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IMPACT OF BORIC ACID SPRAYING DATE WITH DIFFERENT CONCENTRATIONS ON YIELD AND FRUIT QUALITY OF *Pyrus communis* cv. 'LE-CONTE' PEAR TREES

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ABSTRACT

The aim of the study was to examine the response of pear (*Pyrus communis*, L.) trees to foliar applications of boric acid. The experiment was carried out during 2010-2011 and 2011-2012 seasons in a commercial orchard in El-Khatatba city, Monifia Governorate, Egypt on mature ‘Le-Conte’ pear trees grafted on *Pyrus communis* seedlings planted at a space of 5×5 m on a sandy soil under drip irrigation system and modified central leader trained. Annually, foliar sprays with boric acid were applied (i) at 1st September after harvest or (ii) at white bud stage before bloom. Spray treatments involved application of boric acid at a rate of 50, 100 or 150 ppm. Trees untreated with boric acid served as the control. The results revealed that foliar applications of boric acid after harvest or before full bloom at white bud stage increased boron concentration in flowers, fruit set percentage and fruit yield. Additionally, these applications resulted in higher mean fruit weight, size, length, diameter, firmness, seed number per fruit, soluble solids concentration and titratable acidity than those from the control trees. These findings indicate that pre-bloom and postharvest boric acid sprays are successful in increasing pear tree yielding and in improving fruit set. But, boric acid application at the rate of 150 ppm at 1st September after harvest was superior in this respect.
Keywords: Boric acid, Le-Conte, Pear, Spraying Date, *Pyrus communis*.

INTRODUCTION

"Le-Conte" pear (*Pyrus communis*, L. x *Pyrus pyrifolia*, N.) is the main cultivar grown in Egypt orchards which facing certain problems concerned with their production. One of these problems is the low fruit set percentage and that might be attributed to a decrease in boron concentration in flower buds in the winter and flower clusters at full bloom. Also, Jackson (1991) noted that pollen tube germination was completely inhibited at temperatures over 21±1°C unless boron was present. This could explain the importance of boron in reproductive growth of warm season like Egypt.

The total harvested area of pear in Egypt reached about 3741 hectares (8903.58feddan) producing about 48817 tons, and this production is low compared to the other world countries; on the other hand, China occupies the first position globally in pears production, where the total area harvested in China reached about 1131800 hectares (2693684feddan) producing about 15945013 tons (FAO, 2011).

Boron (B) is an essential microelement required for the normal growth of higher plants (Marschner, 1995). It is believed that pear (*Pyrus communis*, L.) trees have a high B requirement and B deficiency causes blossom blast (Kienholz, 1942). The incidence/severity of B deficiency in plants depends on many biological, soil and environmental factors such as the cultivar, rootstock type, pH and soil moisture, organic matter status, clay and oxides of iron (Fe), aluminum (Al) and manganese (Mn) in the soil, the amount of rainfall and air temperature (Goldberg, 1997 and Shorrocks, 1997).

Boron is an essential micronutrient. When it is not present in sufficient quantity, apple and pear profits are reduced. A major effect of B nutrition in fruit trees is its role in fruit set (Faust, 1989). Early research indicated that B is necessary for flower bud formation (Kamali and Childers, 1970), production of pollen grains (Argawala *et al.*, 1981), and pollen tube growth (Dickinson, 1978). Boron applications increase fruit set in sour cherry (Hanson, 1991).

Most plant species have a narrow range between optimal and excessive B levels (Nable *et al.*, 1997). Therefore, B fertilization is most frequently recommended in the form of foliar sprays, to avoid the risk of phytotoxicity. The efficiency of foliar B application is particularly high for species with high phloem B mobility, including all Mallus, Pyrus, Prunus, and Oleaccae (Brown *et al.*, 2002 and Brown and Shelp, 1997).

The B requirements of Le-Conte pear and its influence on fruit set and fruit quality are poorly understood. Therefore, the goal of this study was to examine the effect of spraying date with different concentrations of boric acid **on improving** fruit set, yield and fruit quality of "Le-Conte" pear under Egyptian desert lands conditions.

MATERIALS AND METHODS

1. Plant materials and experimental procedure

The present study was carried out during the two successive seasons of 2010-2011 and 2011-2012 on "Le-Conte" pear trees to evaluate the effect of spraying date with different concentrations of boric acid on improving fruit set, yield and fruit quality of "Le-Conte" pear trees under Egyptian desert lands conditions.

"Le-Conte" pear trees were fifteen years old, budded on *Pyrus communis* rootstock, spaced at 5 meters apart grown in sandy soil under drip irrigation system and trained with modified central leader in a commercial orchard at El-Khatatba city, Monifia Governorate, Egypt.

Management practices were performed according to normal commercial practice in this district. For the purpose of the experiment, 36 trees almost uniform in growth and vigor and in good physical condition were selected for this study for each spraying date, and treated rows were separated by 2 un-treated guard tree rows. The experiment was designed as a completely randomized blocks design with three replicates (three trees for each replicate) to represent the treatments with different concentration of boric acid (50, 100, 150 or 200 ppm) at two dates (the first date at 1st September after harvest and the second at white bud stage before full bloom) and the control trees were sprayed with well water; furthermore, Super Film at 0.1% was used as a surfactant in all treatments. At the first date of boric acid application trees had healthy leaves – flower buds on the spurs were not free from the leaves. But the treatment with boric acid at 200 ppm was canceled because it caused the typical boron toxicity symptoms on mature leaves (marginal or tip chlorosis or both and necrosis).

2. Boron concentration of flower:

Flower B was determined using 40-flowers sample from each replicate at full bloom which extracted using Azomethine-H Colorimetric method according to Yash (1998).

3. **Fruit Set**:

In each growing season, four main branches as uniform as possible were chosen at the four cardinal points of each experimented tree and tagged for calculating:

a) Initial Fruit Set %:

Three weeks after flowering initial fruit set percentage on replicate trees of the studied treatments was calculated from the following formula (Yehia and Hassan, 2005):

Initial fruit set (%) = FR * 100/AVF * NF

FR = Number of fruits/shoot

AVF = Average number of flowers/inflorescence

NF = Number of inflorescences/shoot

b) Final Fruit Set %:

Sixty days after flowering, final fruit set percentage was calculated in the same sequence mentioned above for the initial fruit set percentage.

4. **Yield**:

Average yield per each treatment was recorded as kg fruits per tree by counting number of fruits per tree multiplied by average fruit weight. This was determined approximately 135 to 147days from full bloom, when the average of fruit firmness reached about 14-15 Ib.in^{-2} and when soluble solids in fruit juice reached about 13-14% according to Swindeman (2002) in both seasons of the study.

5. Physical fruit characteristics:

Samples of 10 fruits from each replicate tree were picked randomly at harvest to determine:

- Seed number per fruit.
- Fruit size (cm^3): Fruit size was measured by using the volume of water as cm^3 after dipping fruit in water.
- Fruit length and diameter (cm): Fruit length and diameter were measured by using a vernier calipers as cm, whereas fruit diameter was measured from the middle of the fruit.
- Fruit firmness: It was measured by using a hand Effegi-Penetrometers supplemented with plunger 8 mm diameter and the average was estimated as Ib.in^{-2} (Harker *et al.*, 1996).

6. Chemical fruit characteristics:

- Soluble solids content (SSC): A hand refractometer was used to determine the soluble solids content in fruit juice (AOAC, 1980).
- Total titratable acidity: It was determined in fruit juice by titration with 0.1 N sodium hydroxide and calculated as malic acid according to the method described in AOAC (1980).

- Soluble solids content (SSC) /acid ratio: SSC/acid ratio was expressed by the ratio between SS content and total titratable acidity.

7. Statistical analysis:

The obtained data were statistically analyzed as a completely randomized blocks design with three replicates by analysis of variance (ANOVA) according to the procedure outlined by Snedecor and Cochran (1982), using the statistical package software SAS (SAS Institute Inc. Cary, NC, USA). Comparisons between means were made by using the least significant differences test (LSD) at 5% level of probability as mentioned by Waller and Duncan (1969).

RESULT AND DISCUSSION

1. Flower boron concentration, initial fruit set and final fruit set:

Data in Table 1 illustrated that all treatments increased boron concentration in flowers of Le-Conte pear trees significantly than the control; hence, boric acid at 150 ppm presented the highest values in this respect.

Table (1):Effect of spraying date with different foliar boric acid concentrations on flower boron concentration (mg/kg DM), initial fruit set and final fruit set (%) of 'Le-Conte' pear trees.

Treatment (T)	2011			2012		
	B (mg/kg DW)	Initial fruit set (%)	Final fruit set (%)	B (mg/kg DM)	Initial fruit set (%)	Final fruit set (%)
1) Boric acid 50 ppm	37.95	19.71	3.49	38.55	21.70	3.98
2)Boric acid 100 ppm	39.75	23.12	5.31	41.24	24.45	5.51
3)Boric acid 150 ppm	42.25	29.13	7.07	43.74	34.10	7.76
4) Control	27.05	17.54	2.39	29.30	19.99	3.06
LSD at 5 %	0.63	1.02	0.29	0.75	0.40	0.19
Spraying date (SD)						
1) After harvest	37.96	22.93	4.94	39.89	25.86	5.50
2) White bud stage	35.54	21.83	4.19	36.53	24.27	4.65
F Test	*	*	*	*	*	*
Interaction						
T_1*SD_1	39.25	20.32	3.92	40.15	22.29	4.36
T_1*SD_2	36.65	19.11	3.07	36.95	21.12	3.59
T_2*SD_1	41.80	23.82	5.85	44.14	25.52	6.047
T_2*SD_2	37.70	22.42	4.78	38.35	23.38	4.97
T_3*SD_1	43.75	30.03	7.59	45.99	35.63	8.55
T_3*SD_2	40.75	28.23	6.54	41.50	32.58	6.97
T_4*SD_1	27.05	17.54	2.39	29.30	19.99	3.06
T_4*SD_2	27.05	17.54	2.39	29.30	19.99	3.06
LSD at 5 %	0.89	1.44	0.41	1.07	0.57	0.27

In addition, spraying boric acid after harvest gave a higher concentration of boron in flowers than spraying at white bud stage and this preference was clear also for the impact on each of initial and final fruit set percentages during both seasons of the study and that is may be due to reduce transport of B into the aerial parts (particularly the flowers) of pear trees during spring (at white bud stage) which might be caused by a low transpiration rate resulting from a small leaf area on tree and/or low soil moisture. This seems to be the best explanation because it is known that plant B distribution is primarily governed by the transpiration stream (Marschner, 1995); although phloem mobility of B in Pyrus is also of importance (Brown and Shelp, 1997); hence, in vascular plants, boron moves passively from the roots to the leaves and shoots via transpiration (Husa and McIlrath, 1965). Once in the leaves, boron is, in general, restricted to the apoplast (Sattelmacher, 2001). Therefore, boron is considered to be relatively immobile in the dicotyledonous phloem, and a continuous supply is required to achieve normal plant growth (Brown and Hu, 1998).

Furthermore, it is clearly that there is a positive relationship between boric acid concentrations and each of initial and final fruit set percentages during both seasons of the study. The highest significant effect in initial and final fruit set percentages was obtained with boric acid at 150 ppm; hence, the percent attributed due to this treatment was 29.13 & 34.10 % for initial fruit set and 7.07 & 7.76 % for final fruit set during both seasons, respectively.

On the contrary, the lowest significant effect in this respect was obtained from the control; hence, the percent attributed due to this treatment was 17.54 & 19.99 % for initial fruit set and 2.39 & 3.06 % for final fruit set in the two seasons, respectively. However, the current results are in agreement with those reported by Sotomayor *et al.*, 2010 who found that foliar B treatments before full bloom or after harvest increased B concentration in the flowers which led to an increase in fruit set. This is highly likely as B is known to play an important role in pollen germination and pollen tube growth (Brown *et al.*, 2002) and that was also confirmed by Batjer and Thompson (1949) who stated that the increased fruit set of apparently healthy Anjou pear trees sprayed with boron was caused by an increased translocation of sugar, growth regulators, or both to the flower buds. on the contrary, low boron levels in flowers which observed in control trees reduce fertility by damaging pollen formation and affecting the growth of the pollen tube (Dell and Huang, 1997).

Moreover, spraying boric acid at 150 ppm after harvest was the best interaction which increased significantly each of flower boron concentration, initial and final fruit set percentages; hence, the data attributed due to this interaction was 43.75&45.99 (mg/kg DW) for flower boron concentration, 30.03&35.63 % for initial fruit set and 7.59&8.55 % for final fruit set in the two seasons, respectively.

2. **Fruit number/tree, average fruit weight and yield/tree:**

All boric acid concentrations increased each of fruit number per tree,average fruit weight and yield per tree significantly compared to the control which presented the lowest values in this respect (Table 2); it resulted in 245&265 fruit per tree, 164.33&166.67 g for average fruit weight and 40.25&44.17 kg for yield per tree; reversely, boric acid at 150 ppm demonstrated significantly the highest values in this respect; it resulted in 426.67&438.75 fruit per tree, 234.33&244.33 g for average fruit weight and 100.21&105.12 kg for yield per tree during both seasons of the experiment.

These results confirm those of Wojcik (2006) on apple who mentioned that boron - as an essential trace element required for optimal pollen germination and acceleration of pollen tube growth - was used extensively and was found to reduce percentage of flowers drop and increase percentage of fertile flowers resulting in successful fruit setting and thus increased fruit number and yield. In addition, increasing fruit yield due to B spraying may be attributed to the role of B in enhancing many metabolic processes such as carbohydrate transport (Marschner, 1995 and Mengel and Kirkby, 2001).

Regarding to the effect of treatments on fruit weight, the results obtained confirm the positive correlation between the number of seeds and pear fruit weight, as mentioned in previous works (Hopping, 1990 and Lawes and Woolley, 1990). The higher the number of seeds, the higher the fruit weight will be (Table 2 and 3).

Moreover, spraying boric acid after harvest enhanced each of fruit number per tree, average fruit weight and yield per tree significantly than spraying at white bud stage; hence, it resulted in 330.42&351.25 fruit per tree, 205.67&212.75 g for average fruit weight and 70.02&75.81 kg for yield per tree during both seasons of the study, respectively (Table 2).

Table (2): Effect of spraying date with different foliar boric acid concentrations on fruit number/tree, average fruit weight (g) and yield/tree (kg) of 'Le-Conte' pear trees.

Treatment	2011			2012		
	Fruit number /tree	Average fruit weight (g)	Yield/tree (kg)	Fruit number /tree	Average fruit weight (g)	Yield/tree (kg)
1) Boric acid 50 ppm	293.33	189.00	55.518	299.58	195.00	58.59
2) Boric acid 100 ppm	313.58	205.00	64.41	335.42	215.00	72.32
3) Boric acid 150 ppm	426.67	234.33	100.21	438.75	244.33	105.12
4) Control	245.00	164.33	40.25	265.00	166.67	44.17
LSD at 5 %	8.38	5.14	2.57	6.277	5.43	3.51
Spraying date (SD)						
1) After harvest	330.42	205.67	70.02	351.25	212.75	75.81
2) White bud stage	308.88	190.67	60.18	318.13	197.75	64.29
F Test	*	*	*	*	*	*
Interaction						
T_1*SD_1	301.67	199.00	60.03	316.67	205	64.91
T_1*SD_2	285.00	179.00	51.00	282.50	185	52.26
T_2*SD_1	326.67	215.00	70.23	358.33	225	80.59
T_2*SD_2	300.50	195.00	58.59	312.50	205	64.05
T_3*SD_1	448.33	244.33	109.56	465.00	254.33	113.57
T_3*SD_2	405.00	224.33	90.86	412.50	234.33	96.67
T_4*SD_1	245.00	164.33	40.25	265.00	166.67	44.17
T_4*SD_2	245.00	164.33	40.25	265.00	166.67	44.17
LSD at 5 %	11.86	7.28	3.64	8.88	7.68	4.96

In this respect, spraying boric acid at 150 ppm after harvest was the best interaction which increased significantly each of fruit number per tree, average fruit weight and yield per tree; hence, the data attributed due to this interaction was 448.33&465.00 fruit per tree, 244.33&254.33 g for average fruit weight and 109.563&113.57 kg for yield per tree in the two seasons, respectively (Table 2).

3. **Seed number per fruit, volume, length and diameter of fruit:**

In this study, the highest seed number per fruit, volume, length and diameter of fruit detected at the highest concentration of boric acid (150 ppm) (Table 3). The values of seed number per fruit, volume, length and diameter of fruit due to this concentration were 6.83&7.17 for seed number per fruit, 249.33&259.33 cm^3 for fruit volume, 8.04&8.34 cm for fruit length and 6.81&7.22 cm for fruit diameter in the two seasons, respectively. Whereas, the concentration of boric acid at 50 ppm decreased significantly the seed number per fruit, volume, length and diameter of fruit compared to the other concentrations; hence, the values of seed number per fruit, volume, length and diameter of fruit due to this concentration were 3.83&4.17 for seed number per fruit, 204&210 cm^3 for fruit volume, 6.8&7.2 cm for fruit length and 5.74&6.14 cm for fruit diameter in the two seasons, respectively (Table 3). The results obtained agree with studies by Nyomora *et al.* (2000) on almond and Lovatt (1999) which showed that boron plays a role in pollen germination and the further development of the pollen tube, allowing for an increased amount of fertilized ovules and more seeds per fruit.

Table (3): Effect of spraying date with different foliar boric acid concentrations on seed number per fruit, volume (cm3), length (cm) and diameter (cm) of 'Le-Conte' pear fruits.

Treatment	2011				2012			
	Seed number per fruit	Fruit volume (cm^3)	Fruit length (cm)	Fruit diameter (cm)	Seed number per fruit	Fruit volume (cm^3)	Fruit length (cm)	Fruit diameter (cm)
1)Boric acid 50 ppm	3.83	204	6.80	5.74	4.17	210	7.20	6.14
2)Boric acid 100 ppm	5.33	220	7.53	6.24	5.67	230	7.89	6.64
3)Boric acid 150 ppm	6.83	249.33	8.04	6.81	7.17	259.33	8.34	7.22
4) Control	2.00	174.33	6.72	5.30	2.00	176.67	7.12	5.70
LSD at 5 %	0.87	5.14	0.22	0.28	0.87	5.43	0.22	0.22
Spraying date (SD)								
1) After harvest	5.25	215.67	7.36	6.12	5.50	222.75	7.76	6.52
2)White bud stage	3.75	208.17	7.17	5.93	4.00	215.25	7.52	6.33
F Test	*	*	*	*	*	*	*	*
Interaction								
T_1*SD_1	4.33	209	6.90	5.84	4.67	215	7.3	6.24
T_1*SD_2	3.33	199	6.70	5.64	3.67	205	7.1	6.04
T_2*SD_1	6.33	225	7.63	6.34	6.67	235	8.03	6.74
T_2*SD_2	4.33	215	7.43	6.14	4.67	225	7.74	6.54
T_3*SD_1	8.33	254.33	8.18	6.98	8.67	264.33	8.58	7.38
T_3*SD_2	5.33	244.33	7.90	6.63	5.67	254.33	8.1	7.05
T_4*SD_1	2	174.33	6.72	5.30	2	176.67	7.12	5.70
T_4*SD_2	2	174.33	6.72	5.30	2	176.67	7.12	5.70
LSD at 5 %	1.22	7.28	0.31	0.39	1.22	7.68	0.31	0.31

Boron spraying significantly increased fruit physical characteristics, i.e. fruit weight, volume, length, diameter and flesh (%) compared with the control treatment in both growing seasons. Boron increases the rate of sugar transport to active growing regions and also to develope fruits. Therefore, increasing fruit physical characters may be attributed to the improvement of fruit growth and uptake of B nutrients that accelerate metabolic processes. Similar findings were reported by Desouky *et al*. (2007) and Khayyat *et al*. (2007).

In addition, spraying boric acid after harvest increased each of seed number per fruit, volume, length and diameter of fruit significantly than spraying at white bud stage; indeed, it resulted in 5.25&5.5 for seed number per fruit, 215.67&222.75 cm^3 for fruit volume, 7.36&7.76 cm for fruit length and 6.12&6.52 cm for fruit diameter during both seasons of the study, respectively.

Regarding to the effect of interactions between spraying date and boric acid concentrations on seed number per fruit, volume, length and diameter of fruit in this study , spraying boric acid at 150 ppm after harvest was the best interaction which increased significantly each of seed number per fruit, volume, length and diameter of fruit; hence, the values obtained due to this interaction were 8.33&8.67 for seed number per fruit, 254.33&264.33 cm^3 for fruit volume, 8.18&8.58 cm for fruit length and 6.98&7.38 cm for fruit diameter in the two seasons, respectively.

4. **Fruit firmness, SSC, acidity and SSC/acidity**:

Concerning the effect on fruit firmness, SSC, acidity and SSC/acidity, results in Table 4 reveled that all boric acid concentrations used in this study significantly increased values in this respect than the control during the both season under this study. It is obvious that there is a positive relationship between boric acid concentrations and each of fruit firmness, SSC, acidity and SSC/acidity; hence, the boric acid concentration at 150 ppm presented the highest significant effect in this respect compared to the other treatments; it recorded 14.2&14.39 $lb/inch^2$ for fruit firmness, 14.00&14.28 for SSC, 0.2&0.203 % for acidity and 70.23&70.44 for SSC/acidity under this study during first and second season, respectively.

On the contrary, un-treated trees gave the lowest significant effect in this respect; thus, the result due to this treatment was 11.80&12.20 $lb/inch^2$ for fruit firmness, 12.33&12.53 for SSC, 0.27&0.28 % for acidity and 45.75&44.83 for SSC/acidity during first and second season, respectively.

The obtained data was in the same line with Wojcik, P. and M. Wojcik (2003) who found that foliar treatments with B before full bloom or after harvest increased Ca in fruits and leaves at 80 and 120 days after full bloom. These effects might have resulted from a change in the pattern of Ca transport in plant caused by the increased number of fruits per tree. This is possible as it is known that developing seeds in fruits are strong ‘sinks’ for Ca transport (Oberly, 1973). On the other hand, higher Ca concentrations in fruits and late summer leaves of pear trees sprayed with B before full bloom or after harvest might be also caused by a higher rate of Ca uptake by roots as a consequence of an increase production of auxins by the seeds (increased cropping of trees sprayed with B before full bloom and after harvest suggests about higher number of seeds per tree). This hypothesis is plausible because auxins stimulate the formation of 'fine roots' (Lewak, 1998) which are the main sites of Ca absorption (Clarkson and Sanderson, 1971).

Table (4): Effect of spraying date with different foliar boric acid concentrations on fruit firmness (lb/inch²), SSC, acidity (%) and SSC/acidity of 'Le-Conte' pear fruits.

Treatment (T)	2011				2012			
	Fruit firmness (lb/inch²)	SSC	Acidity (%)	SSC /Acidity	Fruit firmness (lb/inch²)	SSC	Acidity (%)	SSC /Acidity
1) Boric acid 50 ppm	12.2	13	0.23	56.68	12.72	13.22	0.24	55.21
2) Boric acid 100 ppm	13.28	13.43	0.21	63.59	13.62	13.55	0.22	61.76
3) Boric acid 150 ppm	14.2	14	0.20	70.23	14.39	14.28	0.20	70.44
4) Control	11.8	12.33	0.27	45.75	12.20	12.53	0.28	44.83
LSD at 5 %	0.17	0.25	0.01	2.99	0.18	0.23	0.01	3.07
Spraying date (SD)								
1) After harvest	13.19	13.41	0.23	57.55	13.45	13.60	0.24	56.20
2)White bud stage	12.55	12.97	0.22	58.17	13.02	13.18	0.23	57.30
F Test	*	*	*	*	*	*	*	*
Interaction								
T1*SD1	12.4	13.20	0.240	55.09	12.73	13.43	0.250	53.81
T1*SD2	12	12.80	0.220	58.28	12.70	13.00	0.230	56.61
T2*SD1	13.85	13.70	0.220	62.37	13.98	13.75	0.230	59.87
T2*SD2	12.7	13.15	0.203	64.80	13.27	13.35	0.210	63.65
T3*SD1	14.7	14.40	0.200	72.12	14.87	14.70	0.207	71.16
T3*SD2	13.7	13.60	0.200	68.34	13.90	13.85	0.200	69.71
T4*SD1	11.8	12.33	0.270	45.75	12.20	12.53	0.280	44.83
T4*SD2	11.8	12.33	0.270	45.75	12.20	12.53	0.280	44.83
LSD at 5 %	0.247	0.349	0.014	4.23	0.26	0.32	0.015	4.34

The positive relationship between boric acid concentrations and SSC in pear fruit juice can be ascribed to an increases in the concentration of sugars in fruits of plants supplied with supplemental boron which must be the result of an increase in translocation of sugar rather than an effect on photosynthesis the hypothesis is that boron combines with sugar to form a sugar-borate complex (ionizable) which is translocated with greater facility than are non-borated (non-ionized) sugar molecules from the leaves to the steam (Gauch and Dugger, 1952).

Spraying boric acid at different concentrations after harvest was better than spraying them at white bud stage for enhancing fruit firmness, SSC and acidity significantly; it recorded 13.19&13.45 lb/inch^2 for fruit firmness, 13.41&13.60 for SSC and 0.233&0.242 % for acidity during both seasons, respectively. Conversely, spraying boric acid at different concentrations at white bud stage gave a higher value than spraying them after harvest for SSC/acidity; it recorded 58.17&57.30 during both seasons, respectively.

Attributed to the impact of interactions between spraying date and boric acid concentrations on fruit firmness, SSC, acidity and SSC/acidity; the data illustrated in Table 4 cleared that spraying the highest concentration of boric acid (150 ppm) after harvest was the superior interaction in this respect except for acidity which the highest value of it was obtained by control either after harvest or at white bud stage.

Conclusions

The results of the experiment revealed that postharvest and pre-bloom at white bud stage foliar applications of boric acid were effective in increasing pear tree cropping and improving fruit quality. The effectiveness of postharvest and pre-bloom at white bud stage foliar boric acid sprays resulted from improved flower B status, causing better fruit set. However, boric acid application at the rate of 150 ppm at 1st September after harvest was the best treatment in this respect. Therefore, I suggest that flower B full bloom is a more valuable index for predicting pear tree yielding than the analyses of summer leaves, fruits and soil. It follows also that it is necessary to establish threshold values of flower B concentrations for particular pear varieties.

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"تأثير موعد الرش بتركيزات مختلفة من البوريك أسيد على المحصول و جودة ثمار أشجار الكمثرى صنف الليكونت"

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تهدف هذه الدراسة إلى إختبار إستجابة أشجار الكمثرى الليكونت للرش الورقى بواسطة حمض البوريك، و قد أجريت هذه التجربة خلال موسمى 2010-2011 / 2011-2012 فى مزرعة تجارية بمدينة الخطاطبة، محافظة المنوفية، مصر على أشجار كمثرى بالغة صنف الليكونت مطعومة على أصل الكميونس البذرى و المنزرعة على مسافة 5 × 5 م فى تربة رملية تحت نظام الرى بالتنقيط و مرباه بنظام القائد الوسطى المحور. فى كل عام تم الرش الورقى بواسطة حمض البوريك فى ميعادين، أولهما فى أول سبتمبر بعد الحصاد و الثانى عند مرحلة البرعم الأبيض قبل التزهير و كان ذلك بتركيزات 50، 100 و 150 جزء فى المليون و كانت الأشجار الغير معاملة بحمض البوريك ممثلة للكنترول. أثبتت النتائج أن الرش الورقى بحمض البوريك بعد الحصاد أو قبل التزهير عند مرحلة البرعم الأبيض، رفع كل من تركيز البورون فى الأزهار، نسبة العقد و المحصول بالإضافة لذلك أعطت هذه المعاملات أعلى متوسط لكل من وزن، حجم، طول، قطر، صلابة الثمار، عدد البذور بالثمرة، المواد الصلبة الذائبة و الحموضة مقارنة بأشجار الكنترول. هذه النتائج توضح أن الرش بحمض البوريك بعد الحصاد أو قبل التزهير كان ناجحاً فى زيادة محصول أشجار الكمثرى و تحسين نسبة العقد و لكن كانت المعاملة بحمض البوريك عند تركيز 150 جزء فى المليون فى أول سبتمبر بعد الحصاد هى الأفضل فى هذا المجال.

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