10g	3.90f	6.00b
Garlic extract 2 % + S. oil 4 %	2.87de	4.60c	4.73e	6.60b	2.65d	4.50d	4.70d	6.50ab
Garlic extract 4 % + S. oil 4 %	2.73de	4.73c	5.33d	7.00a	2.70d	4.61e	5.25c	7.00a
Hydrogen cyanamide 2 % + S. oil 4 %	3.97b	5.50b	5.80c	7.00a	3.76b	5.45b	5.80b	7.00a
Hydrogen cyanamide 4 % + S. oil 4 %	5.93a	6.37a	7.00a	-	5.70a	6.27a	7.00a	-
Urea phosphite 2 % + S. oil 4 %	3.30c	4.87c	6.20b	7.00a	3.24c	4.79e	6.10b	7.00a
Urea phosphite 4 % + S. oil 4 %	3.03cd	3.80d	4.83e	7.00a	3.13c	3.70f	4.80d	7.00a
Summer oil (S. oil) Caple 4 %	2.63de	3.97d	4.43f	6.57b	2.58d	3.80f	4.35e	6.50ab

Means in the same column followed by the same letter (s) are not significantly (p ≥ 0.05) different.

Table 2. Effect of dormancy breaking agents on date of bud burst, fruit set and duration of flowering period during 2013 and 2014 seasons.

Treatments	Date of bud burst	Date of fruit set	Duration of flowering period
		First season: 2013	
Control	15-Mar	24-Apr	40a
Garlic extract 2 % + S. oil 4 %	05-Mar	05-Apr	31c
Garlic extract 4 % + S. oil 4 %	01-Mar	01-Apr	31c
Hydrogen cyanamide 2 % + S. oil 4 %	05-Mar	05-Apr	31c
Hydrogen cyanamide 4 % + S. oil 4 %	25-Feb	24-Mar	28d
Urea phosphite 2 % + S. oil 4 %	05-Mar	03-Apr	29d
Urea phosphite 4 % + S. oil 4 %	05-Mar	05-Apr	31c
Summer oil (S. oil) Caple 4 %	10-Mar	09-Apr	35b
		Second season: 2014	
Control	16-Mar	27-Apr	42a
Garlic extract 2 % + S. oil 4 %	07-Mar	09-Apr	33b
Garlic extract 4 % + S. oil 4 %	03-Mar	04-Apr	32b
Hydrogen cyanamide 2 % + S. oil 4 %	06-Mar	07-Apr	32b
Hydrogen cyanamide 4 % + S. oil 4 %	27-Feb	26-Mar	27d
Urea phosphite 2 % + S. oil 4 %	05-Mar	03-Apr	29c
Urea phosphite 4 % + S. oil 4 %	08-Mar	10-Apr	33b
Summer oil (S. oil) Caple 4 %	11-Mar	17-Apr	37b

Total bud burst (%):-

Data in Table (3) should that total bud burst % was significantly the highest for the 4 % hydrogen cyanamide in both seasons amounting to 85.67 and 95.33 %, respectively. Statistically equal results were due to the 4 % Garlic extract treatment in the first season only. Whereas, lowest significant percentages were due to urea phosphate treatment at 4 % in both seasons and to control in the second one only.

Flowering bud burst (%):-

The results in Table (3) show that the flowering of bud burst percentages were higher in 1st season than the 2nd.

However urea phosphite at the higher concentration 4 % recorded the highest value (53.0 %), in the 1st season, followed by the two concentration of garlic extract 4 % and 2 % with no significant differences.

Garlic extract at high concentration induced the highest flowering bud burst in the 2nd season, followed by Hydrohen cyanamide 4 % and urea phosphite 2 %. In all cases control had the lowest values in both seasons.

Table 3. The effect of dormancy breaking agents on flowering bud (%) and bud burst (%) of "Le-Cont" pear trees in 2013 and 2014 seasons.

Treatments	Bud burst (%)		Flowering bud (%)	
	1st season	2nd season	1st season	2nd season
Control	58.77 C	45.77 E	29.00 E	24.00 E
Garlic extract 2 % + S. oil 4 %	62.17BC	60.00CD	49.03 AB	34.47 AC
Garlic extract 4 % + S. oil 4 %	84.30 A	62 .77 C	52.60 AB	40.90A
Hydrogen cyanamide 2 % + S. oil 4 %	68.63B	74.60B	30.67 DE	27.63 DE
Hydrogen cyanamide 4 % + S. oil 4 %	85.67A	95.33A	39.00 C	37.67 AB
Urea phosphite 2 % + S. oil 4 %	66.87B	57.23D	47.00 B	38.43 AB
Urea phosphite 4 % + S. oil 4 %	48.00D	46.80E	53.00 A	33.77 BD
Summer oil (S. oil) Caple 4 %	59.60C	63.33C	36.00 CD	30.67 CD

Means in the same column followed by the same letter (s) are not significantly (p ≥ 0.05) different.

Fruit set percentage and yield:

Percentage of fruit set was significantly the highest due to the 4 % hydrogen cyanamide treatment in both seasons amounting to 12.20%, 14.17%, respectively. Considerable results were attained by the 2 % treatment in the first season only (8.83 %) and by the 2 % garlic extract in the second one only.

Control trees have significantly the lowest number of fruits in both seasons (81.00 & 55.33 fruits/tree). All treatments increased it significantly. Statistically the greatest No. of fruits/tree was due to both 4 % garlic extract and the 4 % urea phosphate treatments in the first season and due to the 2 % garlic extract treatment in the second one. All treatments except for the control treatment increased the tree yield significantly in both seasons. Highest significant yield was due both garlic extracts treatments and the 4 % urea phosphite treatment in the first season and due to the 2 % garlic extract treatment in the second season. Our results clear that spraying hydrogen cyanamide 2 or 4 % gave the highest fruit set %, while garlic extract 2 or 4 % and urea phosphite 4 % gave the highest values of yield.

These results are in agreement with those of Kubota *et al*., (2000) and Abd El-Razek *et al*., (2011 and 2013) on apricot and Le - Conte pear cultivar.

Table 4. The effect of dormancy breaking agents on fruit set %, number of fruits /tree and yield / tree (kg) of Le-Cont pear trees in 2013 and 2014 seasons.

Treatments	Fruit set %		Number of fruits/tree		Yield kg/tree	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	3.90 C	1.50 D	81.00G	55.33 G	5.87D	5.39F
Garlic extract 2 % + S.O. 4 %	7.17BC	11.50AB	282.00B	396.33A	48.85A	84.09A
Garlic extract 4 % + S.O. 4 %	5.97 BC	7.57BC	366.00A	363.67B	56.98A	77.64B
Hydrogen Cyanamide 2 % + S.O. 4 %	8.83AB	8.23 B	150.00E	172.33D	21.66C	28.66 CD
Hydrogen Cyanamide 4 % + S.O. 4 %	12.20A	14.17A	193.67D	113.33 F	25.29BC	28.24 D
Urea phosphite 2 % + S.O. 4 %	3.42C	3.98CD	212.33 C	285.67C	30.78B	52.37 C
Urea phosphite 4 % + S.O. 4 %	6.77BC	7.80 B	364.67A	299.33 BC	57.62A	70.26 B
Summer Oil (Caple 4 %)	4.83BC	2.77CD	116.33 F	139.00E	23.86CD	23.09 E

Means in the same column followed by the same letter (s) are not significantly ($p \geq 0.05$) different.

Fruit characters:

It was noticed in Table (5) that means of physical characteristics fruit weight (g) size (cm^3), diameter (cm), length, and firmness were improved by foliar application of the different treatments under study with significant differences relative to control in all cases in the two seasons. A considerable variation on fruit weight was observed among all treatments. Either of Garlic extract at 2 % and urea phosphite 4 % occupied the highest fruit weight were exchangeable during the two seasons, followed by garlic extract at 4 % which came immediately after them in the two seasons, while the lowest weight was resulted by control. Regarding the fruit size, there were two treatments (urea phosphite 2% and garlic extract 2%) which gave highest values (167.3 and 174.0 cm^3), respectively, without any significant differences. Control treatment had the lowest value 82.67 cm^3, other values ranged between 145.0 to 161.3 cm^3, in the first season. In the second season, there were three treatments gave highest values (urea phosphite 4%, garlic extract 2% and garlic extract 4%) ranged between 219.3 and 235.3 cm^3), while the lowest value was 103.33 cm for control.

Fruit diameter was in the same line with fruit size, garlic extract 2 % and urea phosphite 4 % treatments induced the highest significant fruit diameter through the two seasons of study followed by garlic extract at height concentration. Fruit length Table (5) reveal that, urea phosphite 4 % was distinguished with the highest fruit length, beside the high level of diameter, size and weight, that showed significantly the positive response of Le-Conte to urea phosphite treatment, which used breaking dormancy agent and active nutrient elevated growth and fruiting. Followed in descending order other treatments, while control results in the lowest fruit length in both seasons.

Fruit firmness: data clear the effect of treatments to reduce fruit firmness in both seasons compared to control which occupied the highest levels 24.40 & 29.20 ($Lb/inch^2$) but Hydrogen cyanamide 4 % and urea phosphite ranked the softener fruits (17.9 & 20.7) and (18.0 & 21.6) ($Lb/inch^2$), respectively during the two seasons.

Our observed results cleared that spraying garlic extract and urea phosphite had a positive effect on number of fruit/tree, yield and fruit quality parameters. Also, it is noticeable that all fruit observations (fruit weight, size, dimensions and firmness) were improved in the 2nd season than the 1st one may be as a result of the accumulation effect of the studied treatments. These effects were agreed with result obtained by Jarvis *et al*. (1968), Abrigo (1990), Kubota *et al*. (2000) and Abd El-Razek *et al*. (2011) on Valencia and Navel oranges.

Table (6): TSS % in fruit juice, data in Table (6) revealed that the means of treatments were approximately nearly in the 1st season without significant differences except control and Hydrogen cyanamide 4 % which had significantly the inferior values. While in the 2nd season high variation between the different treatments and urea phosphite 4 % is the treatment which gave the highest TSS % but control ranking the lowest TSS %.

Statistical analysis revealed that the highest values of total sugar in fruits were summer oil (4 %) and garlic extract 2 %) (9.00 and 8.81) in the first season, respectively, while in the second season (garlic extract 2 % followed by summer oil 4 %) (8.21 and 7.93) respectively. The lowest value was for control (4.93 and 5.43 %). The other treatments occupied significantly intermediate position in the two seasons except summer on the 1st season (9.0 %).

Table 5.The effect of dormancy breaking agents on fruit weight (g), fruit size (cm3), fruit diameter (cm) ,fruit length (cm) and fruit firmness (Lb/inch) of Le-Cont pear trees in 2013 and 2014 seasons .

Treatments	Fruit weight (g)	Fruit size (cm3)	Fruit diameter (cm)	Fruit length (cm)	Fruit firmness (Lb/inch^2)
			1st season		
Control	71.80 E	82.67 E	4.97 D	5.37 D	24.38 A
Garlic extract 2 % + S.O. 4 %	173.2 A	174.0 A	6.70 A	7.60 B	19.69 C
Garlic extract 4 % + S.O. 4 %	155.7 B	161.3 B	6.60 AB	7.63 B	21.11 B
Hydrogen Cyanamide 2 % + S.O. 4 %	144.4 C	157.3 C	6.30 BC	7.73 AB	18.97 D
Hydrogen Cyanamide 4 % + S.O. 4 %	130.6 D	145.0 D	6.27 C	7.00 C	17.95 E
Urea phosphite 2 % + S.O. 4 %	145.0 C	167.3 AB	6.27 C	7.93 AB	18.06 E
Urea phosphite 4 % + S.O. 4 %	158.0 B	159.7 C	6.73 A	8.23 A	19.60 CD
Summer Oil (Caple 4 %)	143.5 C	146.7 D	5.97 C	7.50 BC	19.71 C
			2nd season		
Control	97.43 E	103.3 G	5.37 E	6.93 C	29.23 A
Garlic extract 2 % + S.O. 4 %	212.2 B	233.3 A	7.17 A	8.40 B	24.55 C
Garlic extract 4 % + S.O. 4 %	213.5 B	219.3 B	7.10 AB	8.33 B	26.41 B
Hydrogen Cyanamide 2 % + S.O. 4 %	166.3 D	175.0 E	6.57 CD	8.30 B	21.20 D
Hydrogen Cyanamide 4 % + S.O. 4 %	211.8 B	207.5 C	6.40 D	8.30 B	20.73 D
Urea phosphite 2 % + S.O. 4 %	183.3 C	190.0 D	6.97 AB	8.30 B	21.58 D
Urea phosphite 4 % + S.O. 4 %	234.7 A	235.3 A	7.17 A	9.07 A	21.69 D
Summer Oil (Caple 4 %)	166.1 D	173.3 F	6.77 BC	8.47 AB	21.16 D

Means in the same column followed by the same letter (s) are not significantly ($p \geq 0.05$) different.

Reducing sugars showed low variation between treatments in the 1st season but it was evident garlic extract 2 %, urea phosphite 4 % and and summer oil 4 % presented the highest significant increase in reducing sugars content and control was the lowest in both seasons.

Harvesting date:

Date of harvest was determined in 15 August in the two seasons, it was depending on the maturity stage of fruits to the different treatments. Fruit firmness is a good guide for fruit maturity.

Hydrogen cyanamide 4 % and urea phosphite had the softener fruit. Fruit weight, TSS %, total and reducing sugars were affected by garlic acid, Hydrogen cyanamide and urea phosphite treatments. All these treatments advanced harvesting date, but the control and the low concentration of treatments delay the maturity of fruit so delaying the date of harvest.

These results agree with Williams and Tax-Tzoc (1990) who stated that Hydrogen cyanamide advanced the harvesting date of apple trees.

Table 6. The effect of dormancy breaking agents on TSS, total and reducing sugars of Le-Cont pear trees in 2013 and 2014 seasons.

Treatments	TSS (%)		Total sugar (%)		Reducing sugar (%)	
	1st Season	2nd season	1st season	2nd season	1st season	2nd season
Control	11.33 C	12.33 D	4.93 E	5.43 F	1.15 B	1.29 D
Garlic extract 2 % + S.O. 4 %	12.73 A	13.60 BC	8.81 A	8.21 A	1.72 A	1.80 A
Garlic extract 4 % + S.O. 4 %	13.13 A	14.07 B	7.73 AB	7.47 BC	1.74 A	1.70 B
Hydrogen Cyanamide 2 % + S.O. 4 %	13.20 A	14.20 B	6.42 CD	6.51 D	1.65 AB	1.68 B
Hydrogen Cyanamide 4 % + S.O. 4 %	12.00 B	12.27 D	8.11 AB	7.30 C	1.66 AB	1.79 A
Urea phosphite 2 % + S.O. 4 %	12.93 A	14.23 B	5.68 DE	5.99 E	1.67 AB	1.59 C
Urea phosphite 4 % + S.O. 4 %	13.00 A	15.87 A	7.09 BC	6.99 CD	2.03 A	1.87 A
Summer oil (Caple 4 %)	12.13 B	12.93 CD	9.00 A	7.93 AB	1.92 A	1.82 A

Means in the same column followed by the same letter (s) are not significantly ($p \geq 0.05$) different.

Hormonal changes during the rest period: Table 7 and fig 1 showed the levels of IAA mg/100g in buds of "Le-Conte pear" cultivar during the second season in three periods (mid of December 2013, end of January 2014 and end of February 2014). It was found that the levels of IAA increased at the end of Feb. for all treatments. At the end of Jan., IAA increased where urea phosphite 4 % and garlic extract 2 % treatments were more effective (0.0453 and 0.0207 mg/100 g) than the other treatments and control. The highest value was for Hydrogen Cyanamide 2% (0.0865 mg/100 g) and the next value was 0.0707 mg/100 g for Garlic extract 2%. The lowest value in the same period was (0.0297) for S.O. 4 % only, and control treatment which gave value 0.0370 mg/100 g.

Table 7. The effect of dormancy breaking agents on changes of endogenous hormone IAA mg/100g in buds of Le-Conte pear cultivar during rest period in the second season

Treatments	end of Dec.	end of Jan.	end of Feb.
Control	0.0000	0.0130	0.0370
Garlic extract 2 % + S.O. 4 %	0.0000	0.0207	0.0707
Garlic extract 4 % + S.O.4 %	0.0000	0.0064	0.0388
Hydrogen Cyanamide 2 % + S.O. 4 %	0.0000	0.0056	0.0865
Hydrogen Cyanamide 4 % + S.O. 4 %	0.0000	0.0091	0.0620
Urea phosphite 2 % + S.O. 4 %	0.0000	0.0004	0.0500
Urea phosphite 4 % + S.O. 4 %	0.0000	0.0453	0.0470
Summer oil (Caple 4 %)	0.0000	0.0206	0.0297

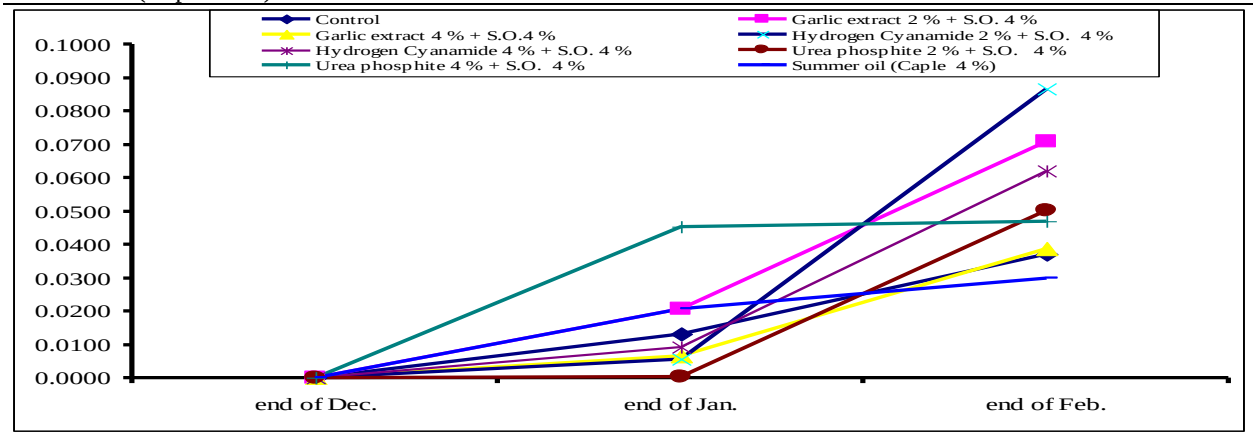

Fig. 1. Increasing level of IAA mg/100g of buds of Le-Conte pear cultivar in three periods (end of Dec., end of Jan. and end of Feb.).

The level of the bioactive Gibberellins mg/100g of buds in the second season for all treatments showed similar pattern (Table 8 and fig 2). It was found that maximum values in the third date (end of Feb.) for all treatments under study. At the end of Dec. garlic extract 2 % showed the highest value (0.026 mg/100 g), while, at the end of Jan. urea phosphite 4% and garlic extract 4 % treatments showed the highest values (0.2374 and 0.0817 mg/100 g). The highest value was for treatment of Hydrogen Cyanamide 2% (0.9891 mg/100 g) the next value was (0.9812 mg/100 g) for garlic extract 2% treatment, in the same date. The lowest value was for summer oil 4 % only (0.5157 mg/100 g) and control (0.5859 mg/100 g).

Table 8.The effect of dormancy breaking agents on changes of endogenous hormone GA_3 mg/100g in buds of Le-Conte pear cultivar during rest period in the second season.

Treatments	end of Dec.	end of Jan.	end of Feb.
Control	0.0191	0.0195	0.4823
Garlic extract 2 % + S.O. 4 %	0.0260	0.0405	0.9812
Garlic extract 4 % + S.O.4 %	0.0142	0.2374	0.8050
Hydrogen Cyanamide 2 % + S.O. 4 %	0.0119	0.0692	0.9891
Hydrogen Cyanamide 4 % + S.O. 4 %	0.0000	0.0257	0.9421
Urea phosphite 2 % + S.O. 4 %	0.0000	0.0257	0.5859
Urea phosphite 4 % + S.O. 4 %	0.0000	0.0817	0.8117
Summer oil (Caple 4 %)	0.0000	0.0126	0.5157

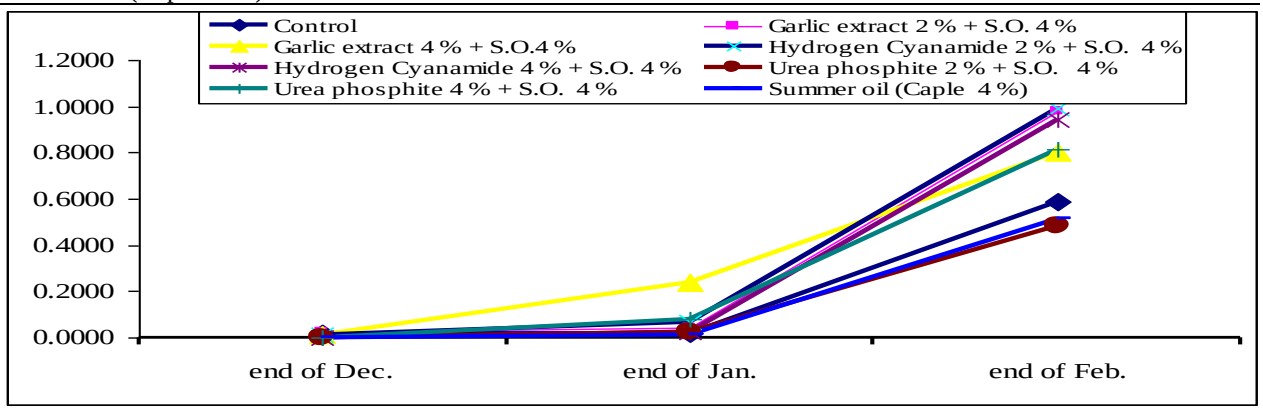

Fig. 2. Increasing level of GA_3 of buds of Le-Conte pear cultivar in three periods (end of Dec., end of Jan. and end of Feb.).

ABA mg/100g levels showed the highest values of buds in the first date (end of Dec.), (2-4 months before blooming). All treatments gave high values in the first date and decreased at second and third dates. For example urea phosphite 2% gave value 0.0066 mg/100 g in the first date (end of Dec.) which decreased to 0.0003 in the third date (end of Feb.). Also garlic extract 4% treatment gave value 0.0040 mg/100 g in the first date decreased to 0.0002 mg/100 g in the third date. While at the end of Jan. urea phosphite 4% showed the highest value (0.0007 mg/100 g).

Table 9. The effect of dormancy breaking agents on changes of endogenous hormone ABA mg/100g in buds of Le-Conte pear cultivar during rest period in the second season.

Treatments	end of Dec.	end of Jan.	end of Feb.
Control	0.0022	0.0003	0.0003
Garlic extract 2 % + S.O. 4 %	0.0024	0.0003	0.0002
Garlic extract 4 % + S.O. 4 %	0.0040	0.0003	0.0002
Hydrogen Cyanamide 2 % + S.O. 4 %	0.0023	0.0002	0.0000
Hydrogen Cyanamide 4 % + S.O. 4 %	0.0009	0.0002	0.0000
Urea phosphite 2 % + S.O. 4 %	0.0066	0.0004	0.0003
Urea phosphite 4 % + S.O. 4 %	0.0039	0.0007	0.0003
Summer oil (Caple 4 %)	0.0034	0.0004	0.0002

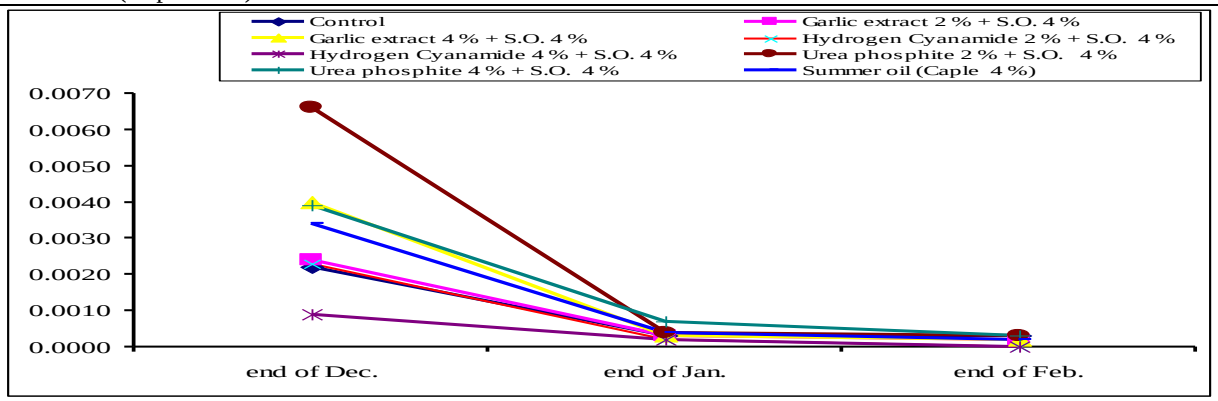

Fig. 3. Decreasing level of ABA mg/100g of buds of Le-Conte pear cultivar in three periods (end of Dec., end of Jan. and end of Feb.).

In the present paper, we reported that the concentration of IAA mg/100g and GA3 mg/100g increased in Le-Conte pear buds at third date (end of Feb., whereas ABA mg/100g decreased from the first date (end of Dec.) to the third date (end of Feb.). These results are in harmony with the findings of **Arafat *et al.*, (1995)**, who stated that concentration both IAA and GA3 sharply decreased in Le-Conte pear flowers buds during endo-dormancy from December to February, whereas ABA slightly decreased from December to January and increased in February. They stated that Abscisic acid and Indol acetic acid levels increased during the time reaching their maximum 2-4 week before blooming. The highest levels of gibberellins were found to be when flower buds are not in development.

CONCLUSIONS

It could be recommended to use urea phosphite in Le-Conte forms to it's preferable to induced a pronounced shortening in flowering duration, increased in yield, fruit size, TSS, reducing sugars.

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دراسات على استخدام بدائل لكاسرات السكون على أشجار الكمثرى صنف "الليكونت"

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أجريت تلك الدراسة خلال موسمي ٢٠١٣، ٢٠١٤ لدراسة تأثير بعض بدائل كسر سكون البراعم الزهرية للكمثرى الليكونت حيث تم خلالها رش مركبات طبيعية متعددة مثل:- ١- مستخلص الثوم ٢ % + ٤ % زيت الصيفى (Caple Oil)٢- مستخلص الثوم ٤ % + ٤ % زيت الصيفى (Caple Oil)٣- دورسى (هيدوجين سينامين) ٢ % + ٤ % زيت الصيفى (Caple Oil)٤- دورسى (هيدوجين سينامين) ٤ % + ٤ % زيت الصيفى (Caple Oil)٥- يوريا فوسفايت ٢ % + ٤ % زيت الصيفى (Caple Oil)٦- يوريا فوسفايت ٤ % + ٤ % زيت الصيفى (Caple Oil)٧- ٤ % زيت الصيفى (Caple Oil) ٨- معاملة المقارنة (الكنترول).جميع المعاملات أظهرت تأثيرات متباينة بالمقارنة بمعاملة الكنترول، لوحظ أن بداية التزهير كانت مبكرة وطول فترة التزهير كانت أقصر عن معاملة الكنترول، وكان الهيدروجين سينامين أعلى تبكير وأقل فترة تزهير بالمقارنة بباقى المعاملات. أيضا زادت نسبة البراعم الكلية المتفتحة ونسبة البراعم الزهرية خاصة مع معاملة الثوم بالتركيز العالى.كل من معاملتى الثوم واليوريا فوسفايت أعطت أعلى عدد ثمار للشجرة وأعلى محصول وزناً وحجماً الهيدروجين سينامين ٤ %، ويوريا فوسفايت ٢ % أعطوا أقل صلابة بالمقارنة مع جميع المعاملات. كان هناك زيادة فى المواد الصلبة الذائبة، السكريات المختزلة بالمقارنة بالأشجار الغير معاملة. خلال فترة السكون التغيرات الهرمونية داخل البراعم للكمثرى الليكونت كانت متغيرة، حيث ارتفعت مستويات الأندول والجبريللين فى نهاية شهر فبراير بينما كان الأبسيسيك اسيد فى أعلى تركيز فى نهاية ديسمبر ووصل الأندول أسيتيك اسيد والجبريللين فى أعلى مستوى خلال مرحلة انتفاخ البراعم فى حين كان الأبسيسيك عند أدنى مستوى له.