

Effects of Spraying Some Chemical Compounds on Fruit Set and Fruit Characteristics of 'Le Conte' Pear Cultivar

Ayman A. Hegazi

Department of Pomology, Faculty of Agriculture, Cairo University, Giza, Egypt

Abstract: This investigation was done during two successive seasons (2009 and 2010) on twelve years old Le Conte pear trees budded on *pyrus communis* rootstock at the farm of Agriculture Research Station at Faculty of Agriculture, Cairo University. The aim of this investigation is to study the effect of the following treatments: yeast at 10, 20, 30%, benzyladenine at 50, 100, 150 ppm, gibbrellic acid (GA₃) at 50, 100 and 150 ppm, boric acid at 25, 50, 100 ppm, flower power at 2, 4, 6% and control (sprayed with water only), sprayed at three dates (7 days before bloom, at full bloom and 7 days after full bloom) on fruit set (initial and final) and fruit characteristics (fruit length, diameter, weight, volume, length/diameter ratio, firmness and total soluble solids). From this investigation it was noticed that fruit set and fruit characteristics were improved with previous treatments compared to the control. Treatments of yeast 20%, 30%, BA 50, 100 ppm, boric acid 50, 100 ppm and flower power 4% and 6% were better as compared to the other treatments in improving fruit set and fruit characteristics. The best date for application was at full bloom compared to the other dates of application (7 days before at full bloom and 7 days after full bloom).

Key words: Pear-Le Conte cultivar-Yeast-BA-GA₃-Boric acid-Flower power-Fruit set-Fruit characteristics.

INTRODUCTION

Pear is considered as the most important economic fruit among the other deciduous fruit trees and the fourth among all fruits in its global distribution [1]. "Le Conte" is the main pear cultivar grown in Egypt, resulted as a hybrid between *pyrus communis* x *pyrus serotina*.

In Egypt productivity of pear orchards varied from year to year and from location to another and this might be due to limited ovules viability and stigma receptivity, poor pollen germinability, ovule abortion, excessive flower abscission and low fruit set [2, 3]. The total cultivated area in Egypt of pear reached about (20400) feddans produced about (124800) tons, with average of 6.12 tons of fruits per feddan according to Ministry of Agriculture [4]. Abou Raya *et al.* [5]; Singh *et al.* [6] and Yehia and Hassan [7] found that, treatments of GA₃ improved fruit set and fruit quality of 'Le Conte' pear fruits. Benzyladenine increased yield of Spadona and Coscia pear cultivars [8], also Le Conte pear cultivar [7]. Greene [9] on apple; Stern *et al.* [10] on pear and Reynolds *et al.* [11] on grape found similar trend by application of cytokinins. Boric acid increased fruit set and improved fruit quality of Kiwifruit, persimmon, olives and pears [12-14, 7]. Shahin *et al.* [15] found that, application of Anna apple cv. with Fertifol

Misr (N, p, K, Mg, Zn, Fe, Mn, Cu, Mo and B) and GA₃ increased fruit set and fruit characters. Jaswant *et al.* [16] worked on Le Conte pear cv. Hegab *et al.* [17] on Balady orange trees (*Citrus sinensis*), Abd El-Motty *et al.* [18] on Keitte mango trees and Khafagy *et al.* [19] on Navel orange trees and found that, active bread yeast have a positive effect on fruit set, yield and fruit quality.

It is important to improve fruit set and fruit quality of pear fruit in order that this investigation was done to study the effect of some compounds i.e. yeast, benzyladnine BA, gibbrellic acid GA₃, boric acid and flower power (compound of Zinc, Boron, Cupper and Moledinum) with different concentrations and different dates of application to study their effects on fruit set and some characters of fruit quality.

MATERIALS AND METHODS

The present study was carried out during two successive seasons 2009 and 2010 on 12 years Le Conte pear trees budded on (*Pyrus commnnis*, L.) rootstock, growing in clay soil at the farm of Agriculture Research Station at Faculty of Agriculture, Cairo University at distance of 5 × 5 meters and subjected to the same agriculture practices.

Trees under Investigation Were Subjected to the Following Treatments:

- 1 Yeast 10%
- 2 Yeast 20%
- 3 Yeast 30%
- 4 Benzyladnine (BA) 50 ppm
- 5 BA 100 ppm
- 6 BA 150 ppm
- 7 Gibbrellic acid (GA₃) 50 ppm
- 8 GA₃ 100 ppm
- 9 GA₃ 150 ppm
- 10 Boric acid 25 ppm
- 11 Boric acid 50 ppm
- 12 Boric acid 100 ppm
- 13 Flower power 2%.
- 14 Flower power 4%.
- 15 Flower power 6%.
- 16 Control (Sprayed with water only).

- Yeast 10 %: Was prepared as 10 g of dry yeast and dissolved in 100 cm³ distilled water and 5 cm³ of black strap molasses was added and the other concentrations (20 and 30%) were prepared with the similar method.
- Flower power consists of 4% zinc, 3% boron, 0.1% copper and 0.002% Molybdenum. This compound was exported by Agriculture Katamy Company from (Kiewit).

Thirty spurs were tagged randomly on each tree (replicate) at three separated dates. The previous treatments were applied at three separated dates. Each of them consists of 48 trees (3replicates × 16 treatments). The first date was 7 days before full bloom (when 20% of flowers reached full opening); the second date at full bloom (when 80% of flowers reached full opening) and the third one was 7 days after full bloom.

Estimated Parameters:

Initial Fruit Set: Was estimated at 21 days after full bloom as average number of fruits / spur.

Final Fruit Set: Was estimated at 60 days after full bloom as average number of fruits/spur.

Fruit Characters: Samples of 15 fruits from each replicate tree (45 fruits for each treatment) were collected randomly at harvest time and the following measurements were recorded.

- Average fruit length (cm).
- Average fruit diameter (cm).
- Average fruit weight (g).
- Average fruit volume (cm³).
- Fruit shape index (fruit length / fruit diameter ratio).
- Average fruit firmness (Lb/inch²) by using U.C firmness tester (A. Metek, Testing Equipment system, U.S.A) which was equipped with plunger 5/16 inch.
- Average total soluble solids (TSS%): Total soluble solids in juice were measured using Abb. Refractometer (Bausch and Lomb. Japan).

Experimental Design and Data Analysis: The layout of the experiment was randomized complete blocks design that each treatment was replicated three times with one tree per replicate. The obtained data was subjected to analysis of variance (ANOVA) according to Snedecor and Cochran [20]. Mstat-C program was used to calculate least significant differences LSD to compare between means of treatments according to Waller and Duncan [21] at probability of 0.05 [22].

RESULTS AND DISCUSSION

Effect of Treatments Sprayed at 7 Days Before Full Bloom on Fruit Set: In the first season, it was noticed that initial fruit set (number of fruits / spur) was significantly the highest (1.28) with yeast treatment at 30% compared with the other treatments, while, it was the lowest (0.16) with BA treatment at 100 ppm (Table 1).

Final fruit set was higher (0.86 and 0.67 fruits / spur) with yeast at 30% and flower power 2% compared with the other treatments.

In the second season, initial fruit set was significantly higher (1.26, 1.18, 0.99 and 0.98) with treatments of BA at 50 ppm, boric acid at 100 ppm, BA 100 at ppm and boric acid at 50 ppm, respectively compared with the other treatments (Table 2).

Final fruit set was significantly higher (0.73, 0.64 and 0.56 fruits/spur) with treatments of boric acid at 100 ppm, boric acid at 50 ppm and BA at 100 ppm, respectively (Table 2).

Effect of Treatments Sprayed at 7 Days Before Full Bloom on Fruit Characteristics: Fruit length, diameter, weight and volume were significantly the highest with treatments of yeast at 10%, flower power at 4% and boric acid at 50 ppm while, they were significantly the lowest with treatments of control, boric acid at 100 ppm, BA at 50 ppm and GA₃ at 100 ppm (Table 1).

Table 1: Effect of treatments sprayed at 7 days before full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2009 season).

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	0.62	0.61	8.13	5.90	130.87	140.00	1.24	12.50	11.67
2	0.82	0.50	7.23	5.40	118.20	112.00	1.35	12.13	11.83
3	1.28	0.86	6.83	5.37	101.07	105.67	1.27	13.07	11.87
4	0.35	0.28	5.40	4.30	79.70	68.67	1.26	13.83	11.67
5	0.16	0.15	7.13	5.43	105.17	106.00	1.32	13.50	11.33
6	0.38	0.38	7.03	5.60	112.83	119.00	1.26	13.20	12.33
7	0.61	0.41	6.67	5.30	104.43	106.33	1.26	12.00	11.67
8	0.73	0.62	5.83	4.63	86.63	89.33	1.26	12.17	10.33
9	0.49	0.38	7.03	5.33	106.37	98.33	1.31	12.63	11.33
10	0.30	0.20	6.53	5.17	89.97	90.00	1.27	12.57	11.33
11	0.46	0.38	7.53	6.37	133.67	136.67	1.19	11.97	11.33
12	0.56	0.51	5.33	4.60	62.57	69.33	1.16	12.33	10.33
13	0.76	0.67	7.10	5.30	99.93	100.67	1.34	12.07	12.83
14	0.56	0.37	7.90	5.70	124.73	120.00	1.39	11.10	12.67
15	0.57	0.41	6.40	5.37	94.27	101.67	1.19	11.40	11.00
16	0.44	0.29	5.23	4.40	83.60	82.00	1.19	11.00	10.67
LSD at 0.05	0.174	0.229	0.874	0.685	17.25	15.88	0.190	0.675	1.130

Table 2: Effect of treatments sprayed at 7 days before full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2010 season).

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	0.64	0.51	5.90	5.13	94.17	74.33	1.15	12.53	10.67
2	0.73	0.49	5.30	4.33	77.13	74.00	1.22	13.17	10.67
3	0.67	0.51	6.17	4.87	75.73	80.00	1.27	12.75	10.33
4	1.25	0.53	6.07	5.15	85.60	80.67	1.18	12.48	11.00
5	0.99	0.56	5.37	4.75	82.87	80.33	1.14	13.82	12.00
6	0.59	0.40	7.47	5.40	110.23	80.00	1.38	11.27	13.67
7	0.56	0.38	5.83	5.30	91.83	103.33	1.10	13.50	11.00
8	0.62	0.32	6.03	5.37	110.43	94.67	1.12	13.10	12.33
9	0.81	0.36	5.30	4.70	87.30	87.00	1.13	13.77	10.67
10	0.64	0.39	7.50	5.47	109.90	95.33	1.37	11.73	13.67
11	0.98	0.64	6.83	5.27	89.70	96.67	1.30	13.40	12.00
12	1.18	0.73	6.57	5.47	101.40	105.33	1.20	12.52	13.00
13	0.59	0.45	5.87	5.00	92.33	95.00	1.19	12.81	10.33
14	0.50	0.33	5.37	4.40	94.33	92.67	1.22	12.80	11.67
15	0.63	0.34	7.20	5.53	105.20	120.00	1.30	11.90	10.67
16	0.41	0.23	5.11	4.47	82.67	83.67	1.14	13.00	10.50
LSD at 0.05	0.394	0.197	0.582	0.160	13.49	18.89	0.117	0.537	0.848

There was no significant difference between different treatments concerning fruit length/diameter ratio except treatments of flower power at 4% which recorded the highest value 1.39.

Fruit firmness was the highest (13.83, 13.50 and 13.20 1 b/in.²) in treatments of BA at 50 ppm, BA at 100 ppm and BA at 150 ppm, while it was the lowest (11.00) 1 b/in.² with control treatment.

Total soluble solids were the highest (12.80) with flower power at 2% while, it was the lowest (10.33 and 10.67) with treatments of boric acid at 100 ppm and control treatments.

In the second season, it was observed that fruit length, diameter and weight were the highest with treatments of flower power 6%, BA 150 ppm and boric

acids 25 ppm, while they were the lowest with control treatment (Table 2).

Fruit volume was the highest (120.00, 105.33 and 103.33 cm³) in treatments of flower power at 6%, boric acid at 100 ppm and GA₃ at 50 ppm while, the lowest values were 74.00 and 74.33 cm³ with treatments yeast at 20 and 10%.

Fruit firmness was the highest (13.40, 13.50, 13.77 and 13.82 1 b/in.²) with treatments of boric acid at 50 ppm, GA₃ at 50 and 150 ppm and BA at 100 ppm compared with the other treatments.

Total soluble solids were the highest (13.00, 13.67 and 13.67) with treatments boric acid at 100 ppm, BA at 150 ppm and boric acid at 25 ppm compared with the other treatments.

Table 3: Effect of treatments sprayed at full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2009 season)

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	1.00	0.80	7.37	5.63	124.47	130.00	1.31	12.40	11.00
2	1.07	0.52	7.07	5.80	114.00	116.67	1.22	12.63	11.30
3	0.73	0.57	7.07	5.47	109.50	120.00	1.29	12.50	11.80
4	1.45	1.33	6.70	5.87	129.30	140.00	1.14	13.87	11.33
5	0.49	0.40	7.63	5.60	111.50	110.00	1.36	14.87	10.67
6	0.65	0.55	5.83	4.53	83.27	80.67	1.07	14.17	10.87
7	0.58	0.49	7.60	6.20	162.17	173.33	1.23	12.70	11.93
8	0.68	0.50	5.87	5.03	85.37	80.33	1.18	13.63	11.20
9	0.64	0.59	7.83	6.07	139.90	160.00	1.30	13.88	11.33
10	0.65	0.48	6.77	5.57	114.27	113.33	1.22	13.77	10.67
11	0.70	0.56	7.63	5.80	132.00	133.33	1.30	12.43	12.00
12	0.71	0.50	7.43	5.77	118.27	116.67	1.32	12.53	11.67
13	1.35	0.82	7.47	5.77	137.60	133.33	1.34	13.63	11.93
14	0.80	0.46	7.50	5.57	119.40	113.33	1.28	12.87	12.00
15	0.66	0.53	7.03	5.70	115.93	103.33	1.41	11.00	11.00
16	0.42	0.23	5.20	4.60	86.67	85.67	1.11	11.50	11.50
LSD at 0.05	0.587	0.601	0.928	5.633	23.76	31.91	0.166	0.986	0.799

Table 4: Effect of treatments sprayed at full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2010 season).

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	0.60	0.40	8.43	6.07	165.33	158.33	1.39	12.57	11.67
2	0.76	0.52	7.37	5.57	127.00	118.00	1.33	12.33	11.83
3	1.02	0.73	6.85	5.50	105.00	114.00	1.25	13.37	11.60
4	0.40	0.29	5.63	5.03	82.33	76.33	1.10	13.77	11.67
5	0.18	0.14	7.20	5.37	110.00	117.67	1.35	13.63	11.50
6	0.40	0.35	6.97	5.60	101.00	146.67	1.24	13.37	10.30
7	0.60	0.44	7.00	5.63	121.00	128.33	1.24	12.20	12.00
8	0.77	0.65	6.10	4.70	99.00	91.33	1.30	12.33	11.33
9	0.52	0.45	6.73	5.40	104.67	105.00	1.25	12.83	11.50
10	0.31	0.22	6.37	5.43	116.50	115.00	1.36	12.43	12.00
11	0.45	0.39	7.87	6.63	185.00	195.00	1.19	11.77	11.67
12	0.58	0.52	5.43	4.63	81.33	82.33	1.18	12.23	10.67
13	0.80	0.67	6.20	4.73	84.27	85.00	1.33	11.93	10.53
14	0.56	0.40	7.83	6.13	159.57	157.67	1.28	10.33	10.80
15	0.59	0.57	6.27	5.55	126.00	131.00	1.13	11.17	12.17
16	0.45	0.36	6.00	4.90	84.67	83.33	1.22	11.27	10.33
LSD at 0.05	0.139	0.174	0.972	6.067	17.82	18.14	0.158	0.623	0.898

Effect of Treatments Sprayed at Full Bloom on Fruit Set:

In the first season, it was obvious that initial fruit set was the highest (0.99, 1.07, 1.35 and 1.45 fruits / spur) with treatments yeast at 10% and 20%, flower power at 2% and BA at 50 ppm while, the lowest value was (0.41 fruit / spur) with control treatment (Table 3).

Final fruit set recorded the highest values (0.80, 0.82 and 1.33) with treatments of yeast at 10%, flower power at 2% and BA at 50 ppm compared with the other treatments and there were no significant difference between values of final fruit set among these treatments.

In the second season, initial fruit set was the highest (1.02 fruits/spur) with treatment of yeast 30% while, the lowest (0.18) with treatment BA at 100 ppm (Table 4). Final fruit set was the highest (0.73) with treatment of yeast at

30% while; the lowest value was (0.14) with treatment BA at 100 ppm.

Effect of Treatments Sprayed at Full Bloom on Fruit Characteristics: Fruit length, diameter, weight and volume were significantly higher with treatments of GA₃ at 50 and 150 ppm while, the lowest values were found with control treatment (Table 3).

Fruit length / diameter ratio was the highest (1.41) with treatment of flower power at 6% while; it was the lowest (1.07) with treatment of BA at 150 ppm

Fruit firmness was the highest (14.87, 1 b/in²) with treatment of BA at 150 ppm while, it was the lowest (11.00 and 11.50 1 b/in²) with flower power at 6% and control treatments.

Table 5: Effect of treatments sprayed at 7 days after full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2009 season)

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	0.70	0.53	6.53	5.40	105.67	80.00	1.21	12.97	12.33
2	0.74	0.57	5.53	4.55	80.00	81.33	1.22	13.20	11.30
3	0.67	0.53	6.42	5.20	79.90	91.67	1.23	12.92	11.00
4	1.07	0.77	6.23	5.50	82.17	84.00	1.13	12.62	11.33
5	0.90	0.68	5.60	4.88	83.17	82.33	1.15	13.98	12.33
6	0.62	0.41	5.47	4.93	90.67	88.00	1.21	11.93	12.53
7	0.60	0.39	5.87	5.60	85.67	98.33	1.05	13.73	11.67
8	0.62	0.36	6.53	5.43	108.33	93.00	1.21	13.13	13.00
9	0.81	0.45	5.47	5.00	83.67	84.33	1.09	13.82	11.33
10	0.69	0.48	7.70	5.67	112.00	93.00	1.36	11.95	13.67
11	0.95	0.69	6.93	5.37	91.67	100.67	1.29	13.42	12.67
12	1.15	0.92	6.70	5.57	106.00	109.67	1.20	12.67	12.33
13	0.67	0.51	5.90	5.20	88.20	96.33	1.14	12.80	11.33
14	0.50	0.34	5.50	4.60	86.33	87.00	1.20	12.90	12.33
15	0.65	0.41	7.00	5.59	108.67	118.33	1.25	11.97	11.33
16	0.44	0.25	5.37	4.70	80.33	80.00	1.14	13.03	10.90
LSD at 0.05	0.235	0.197	0.268	0.471	7.172	9.477	1.210	0.288	0.866

Table 6: Effect of treatments sprayed at 7 days after full bloom on fruit set and fruit characteristics of Le Conte pear cultivar (2010 season).

Treatments	Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	0.92	0.75	7.47	6.00	115.17	150.00	1.26	12.43	11.43
2	0.95	0.70	7.23	5.97	114.17	121.67	1.21	12.87	11.73
3	0.70	0.53	7.20	5.60	120.40	118.33	1.29	12.50	11.13
4	1.53	1.27	6.73	5.47	124.03	116.67	1.24	13.25	11.80
5	0.53	0.43	6.90	5.80	122.70	120.00	1.19	13.32	10.97
6	0.68	0.58	5.33	4.40	81.07	80.00	1.21	13.50	10.93
7	0.73	0.53	6.93	5.40	94.03	111.67	1.30	13.67	10.33
8	0.68	0.52	5.83	5.33	91.27	90.00	1.10	12.50	10.50
9	0.64	0.43	7.70	6.23	133.33	150.00	1.24	14.70	11.67
10	0.68	0.40	7.20	5.60	116.67	119.33	1.29	14.17	11.67
11	0.72	0.53	7.47	5.80	121.27	120.00	1.29	12.77	11.80
12	0.73	0.55	7.33	5.97	132.00	133.33	1.23	13.67	12.00
13	1.33	1.00	7.67	5.90	137.33	132.67	1.30	13.87	12.07
14	1.02	0.70	7.53	5.67	122.33	119.00	1.33	12.97	12.00
15	0.71	0.55	7.80	5.97	147.60	156.67	1.31	11.75	14.33
16	0.45	0.24	5.10	4.70	82.20	83.33	1.09	12.00	10.20
LSD at 0.05	0.361	0.372	0.558	0.745	14.52	32.08	0.139	0.850	1.270

Fruit total soluble solids were the highest (12.00 and 12.00) with treatments of boric acid at 50 ppm and flower power at 4%, while, it was the lowest (10.67 and 10.67) with treatments of BA at 100 ppm and boric acid at 100 ppm

In the second season, fruit length, diameter, weight and volume were the highest with treatments of yeast at 10% and boric acid at 50 ppm while, it was the lowest with treatments of boric acid at 100 ppm and control (Table 4).

Fruit length / diameter ratio was the highest (1.39) with treatment yeast at 10%, while it was the lowest (1.10) with BA at 50 ppm

Fruit firmness was the highest (13.63 and 13.77 1b/in²) with treatments of BA at 100 and 50 ppm, while it was the lowest (10.33 1 b/in²) with treatment flower power at 4%.

Fruit total soluble solids were the highest (12.17) with treatment of flower power at 6% while, it was the lowest (10.30 and 10.33) with treatments of BA at 150 ppm and control treatments.

Effect of Treatments Sprayed at 7 Days after Full Bloom on Fruit Set: In the first season, it was noticed that initial fruit set was the highest (1.15, 1.07 and 0.95 fruits/spur) with treatments of boric acid at 100 ppm, BA at 50 ppm and boric acid at 50 ppm while, the lowest value (0.44 fruits / spur) was obtained with the control (Table 5).

Final fruit set was the highest (0.92 and 0.77 fruits/spur) with treatments of boric acid at 100 ppm and BA at 50 ppm while, the lowest value (0.25 fruits/spur) was recorded with control treatment.

In the second season, similar trend was observed that initial fruit set was the highest (1.53 and 1.33 fruits/spur) with treatments of BA at 50 ppm and flower power at 2% (Table 6).

Final fruit set recorded the highest average (1.27 and 1.00 fruits/spur) with treatments of BA at 50 ppm and flower power at 2%.

Effect of Treatments Sprayed at 7 Days after Full Bloom on Fruit Characteristics: In the first season, it was observed that fruit length, diameter and TSS recorded the highest values with treatment of boric acid at 25 ppm while, the lowest values were recorded with the control and flower power at 4% (Table 5).

Fruit weight was the highest (105.67, 106.00, 108.67 and 112.00 g) with treatments of yeast at 10%, boric acid at 100 ppm, flower power at 6% and boric acid at 25 ppm while, the lowest values (79.00, 80.00 and 80.33 g) were recorded with treatments of yeast at 30%, yeast at 20% and control.

Fruit volume was the highest (118.33 cm³) with treatment of flower power at 6%, while, the lowest value (80.00, 80.00 and 81.33 cm³) with treatments of yeast at 10%, control and yeast at 20%.

Fruit length / diameter ratio was the highest (1.36) with treatment of boric acid at 25 ppm while, the lowest value (1.04) was recorded with treatment of GA₃ at 50 ppm.

Fruit firmness was the highest (13.98, 13.82 and 13.73 l b/in²) with treatments of BA at 100 ppm, GA₃ at 150 and 50 ppm while, the lowest value was (11.93, 11.95 and 11.97 l b/in²) with treatments of BA at 150 ppm, boric acid at 25 ppm and flower power at 6%.

In the second season, fruit length, weight, volume and TSS were the highest with treatments flower power at 6%, 4%, 2% boric acid at 100 ppm boric acid at 50 ppm, GA₃ at 150 ppm and yeast at 10%, while the lowest values with fruits of treatments control and BA at 150 ppm (Table 6).

Fruit diameter was the highest (6.23 cm) with treatment of GA₃ at 150 ppm, while the lowest value was (4.40 and 4.70 cm) with treatments of BA at 150 ppm and control.

Fruit firmness was the highest (14.70, 14.17 and 13.87 l b/in²) with treatments GA₃ at 150 ppm, boric acid at 25 ppm and flower power at 2% while, the lowest values were (11.75, 12.00 and 12.43 l b/in²) with treatments of flower power at 4%, control and yeast at 2%.

Effect of Treatments Sprayed at Different Dates on Fruit Set: In the first season, it was observed that initial fruit set was the highest (1.45, 1.35, 1.28 and 1.15) fruits /spur

with treatments of BA 50 ppm at full bloom, flower power 2% at full bloom, yeast 30% at 7 days before full bloom and boric acid 100 ppm at 7 days after full bloom (Table 7).

While, the lowest values were (0.16, 0.30, 0.35, 0.38, 0.42, 0.44 and 0.44 fruits / spur) with treatments BA 100 ppm, at 7 days before full bloom, boric acid 25 ppm at 7 days before full bloom, BA 50 ppm at 7 days before full bloom, BA 150 ppm at 7 days before full bloom, control at full bloom, control at 7 days before full bloom and control at 7 days after full bloom.

Final fruit set was the highest (1.33 fruits/spur) with BA 50 ppm at full bloom while, the lowest values (0.15, 0.20, 0.23, 0.25 and 0.29 fruit/spur) were obtained with treatments of BA 100 ppm at 7 days before full bloom, boric acid 25 ppm at 7 days before full bloom, control at full bloom, control at 7 days after full bloom and control at 7 days before full bloom.

In the second season, similar trend was observed that initial fruit set was the highest with treatments BA 50 ppm at 7 days after full bloom, flower power 2% at 7 days after full bloom and BA 50 ppm at 7 days before full bloom while, it was the lowest with BA 100 ppm at full bloom, boric acid 25 ppm at full bloom, BA 50 ppm at full bloom and control at all dates of applications (Table 8).

Final fruit set was the highest (1.27 fruits /spur) with BA 50 ppm at 7 days after full bloom while, it was the lowest (0.14, 0.22, 0.23 and 0.24) with treatments of BA 100 ppm at full bloom, boric acid 25 ppm at full bloom, control at 7 days before full bloom and control at 7 days after full bloom. These results are in line with findings of Yehia and Hassan [7] on Le Conte pear cv. that boron could be attributed to enhance pollen germination and pollen tube growth which increased fruit set and yield.

Also, findings of Abd El- Motty *et al.* [18] on Keitte mango cv. that spraying Keitte mango trees once at full bloom with yeast at 0.2% was very effective in improving fruit set.

These results showed that flower power increased fruit set and results are in line with results of Shahin *et al.* [15] on Anna apple cv. that (Fertifol Misr) (N, P, K, Mg, Zn, Fe, Mn, Cu, Mo and B) and GA₃ improved fruit set %.

GA₃ could lead to an increase in fruit set for deciduous trees [23]. Flower power which contains (Zn, B, Cu and Mn) may be responsible for building and moving carbohydrate from leaves to fruits and encourage the biosynthesis of cellulose which positively strengthens the cell wall.

In addition, Zn and B played an important role in biosynthesis and moving of the natural auxin namely IAA to the pedicels of fruits [24].

Table 7: Effect of treatments sprayed at different dates on fruit set and fruit characteristics (2009 season)

Treatments		Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	At 7 days before full bloom	0.62	0.61	8.13	5.90	130.87	140.00	1.24	12.50	11.67
2		0.82	0.50	7.23	5.40	118.20	112.00	1.35	12.13	11.83
3		1.28	0.86	6.83	5.37	101.07	105.67	1.27	13.07	11.87
4		0.35	0.28	5.40	4.30	79.70	68.67	1.26	13.83	11.67
5		0.16	0.15	7.13	5.43	105.17	106.00	1.32	13.50	11.33
6		0.38	0.38	7.03	5.60	112.83	119.00	1.26	13.20	12.33
7		0.61	0.41	6.67	5.30	104.43	106.33	1.26	12.00	11.67
8		0.73	0.62	5.83	4.63	86.63	89.33	1.26	12.17	10.33
9		0.49	0.38	7.03	5.33	106.37	98.33	1.31	12.63	11.33
10		0.30	0.20	6.53	5.17	89.97	90.00	1.27	12.57	11.33
11		0.46	0.38	7.53	6.37	133.67	136.67	1.19	11.97	11.33
12		0.56	0.51	5.33	4.60	62.57	69.33	1.16	12.33	10.33
13		0.76	0.67	7.10	5.30	99.93	100.67	1.34	12.07	12.83
14		0.56	0.37	7.90	5.70	124.73	120.00	1.39	11.10	12.67
15		0.57	0.41	6.40	5.37	94.27	101.67	1.19	11.40	11.00
16		0.44	0.29	5.23	4.40	83.60	82.00	1.19	11.00	10.67
1	At full bloom	1.00	0.80	7.37	5.63	124.47	130.00	1.31	12.40	11.00
2		1.07	0.52	7.07	5.80	114.00	116.67	1.22	12.63	11.30
3		0.73	0.57	7.07	5.47	109.50	120.00	1.29	12.50	11.80
4		1.45	1.33	6.70	5.87	129.30	140.00	1.14	13.87	11.33
5		0.49	0.40	7.63	5.60	111.50	110.00	1.36	14.87	10.67
6		0.65	0.55	5.83	4.53	83.27	80.67	1.07	14.17	10.87
7		0.58	0.49	7.60	6.20	162.17	173.33	1.23	12.70	11.93
8		0.68	0.50	5.87	5.03	85.37	80.33	1.18	13.63	11.20
9		0.64	0.59	7.83	6.07	139.90	160.00	1.30	13.88	11.33
10		0.65	0.48	6.77	5.57	114.27	113.33	1.22	13.77	10.67
11		0.70	0.56	7.63	5.80	132.00	133.33	1.30	12.43	12.00
12		0.71	0.50	7.43	5.77	118.27	116.67	1.32	12.53	11.67
13		1.35	0.82	7.47	5.77	137.60	133.33	1.34	13.63	11.93
14		0.80	0.46	7.50	5.57	119.40	113.33	1.28	12.87	12.00
15		0.66	0.53	7.03	5.70	115.93	103.33	1.41	11.00	11.00
16		0.42	0.23	5.20	4.60	86.67	85.67	1.11	11.50	11.50
1	At 7 days after full bloom	0.70	0.53	6.53	5.40	105.67	80.00	1.21	12.97	12.33
2		0.74	0.57	5.53	4.55	80.00	81.33	1.22	13.20	11.30
3		0.67	0.53	6.42	5.20	79.90	91.67	1.23	12.92	11.00
4		1.07	0.77	6.23	5.50	82.17	84.00	1.13	12.62	11.33
5		0.90	0.68	5.60	4.88	83.17	82.33	1.15	13.98	12.33
6		0.62	0.41	5.47	4.93	90.67	88.00	1.21	11.93	12.53
7		0.60	0.39	5.87	5.60	85.67	98.33	1.05	13.73	11.67
8		0.62	0.36	6.53	5.43	108.33	93.00	1.21	13.13	13.00
9		0.81	0.45	5.47	5.00	83.67	84.33	1.09	13.82	11.33
10		0.69	0.48	7.70	5.67	112.00	93.00	1.36	11.95	13.67
11		0.95	0.69	6.93	5.37	91.67	100.67	1.29	13.42	12.67
12		1.15	0.92	6.70	5.57	106.00	109.67	1.20	12.67	12.33
13		0.67	0.51	5.90	5.20	88.20	96.33	1.14	12.80	11.33
14		0.50	0.34	5.50	4.60	86.33	87.00	1.20	12.90	12.33
15		0.65	0.41	7.00	5.59	108.67	118.33	1.25	11.97	11.33
16		0.44	0.25	5.37	4.70	80.33	80.00	1.14	13.03	10.90
LSD value		0.370	0.377	0.762	0.566	17.08	20.910	0.158	0.687	0.923

Table 8: Effect of treatments sprayed different dates on fruit set and fruit characteristics of Le Conte pear cultivar (2010 season).

Treatments		Initial fruit set	Final fruit set	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm ³)	L/D Ratio	Fruit firmness (1 b/in ²)	TSS (%)
1	At 7 days before full bloom	0.64	0.51	5.90	5.13	94.17	74.33	1.15	12.53	10.67
2		0.73	0.49	5.30	4.33	77.13	74.00	1.22	13.17	10.67
3		0.67	0.51	6.17	4.87	75.73	80.00	1.27	12.75	10.33
4		1.25	0.53	6.07	5.15	85.60	80.67	1.18	12.48	11.00
5		0.99	0.56	5.37	4.75	82.87	80.33	1.14	13.82	12.00
6		0.59	0.40	7.47	5.40	110.23	80.00	1.38	11.27	13.67
7		0.56	0.38	5.83	5.30	91.83	103.33	1.10	13.50	11.00
8		0.62	0.32	6.03	5.37	110.43	94.67	1.12	13.10	12.33
9		0.81	0.36	5.30	4.70	87.30	87.00	1.13	13.77	10.67
10		0.64	0.39	7.50	5.47	109.90	95.33	1.37	11.73	13.67
11		0.98	0.64	6.83	5.27	89.70	96.67	1.30	13.40	12.00
12		1.18	0.73	6.57	5.47	101.40	105.33	1.20	12.52	13.00
13		0.59	0.45	5.87	5.00	92.33	95.00	1.19	12.81	10.33
14		0.50	0.33	5.37	4.40	94.33	92.67	1.22	12.80	11.67
15		0.63	0.34	7.20	5.53	105.20	120.00	1.30	11.90	10.67
16		0.41	0.23	5.11	4.47	82.67	83.67	1.14	13.00	10.50
1	At full bloom	0.60	0.40	8.43	6.07	165.33	158.33	1.39	12.57	11.67
2		0.76	0.52	7.37	5.57	127.00	118.00	1.33	12.33	11.83
3		1.02	0.73	6.85	5.50	105.00	114.00	1.25	13.37	11.60
4		0.40	0.29	5.63	5.03	82.33	76.33	1.10	13.77	11.67
5		0.18	0.14	7.20	5.37	110.00	117.67	1.35	13.63	11.50
6		0.40	0.35	6.97	5.60	101.00	146.67	1.24	13.37	10.30
7		0.60	0.44	7.00	5.63	121.00	128.33	1.24	12.20	12.00
8		0.77	0.65	6.10	4.70	99.00	91.33	1.30	12.33	11.33
9		0.52	0.45	6.73	5.40	104.67	105.00	1.25	12.83	11.50
10		0.31	0.22	6.37	5.43	116.50	115.00	1.36	12.43	12.00
11		0.45	0.39	7.87	6.63	185.00	195.00	1.19	11.77	11.67
12		0.58	0.52	5.43	4.63	81.33	82.33	1.18	12.23	10.67
13		0.80	0.67	6.20	4.73	84.27	85.00	1.33	11.93	10.53
14		0.56	0.40	7.83	6.13	159.57	157.67	1.28	10.33	10.80
15		0.59	0.57	6.27	5.55	126.00	131.00	1.13	11.17	12.17
16		0.45	0.36	6.00	4.90	84.67	83.33	1.22	11.27	10.33
1	At 7 days after full bloom	0.92	0.75	7.47	6.00	115.17	150.00	1.26	12.43	11.43
2		0.95	0.70	7.23	5.97	114.17	121.67	1.21	12.87	11.73
3		0.70	0.53	7.20	5.60	120.40	118.33	1.29	12.50	11.13
4		1.53	1.27	6.73	5.47	124.03	116.67	1.24	13.25	11.80
5		0.53	0.43	6.90	5.80	122.70	120.00	1.19	13.32	10.97
6		0.68	0.58	5.33	4.40	81.07	80.00	1.21	13.50	10.93
7		0.73	0.53	6.93	5.40	94.03	111.67	1.30	13.67	10.33
8		0.68	0.52	5.83	5.33	91.27	90.00	1.10	12.50	10.50
9		0.64	0.43	7.70	6.23	133.33	150.00	1.24	14.70	11.67
10		0.68	0.40	7.20	5.60	116.67	119.33	1.29	14.17	11.67
11		0.72	0.53	7.47	5.80	121.27	120.00	1.29	12.77	11.80
12		0.73	0.55	7.33	5.97	132.00	133.33	1.23	13.67	12.00
13		1.33	1.00	7.67	5.90	137.33	132.67	1.30	13.87	12.07
14		1.02	0.70	7.53	5.67	122.33	119.00	1.33	12.97	12.00
15		0.71	0.55	7.80	5.97	147.60	156.67	1.31	11.75	14.33
16		0.45	0.24	5.10	4.70	82.20	83.33	1.09	12.00	10.20
LSD value		0.316	0.259	0.718	0.660	14.755	22.846	0.134	0.679	1.021

BA may prolong the time during which the pollen tubes can reach the ovule and affect a successful fertilization, by delaying senescence of the ovarian tissues [25]. Also BA may act by attracting substances that promote pollen tube growth or it may encourage the growth of tissues. Potential sources of growth substances that enhance growth of ovarian and other tissues involved [26].

Effect of Treatments Sprayed at Different Dates on Fruit Characteristics: Fruit length and diameter were significantly higher with treatments of yeast 10% and boric 50 ppm at 7 days before full bloom, while it was the lowest with treatments of control of different dates of application (Table 7).

Fruit diameter was highest (6.37 cm) with treatment of boric acid 50 ppm at 7 days before full bloom while, it was the lowest at control of different dates (7 days before full bloom, full bloom and 7 days after full bloom).

Fruit weight was the highest (162.17 g) with treatment GA₃ 50 ppm at full bloom while, the lowest value was (62.57 g) with boric acid 100 ppm at 7 days before full bloom. Fruit volume was the highest (173.33 and 160.00 cm³) with treatments of GA₃ 50 ppm and GA₃ 150 ppm at full bloom. While, the lowest value (68.67 cm³) was recorded with treatment of BA 50 ppm at full bloom.

Length / diameter ratio was the highest (1.410) with treatment flower power 6% at full bloom while, it was the lowest 1.07 in treatment BA 150 ppm at full bloom.

Fruit firmness was the highest (14.87 1 b/in²) with treatment of BA 100 ppm at full bloom, while, the lowest was 11.10, 11.40 and 11.50 1 b/in² with treatments of control at different dates of spraying.

Fruit total soluble solids were the highest (13.67, 13.00 and 12.83) with treatment of boric acid 25 ppm at 7 days after full bloom, GA₃ 100 ppm at 7 days after full bloom and flower power 2% at 7 days before full bloom while, the lowest (10.67) with treatment of control at 7 days before full bloom.

In the second season, similar trend was observed that treatments increased fruit characteristics compared with the control (Table 8).

These results are in line with findings of Abd El-Motry *et al.* [18] that spraying Keitte mango cv. with yeast 0.2% at full bloom was effective in improving fruit weight, length, width, pulp / fruit percentage and total soluble solids (T.S.S).

Also, Hegab *et al.* [17] found that biofertilizer containing N, P, K, Ca, Mg and S as well as Zn, Fe, Mn, Cu, Mo, Co and active bread yeast extract have positive

effect on fruit quality of Balady orange fruit trees. The effect of active bread yeast was attributed to its own component from different nutrients, higher percentage of proteins, massive amount of vitamin B and the natural plant growth hormones namely cytokinins and releasing CO₂, which, reflected on improving net photosynthesis [27, 28].

Also, these results are in line with findings of Yehia and Hassan [7] on Le Conte pear cv. that similar positive effects of GA₃ on Le Conte pear fruit weight, volume, dimensions and T.S.S. Similar trend was observed on Canino apricot in response to 40 ppm GA₃ at full bloom.

Also, results are in agreement with results of Yehia and Hassan [7] on Le Conte pear cv. and Stern and Flaishman [8] on Spadona and Coscica pear cultivars that BA increased fruit volume and shape that BA stimulate cell division.

From this Investigation it Could Be Investigated That:

- Fruit set (initial and final) improved with application of treatments compared with the control.
- Treatments of yeast 20%, 30%, BA 50, 100 ppm, boric acid 50, 100 ppm and flower power 4% and 6% were better as compared to the other treatments in improving fruit set and fruit characteristics.
- Application of treatments at full was better as compared to the other dates of application (7 days before full bloom and 7 days after full bloom)

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