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Effect of Ringing and Amino Acids Application on Improving Fruiting of Le Conte Pear Trees

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Abstract: This study was conducted on 12 years Le Conte pear trees during three successive seasons. This investigation aimed to evaluate the effect of different tree ringing and amino acids foliar spray treatments to improve flowering, fruit set and fruit characteristics of Le Conte pear trees. Residual effects of the applied treatments which were measured in the second and third seasons of this investigation showed that main branches ringing and one g/L amino acids foliar spray with trunk ringing resulted in the highest significant number of floral spurs/m and number of flowers/spur. All the applied treatments significantly increased initial fruit set, final fruit set and yield compared to the control trees in both seasons of the study. Moreover, the highest significant level of fruit set, yield, fruit weight and number of seeds/fruit resulted from one g/L amino acids foliar spray treatment with or without main branches ringing in the two successive seasons. Similarly all of the applied treatments significantly increased fruit softening but not affected on other fruit characteristics during both seasons. Thus, in this study either to apply one g/L amino acids foliar spray treatment with or without main branches ringing could be recommended from results as they significantly increased productivity of Le Conte pears trees.

Key words: Ringing · Amino Acids · Fruiting · Le Conte · Pear trees

INTRODUCTION

Le Conte is the main pear cultivar grown in Egypt resulted as a hybrid between *Pyrus communis* X *Pyrus serotina*. The total harvested area of pears fluctuated sharply during the last decades due to fire blight infection as it dropped from 10990 feddans at 1999 to 6960 feddans at 2005. However, it started to increase gradually with the applications of treatments to control fire blight as it reached 20400 feddans at 2009 according to FAO Statistics Division, 2011. Productivity of pear varies in Egypt from year to year and location to another. This might be attributed to limited ovules viability and stigma receptivity, poor pollen germination ability, ovule abortion, excessive flower abscission and low fruit set [1].

In order to improve productivity in terms of fruit set and fruit quality several investigations were carried out by applying trunk girdling on pears and apple [2-4] and on peach and nectarine [5]. Girdling affects assimilate partitioning and the flow of plant hormones and nutrients throughout the tree [6].

Polyamines are low molecular weight aliphatic amine compounds existents at every place in plants, animals and bacteria. They have been associated with growth and tissue differentiation [7, 8]. The influence of polyamines in increasing fruit set has been observed in apple (*Malus domestica* Borkh.) and Comice pear. Particularly in Comice pear, putrescine enhanced pollen tube ovule penetration and delayed ovule senescence without affecting flower ethylene production [9]. It has been suggested that polyamines reduce senescence rates in some plant tissues by antagonism with ethylene, possibly by competing for S-adenosylmethionine, a common precursor of both plant bio-regulators [7].

The present investigation was carried out to study the effects of different combinations of amino acids foliar spray, main branches ringing and trunk ringing treatments on improving flowering, fruit set, yield and fruit quality of Le Conte pear trees.

MATERIALS AND METHODS

This study was carried out during three successive seasons 2007, 2008 and 2009. The effects of the studied treatments were measured on the treated trees during the season of treatment application and the following season

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another group of trees were used for treatments. In the second and the third seasons (2008 and 2009), residual effects of the applied treatments of seasons 2007 and 2008 were measured. Experimental treatments were applied on 12 years old, Le Conte pear trees budded on *Pyrus communis* rootstock, planted at 5X5 m and grown in loamy soil in the Experimental Research Station of the Faculty of Agriculture Cairo University at Giza. Trees were of normal growth, uniform in vigor under furrow irrigation system and received normal fertilization and cultural practices as scheduled in the program of the Station. The experiment was conducted on 54 trees; 27 trees in each season of treatments application as nine treatments were applied and each treatment comprised of three trees. Each tree was considered a replicate. The applied treatments in each season involved the following:

- T1) Control
- T2) Trunk ringing
- T3) Main branches ringing
- T4) 1/2 g/L amino acids agent
- T5) 1/2 g/L amino acids agent with trunk ringing
- T6) 1/2 g/L amino acids agent with main branches ringing
- T7) One g/L amino acids agent
- T8) One g/L amino acids agent with trunk ringing
- T9) One g/L amino acids agent with main branches ringing

Every ringing treatment was applied at bud burst, at two half squire in different direction one under one. Moreover, every foliar spray of amino acids agent treatment was applied twice at each season during bud burst and full bloom stages.

The amino acids agent which was used in this study was PEPTON 85/16®. APC Europe Co. AV san Julian – Spain. The effects of the previous treatments were studied by evaluating their influence on the following parameters:

Flowering Characteristics: Flowering characteristics involved number on floral spurs per meter and average number of flower/spur were measured only during the following season of treatments application (2008 – 2009). At the beginning of the growing season on each replicate tree five two years old shoots distributed on different sides were chosen randomly, tagged, there lengths were measured and their flowers were counted at full bloom. All inflorescences on each shoot were counted and recorded.

Average Number of Floral Spur/meter on Two Years Old Branches: Number of floral spurs of the tagged shoots was counted to calculate it per meter.

Average Number of Flowers/spur: Number of flowers on spurs of the tagged shoots was counted to calculate average number of flowers/spur.

Fruiting Characteristics: Fruiting parameters were measured during the season of treatments application and were measured on the same trees during the following season as residual effect of the applied treatments.

Initial Fruit Set: Three weeks after flowering initial fruit set percentage on replicate trees of the studied treatments was calculated [1] from the following formula: Initial fruit set % = (No. of fruit-lets / total no. flowers at full bloom) X 100

Final Fruit Set: Sixty days after flowering, final fruit set percentage was calculated [1] from the following formula: Final fruit set % = (No. of fruit-lets at 60 days from full bloom / total no. flowers at full bloom) X 100

Yield: The produced fruit yield on each replicate tree resulting from the applied treatments was expressed as weight of fruits in kg/ tree, which was attained at harvest stage. This was determined 135 days after flowering in every season of the study.

Fruit Characteristics: Samples of 10 fruits from each replicate tree i.e. 30 fruits for each of the applied treatments was picked randomly at harvest to determine:

Physical Characteristics:

- Average fruit weight (g/ fruit).
- Average number of seed per fruit.
- Fruit firmness as Lb/ inch^2 by the use of magness taylor pressure tester.

Chemical Fruit Characteristics:

- Total soluble solids of fruit juice (TSS %) was measured by hand refractometer.
- The percentage of total acidity was determined as in fruit juice was measured as malic acid according to A.O.A.C [10].

The experiment followed complete randomized block design on 54 trees; 27 trees in each season, treatments application were nine treatments. Results of the measured parameters were subjected to computerized statistical analysis using MSTAT package for analysis of variance (ANOVA) and means of treatments were compared using LSD at 0.05 according to Snedecor and Cochran [11].

RESULTS AND DICUSSION

Flowering Characteristics

Average Number of Floral Spur/meter: Fig. 1a shows that, studying the residual effects of the applied treatments showed that the highest significant average number of floral spurs/m was produced from main branches ringing treatment as it averaged 29.6 and 30.9 / m in both seasons of the study. Nevertheless, the lowest average number of floral spurs/m was produced from control trees as it averaged 18.8 and 20 /m during both seasons.

Average Number of Flowers/spur: Fig. 1b shows that, studying the residual effects of the applied treatments showed that all treatments increased average number of flowers / spur. The highest significant number was produced from one g/L amino acids foliar spray with trunk ringing as it averaged 12.6 at the season 2008 and from main branches ringing treatment as it averaged 11.6 at the season 2009.

Number of Floral Spurs per Meter

Number of Flowers per Spur: Fig. 1: Residual effect of some cultural practices on flowering of Le Conte pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Fruiting: Fig. 2a-c shows that, the direct effect of one g/L amino acids foliar spray produced the highest significant initial, final fruit set and yield as it resulted in 17.3%, 19.2% initial fruit set, 9.1%, 6.3% final fruit set; and 104.7, 84.7 kg/tree in both seasons of the study respectively. The lowest significant initial, final fruit set and yield were observed in the control trees as it averaged 5.3%, 6.9%; 3.1%, 2.9% and 54.7, 34.7 kg/tree in both seasons respectively.

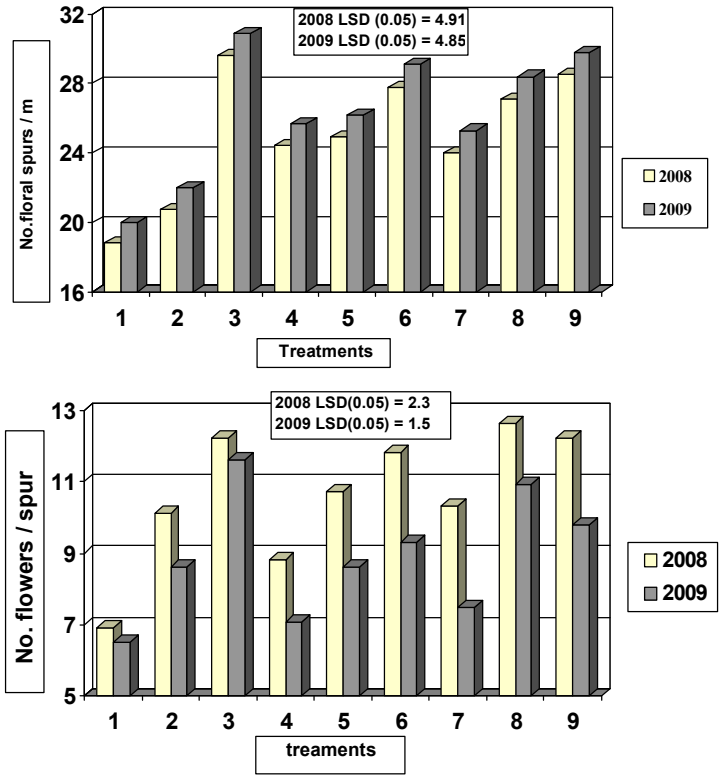
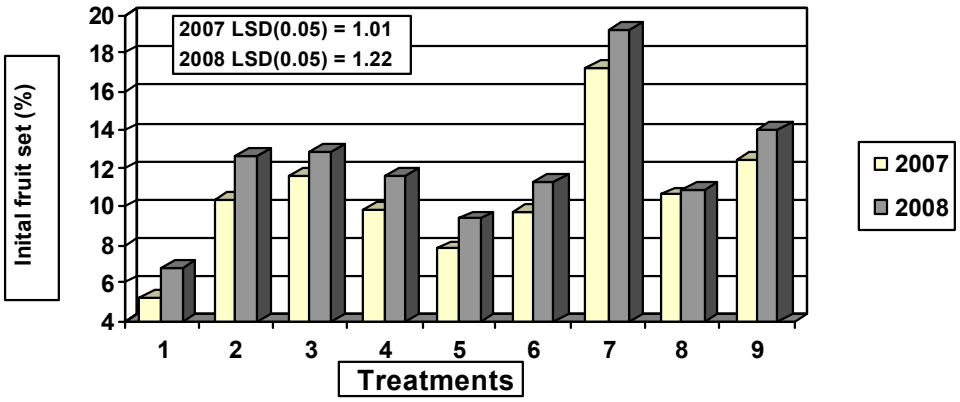
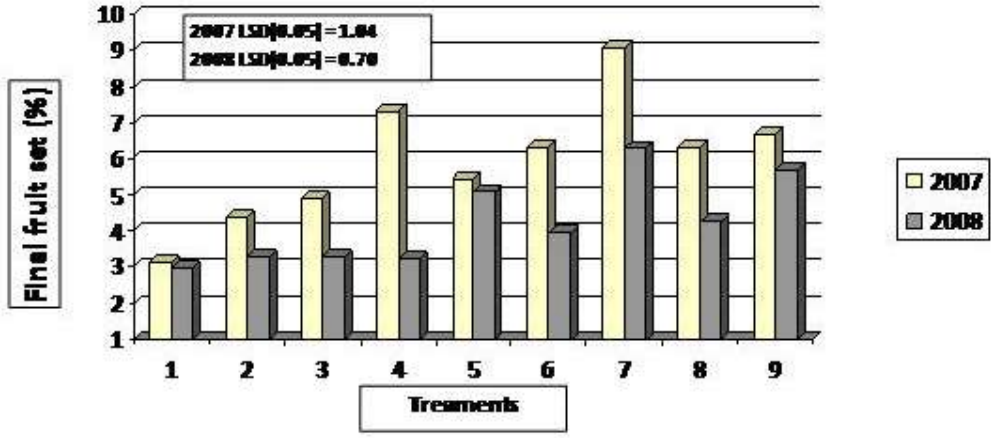


Fig. 1: Residual effect of some cultural practices on flowering of Le Conte pear trees
1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

a) Initial fruit set percentage



b) Final fruit set percentage



c) Yield kg/tree

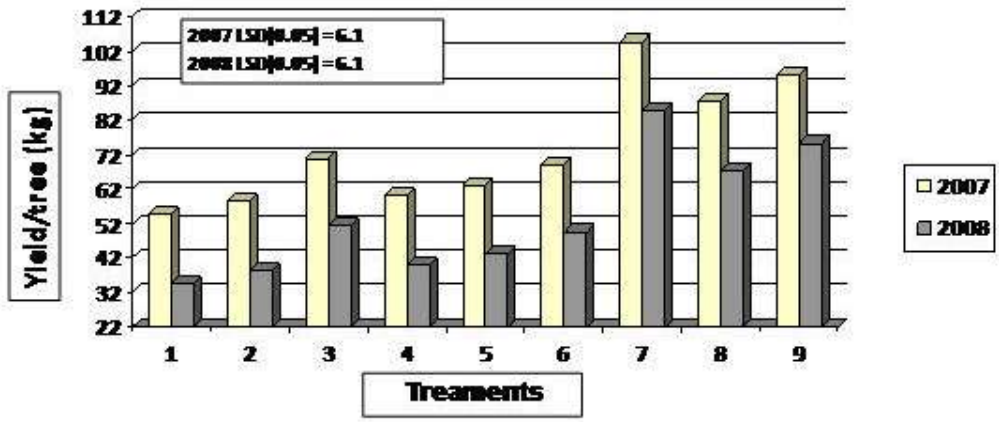
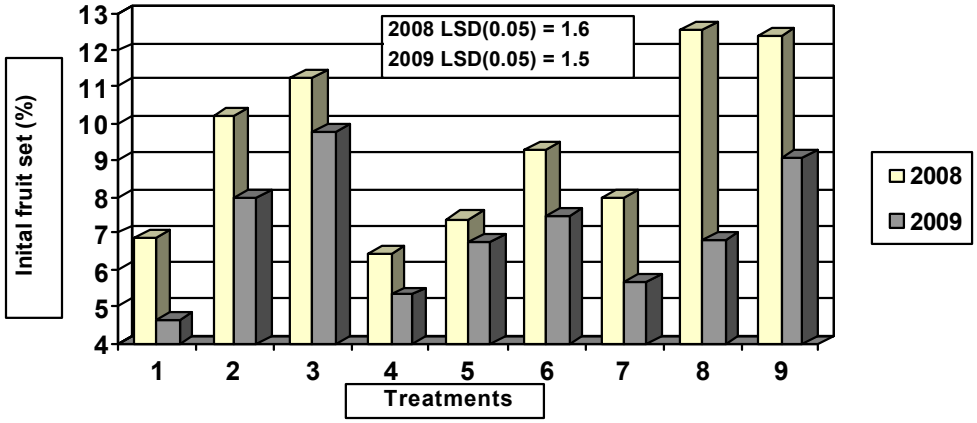
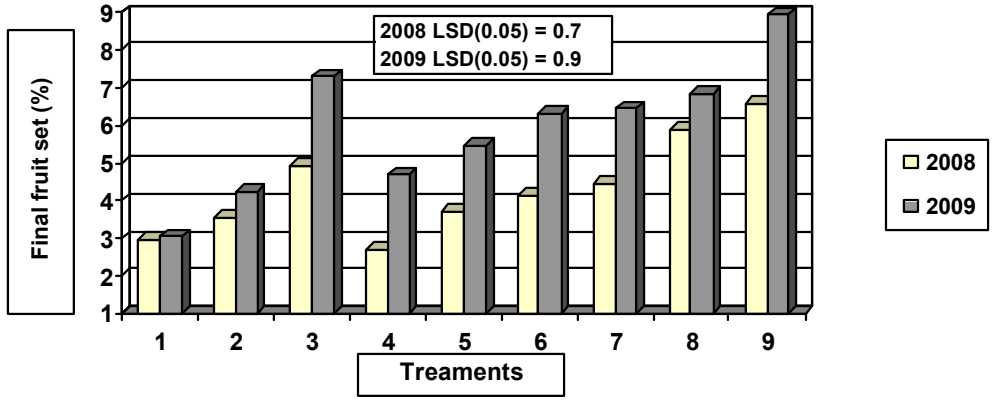


Fig. 2: Direct effect of some cultural practices on fruiting of Le Cont pear trees
1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

a) Initial fruit set percentage



B) Final fruit set percentage



c) Yield kg/tree

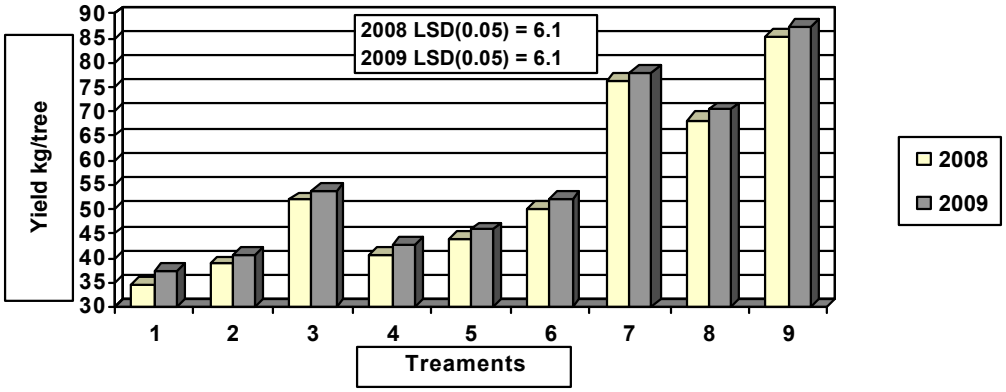
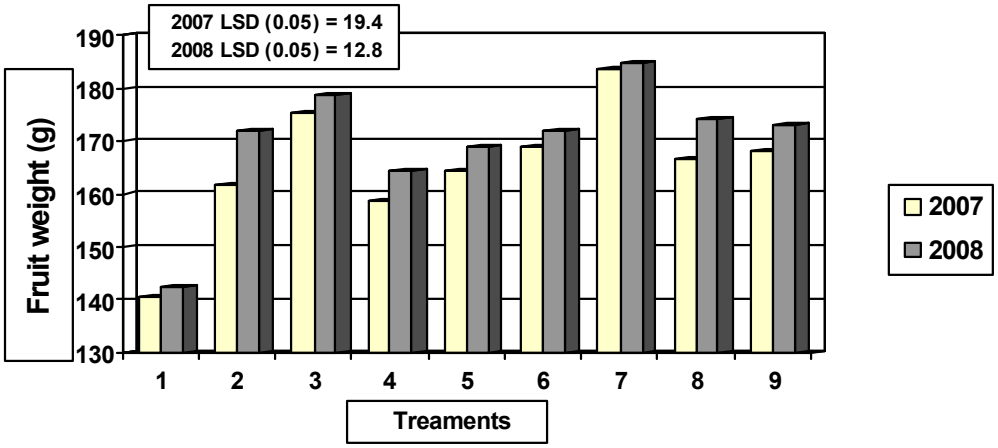
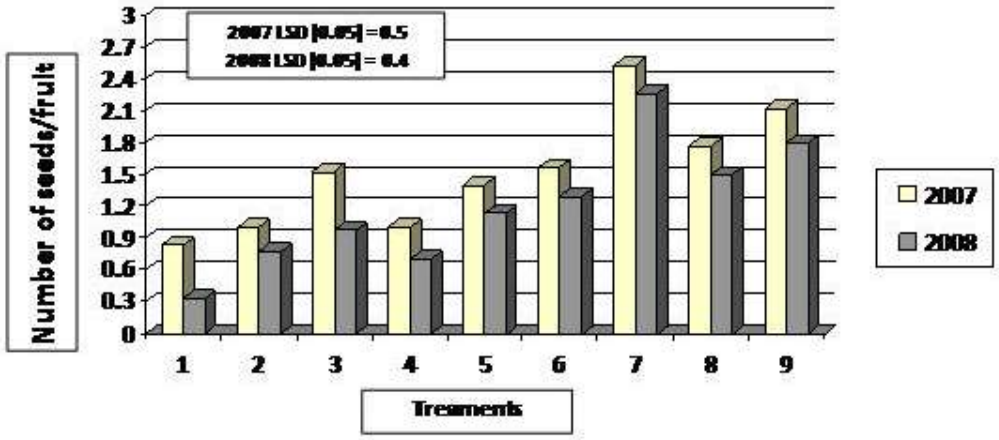


Fig. 3: Residual effect of some cultural practices on fruiting of Le Conte pear trees
1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

a) Fruit weight:



b) Number of seeds/fruit:



c) Fruit firmness:

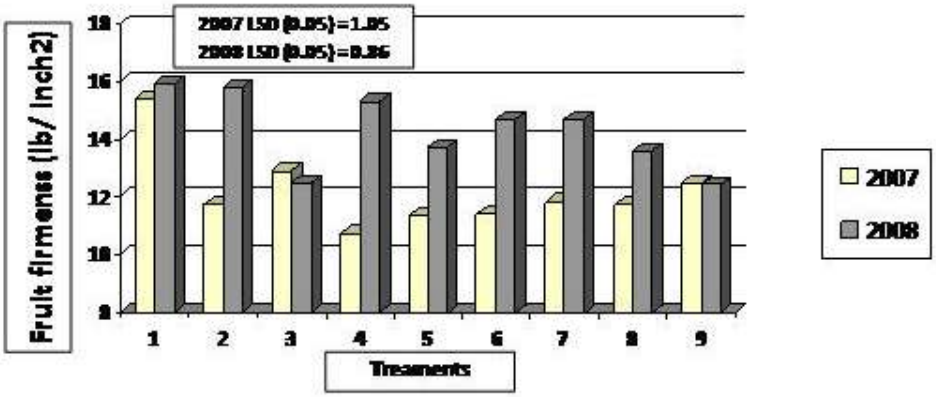
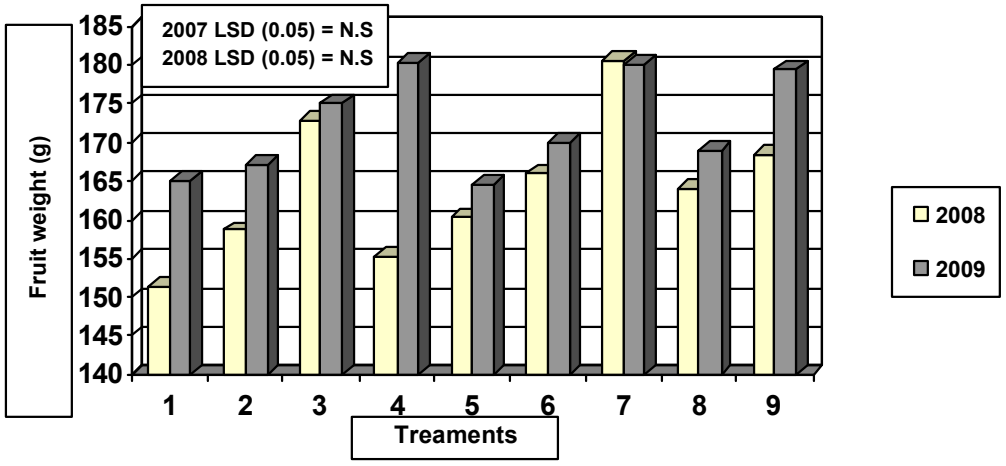


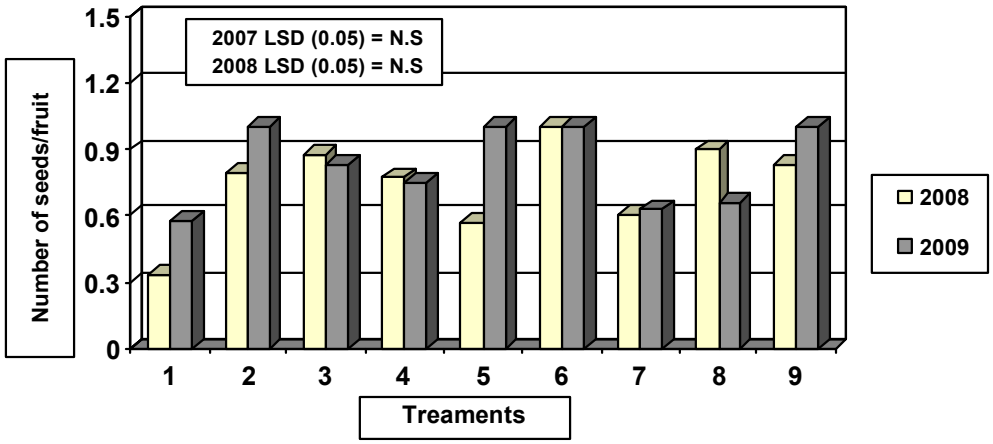
Fig. 4: Direct effect of some cultural practices on fruit characteristics of Le conte pear trees

1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

a) Fruit weight:



b) Number of seeds/fruit:



c) Fruit firmness:

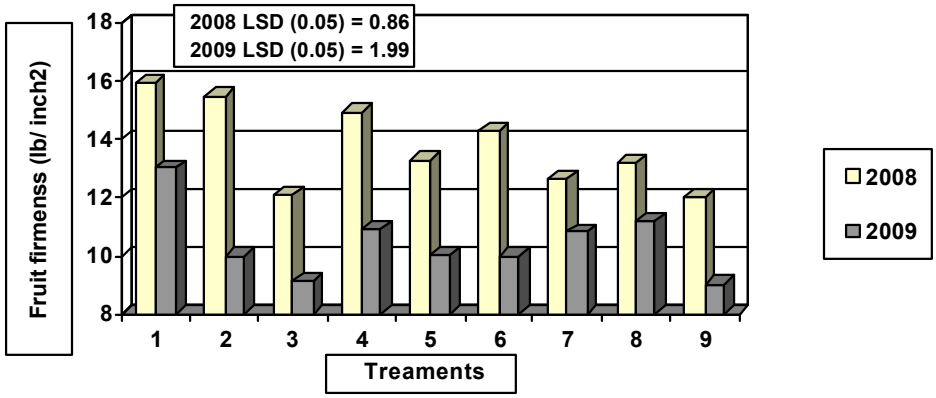


Fig. 5: Residual effect of some cultural practices on fruit characteristics of Le Conte pear trees
1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Initial Fruit Set Percentage
Final Fruit Set Percentage

Yield Kg/tree: Fig. 2: Direct effect of some cultural practices on fruiting of Le Cont pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1 /2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Fig. 3a-c shows that, the residual effects of all treatments significantly improved fruiting. The residual effect of one g/L amino acids foliar spray with trunk ringing and one g/L amino acids foliar spray with main branches ringing produced the highest significant initial fruit set as it reached 12.6 and 12.4% at first season, the residual effect of main branches ringing produced the highest significant percentage as it reached 9.8% at second season. Nevertheless, the lowest significant initial fruit set was produced from control trees as it averaged 6.9% and 4.7% during both seasons.

Meanwhile, the residual effect of one g/L amino acids foliar spray with main branches ringing produced the highest significant final fruit set and yield as it reached 6.6%, 8.9% and 85.4, 87.2 kg/tree in both seasons of the study.

Initial Fruit Set Percentage
Final Fruit Set Percentage

Yield kg/tree: Fig. 3: Residual effect of some cultural practices on fruiting of Le Conte pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Fruit Characteristics

Physical Characteristics: Fig. 4a-c shows that, the direct effect of one g/L amino acids foliar spray produced the highest significant fruit weight and number of seeds/fruit as it resulted in 183.5, 184.8g and 2.53, 2.27 seeds/fruit in both seasons of the study. The lowest significant fruit weight and number of seeds/fruit were observed in the control trees as it averaged 140.6, 151.5 g and 0.83, 0.33 seeds/fruit in both seasons (2007 and 2008). At both seasons of the study the direct effects of treatments significantly decreased fruit firmness than control trees.

Fruit Weight
Number of Seeds/fruit

Fruit Firmness: Fig. 4: Direct effect of some cultural practices on fruit characteristics of Le conte pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) ½ g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Fig. 5a-c shows that, the residual effects of the applied treatments on fruit weight and number of seeds/fruit were not significant at both seasons (2008 and 2009) of the study. Meanwhile, the residual effects of the applied treatments significantly decreased fruit firmness in both seasons than control trees, the lowest significant fruit firmness produced from main branches ringing and one g/L amino acids foliar spray with main branches ringing treatments as it averaged 12.1, 9.2 and 12.0, 9.0 lb/ inch^2 during both seasons.

Fruit Weight
Number of Seeds/fruit

Fruit Firmness: Fig. 5: Residual effect of some cultural practices on fruit characteristics of Le Conte pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

Chemical Fruit Characteristics: Fig. 6 a and b shows that, the direct effects of applied treatments produced no significant differences on percentages of TSS and total acidity during both seasons of the study.

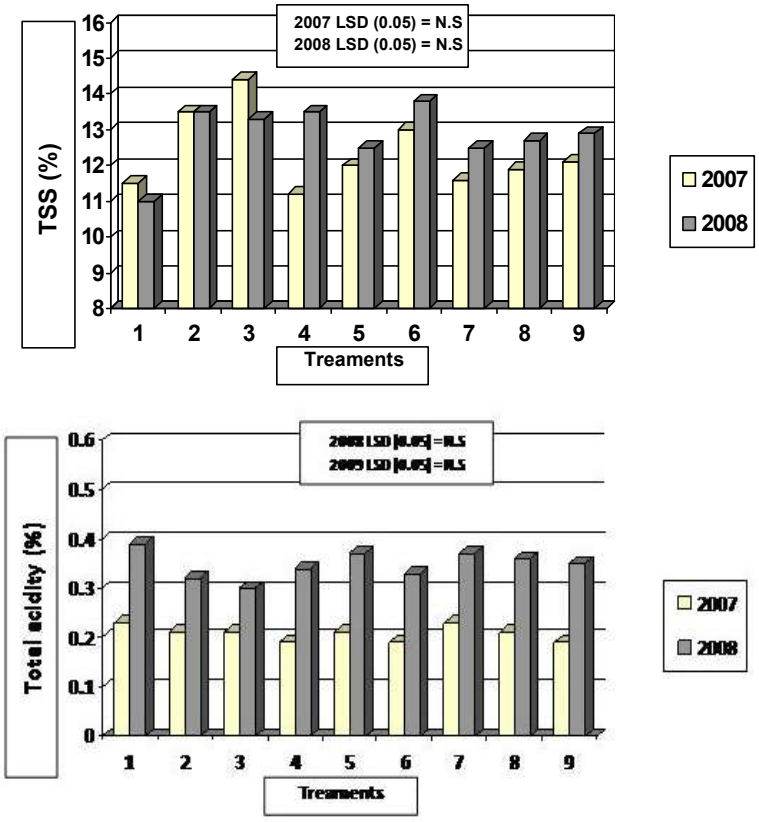


Fig. 6: Direct effect of some cultural practices on fruit characteristics of Le Conte pear trees
1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

TSS:

Total Acidity: Fig. 6: Direct effect of some cultural practices on fruit characteristics of Le Conte pear trees 1) Control; 2) Trunk ringing; 3) Main branches ringing; 4) 1/2 g/L foliar spray of amino acids; 5) 1/2 g/L foliar spray of amino acids with trunk ringing; 6) 1/2 g/L foliar spray of amino acids with main branches ringing; 7) 1g/L foliar spray of amino acids; 8) 1g/L foliar spray of amino acids with trunk ringing; 9) 1g/L foliar spray of amino acids with main branches ringing.

The general positive effects of amino acid foliar spray applications could be attributed to enhanced pollen tube ovule penetration and delayed ovule senescence which increases fruit set and yield. Similar findings were reported on pear [7, 9]. Also it was reported that direct effect of girdling increased yield per tree and fruit weight of Anna apple [12] and Canino apricot [13].

It was found from the present study ringing application increased number of spurs/m and number of flowers/spur which was parallel to previous findings on different deciduous fruits [2, 13, 14].

It was found from the present study that fruit chemical characteristics was significantly not significantly affected with different treatments which agree with previous studies performed on 'Le Conte' pear as a result of girdling application [2].

CONCLUSION

It can be concluded from results of the present study that one g/L amino acids foliar spray with or without main branches ringing treatments significantly improved fruiting and fruit quality of Le Conte pear trees, consequently they are recommended to be effectively applied in the under same conditions.

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